

## TOP FOUR ACTIONS TO TAKE CONTROL OF ENERGY COSTS FOR SERVICE MECHANICS AND CONTRACTORS

Refrigeration accounts for more than half the power bill in most grocery stores in the Northwest. When heating and air-conditioning are added, the combination approaches three-quarters of all energy used. For this reason, refrigeration and HVAC are good places to look for energy cost reduction opportunities.

Here we describe four high-impact steps you can take with the help of your refrigeration technicians and other outside contractors to reduce energy cost in your stores. The first two – checking and optimizing the setup of refrigeration and outside air controls – are generally the top two opportunities in a store in terms of savings-impact-per-dollar-of-implementation-cost. They focus on making your current equipment work as well as it possibly can. The other two steps, while not as large in terms of savings potential, are nonetheless valuable and worth your attention. These would typically be implemented by a small specialty contractor or by in-house facilities staff.

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### 1. OPTIMIZE THE SETUP OF THE EXISTING REFRIGERATION CONTROLS.

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The single highest-impact step you can take to reduce energy cost in a grocery store is review the setup of the refrigeration controls and make adjustments that optimize their operation. Although a system may appear to be working just fine – product stays cold and flies out the front door – a day or two of focused attention by a service mechanic or refrigeration commissioner can improