

# The case for moving condensing units outdoors

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## Abstract

Restaurant and convenience store (c-store) operators have numerous refrigeration options at their disposal. Among the most common include:

- **Self-contained cases** — stand-alone units that integrate the compressor and condenser into the in-store case
- **Centralized rack system** — a remotely located system designed to feed refrigerant from a machine room to cases and coolers throughout the store; condensers are typically located outside the facility on the roof
- **Outdoor condensing units (OCU)** — remote system that moves the compressor and condenser to outside the facility; typically deployed in a one-condenser-per-fixture configuration, but also available in a multiplex architecture to service multiple fixtures in the same suction group

Each refrigeration system has its rightful place in the foodservice industry, depending on the specific application and the facility's unique operating criteria. Recent advances in OCU technology have strengthened the case for choosing outdoor condensing units over self-contained or rack systems. The purpose of this white paper is to explore the emerging potential of modern OCUs and demonstrate how operators can best deploy them to address operational challenges.

## The challenging restaurant and convenience store landscapes

### Consumer expectations

Today's restaurant and c-store operators face unprecedented market pressures. The demand for fresh, sustainably sourced food offerings has created a consumer preference for brands that incorporate eco-friendly practices into every aspect of their operations — from the supply chain to the counter. Combined with the desires to reduce operating expenses and meet corporate sustainability objectives, this has led many operators to look for energy-efficient systems and refrigeration equipment that utilize low-global warming potential (GWP) refrigerants.

Consumers also seek an inviting, welcoming in-store experience, with an environment that's consistently clean, quiet, comfortable and aesthetically pleasing. They want increased access through convenient hours, without ever compromising the quality of the product. Preserving the brand's reputation means preventing food loss and spoilage and protecting against refrigeration equipment failure.

### Operational constraints

When considering refrigeration equipment replacement options, restaurant and c-store operators must be aware of the constraints and long-term impacts of their selections, including:

- **Noise ordinances** — residential areas and locations with noise ordinances often prohibit the use of mechanical equipment that exceeds this threshold.
- **Kitchen designs and available floor space** — some kitchen layouts dictate the selection of equipment, requiring the use of either fixed refrigeration units, or necessitating the option for more flexible, movable equipment. In addition, limited facility floor space is often a determining factor on what type of refrigeration equipment is selected.
- **Internal comfort and environment** — the choice of refrigeration equipment can have significant impacts on the internal heat and noise levels of the restaurant.
- **Lease restrictions** — some facility owners place limits on the amount of modifications that can be made to the structure. This may impact the option to mount equipment onto the building's exterior.
- **Sanitation concerns** — equipment that's easy to move for cleaning purposes is often preferred. Operators should be aware of the flexibility of their equipment's footprint.
- **Increasing refrigerant costs** — operators of refrigeration systems that use phased-out refrigerants can expect to see an increase in the cost of these chemicals due to dwindling supply.
- **Exposure to the elements** — restaurants located in coastal regions or extremely cold environments often deter operators from using outdoor equipment.

Regardless of the particular facility challenge, operators should seek refrigeration options that overcome these constraints while offering the best opportunities for commercial success.

## Regulatory requirements

Keeping up with the dynamic regulatory climate is an ongoing challenge for the refrigeration industry. Both the Department of Energy (DOE) and the Environmental Protection Agency (EPA) have rulings that impact the foodservice segment. While the burden of DOE and EPA compliance falls primarily on OEMs, operators need to be aware of the implications to their businesses. California-based operators may also be directly impacted by the California Air Resources Board (CARB) initiative on refrigerant management.

### DOE

The Department of Energy's ruling on minimum efficiency levels in commercial refrigeration equipment (CRE) takes effect on March 27, 2017. All CRE — including refrigerators and freezers with either a self-contained or remote condensing unit — manufactured after this date must be designed to meet the new minimum efficiency standards, as measured in kilowatt hours per day. Operators who are replacing existing equipment or starting up a new facility should seek units that comply with the DOE's new minimum efficiency standards.

### EPA

The EPA's Significant New Alternatives Policy (SNAP) is establishing new requirements for refrigerant use in commercial refrigeration applications, phasing out longstanding refrigerants in favor of more eco-friendly options. Among the substitutes the EPA SNAP has deemed as acceptable include R-407 C/A, R-448A and R-449A. Operators need to be aware of the potential impacts these new refrigerants will have on system design, performance and serviceability. For example, adding or removing fixtures from a rack system may require significant system and refrigerant changes.

### CARB

CARB's Refrigerant Management Program (RMP) is a state-wide initiative for best practices in leak detection, calling for increased inspections, registration of detection methods, and detailed reporting to verify the process. The refrigerant charge limit threshold at which inspections are required is 50 pounds. To avoid the costs associated with annual inspections and potential fees, operators in California may opt for low-charge systems that use less than 50 pounds of refrigerant. As a result, many operators are moving away from high-charge rack systems to lower-charge units.

It's also important to realize that CARB's RMP may be a precursor to a larger, national effort to combat refrigerant leaks. The EPA's recently proposed amendment to section 608 of its Clean Air Act is one indication of its plans to implement more stringent standards nationwide.

Selecting equipment that meets most or all of these requirements will be critical to operators who are making new or replacement equipment decisions in the near future.

## Cost of ownership

With all of this to consider as restaurant and c-store operators update or install new refrigeration systems, cost is still perhaps their most important consideration. Here, operators must choose between:

1. Selecting a traditional system that may offer lower first costs, but represents a higher total cost of ownership, without addressing all of the challenges that operators face
2. Invest in new technology that offers a lower total cost of ownership while addressing the full range of operator challenges

## Refrigerated equipment selection considerations

The selection of commercial refrigeration equipment is largely dictated by application-specific, economic and environmental drivers. To make the best equipment selections for their facility, operators must answer the following questions:

- Where are we putting the equipment?
- What are the locational or physical constraints of the facility?
- What are the environmental, internal climate and/or customer comfort goals?
- Are low first costs or a lower total cost of ownership more important?

As with most key operating decisions, it's important to understand the limitations and tradeoffs for each equipment option.

### Self-contained units

Individual self-contained units may be more expensive, but their plug-and-play capability is often preferred in kitchens that permit a more flexible layout. However, since each self-contained fixture produces noise and exhaust heat, they can quickly have a negative effect on the in-store environment and put a strain on the facility's AC load.

Operators need to weigh the pros and cons of each option to determine the best alignment for their particular application and business' operating objectives.

### Centralized rack systems

Centralized rack systems share some of the same installation constraints as OCUs, such as limited ability to move cabinets around as needed within a fixed kitchen layout. They also occupy physical space within the facility and require higher charges of refrigerant to support multiple cabinets throughout the restaurant — all without providing measurable efficiency benefits.

### OCUs

Even though modern OCUs offer operators many advantages, there are situations where deployment is limited by a facility's physical constraints. These scenarios include:

- Installation in a leased building where drilling holes in the wall or ceiling is prohibited
- Restaurant is located on the interior of a larger building where access to the outside for remote installation is unachievable

- Difficulty moving equipment around in a high-density kitchen or one with an inflexible layout

If operators are able to overcome these limitations, they stand to benefit from the added efficiency gains that modern OCU systems can deliver. The option to configure OCUs in a multiplex architecture also represents the potential for increased energy efficiency and sustainability. And while the initial investment in OCUs may be a deterrent for some operators, the remote refrigeration cabinets used in this architecture are less expensive than self-contained units.

## Making the move toward modern outdoor condensing units

Modern dedicated OCUs are becoming a preferred option for those seeking a lower total cost of ownership and a way to solve myriad operational challenges. Let's take a closer look at the justification for this trend.

### Improve energy efficiencies

Compared to legacy OCUs, modern remote systems are capable of providing annual efficiency improvements of up to 20 percent or more. These gains can be attributed to reliable and efficient scroll compressor technology and variable speed fans, combined with large condenser coils and smart electronic controls.

### Create a better indoor environment

Additional facility efficiencies and improved indoor comfort levels are achieved by removing the heat load produced by self-contained units. By locating the condensing unit outdoors, operators also lighten the load on their AC systems, reduce refrigeration noise, and reclaim space that would be occupied by a centralized rack machine room.

### Comply with regulatory requirements

Modern OCUs are engineered to address today's regulatory challenges. They're designed to maximize energy efficiencies and meet the DOE's new requirements for remote condensing units used on commercial refrigeration equipment.

Since these OCUs utilize acceptable, low-GWP refrigerants as recommended by the EPA's SNAP requirement, operators can move away from a soon-to-be obsolete generation of equipment.

Finally, the dedicated one-to-one architecture of OCUs keeps refrigerant charges to a minimum, thereby meeting CARB requirements and avoiding the added expense and effort associated with maintaining proper documentation and leak detection protocols required by some regional jurisdictions.

### Remove location restrictions with slim profile and low noise

The slim chassis, lightweight design and wall-mount option of modern OCUs give operators the possibility to install the unit in space-constrained locations. This added flexibility lowers installation costs and helps avoid expensive system design workarounds, or even the worst-case scenario, i.e., relocation.

Compared to traditional OCUs, this greatly expands installation options where excess noise would typically prevent their use in customer-facing locations, such as entryways, patios or potentially even indoors.

### Corrosion resistant, built for extremes

Modern OCUs are designed to withstand extreme environments, from arctic blasts to desert heats. Engineered with a protective enclosure and condenser coil fin coatings, these next-generation OCUs resist corrosion, even in unforgiving coastal zones.

The inclusion of a heated and insulated receiver eliminates operational concerns in low ambient temperatures. On-board electronic controls constantly tune and adapt the system for optimum performance and maximum efficiencies in all conditions.

### Electronic connectivity for added reliability and built-in protection

Built-in compressor electronics provide diagnostics and protection to vastly improve OCU reliability. System faults are immediately communicated to service technicians to help

them quickly (and remotely) diagnose system conditions, often eliminating nuisance service calls.

Advanced diagnostic features and smart algorithms, combined with connectivity to a facility management/controls system, provide operators and technicians with the following benefits:

- Receive fault alerts for early detection of potential failures
- Prevent compressor failure by maintaining a safe operating envelope
- Evaluate key performance indicators

### Simplified maintenance, improved reliability

With integrated electronics and one-to-one, dedicated architectures, modern OCUs are less complicated than rack or multiplex systems to operate, service and maintain. The inclusion of scroll compression technology also results in the highest degree of refrigeration reliability available. The end results are increased uptime, extended compressor lifespan and greatly reduced lifecycle costs.

Operators have the peace of mind knowing that these advanced diagnostics and protective measures will eliminate downtime and protect their brand reputations. They can stop worrying about product loss and focus on making important decisions to improve their businesses.

## Conclusion: Moving condensing units outside makes good business sense

In today's demanding restaurant and convenience store markets, operators are re-evaluating the critical role refrigeration system architecture plays in meeting business objectives. Sustainability targets, total store energy usage, and regulatory compliance are all important factors in the modern refrigeration equation.

Operators who choose to make the move to outdoor condensing need to be aware that not all OCUs are alike. In particular, legacy units — such as those that have been in use for decades — may not address today's diverse operator challenges. To ensure maximum efficiency, reliability, sustainability and installation flexibility, operators should

look for modern OCUs capable of delivering the following advantages:

- Enhanced reliability through proven scroll compression technology
- Compliance with energy efficiency minimums using eco-friendly refrigerants
- Optimized in- and outside-store environments for customers, staff and neighbors
- Improved installation flexibility via quiet, slim-profile design
- Protection against system failures to prevent product loss and equipment replacement costs
- Advanced diagnostics to detect system issues before they occur
- Durability to withstand the most extreme outdoor environments

All told, these benefits add up to a lower total cost of ownership for modern OCUs compared to legacy units or other traditional refrigeration methods. For those taking the long-term view of their business and operating expenses, the case for modern OCUs becomes even stronger as the life cycle progresses.



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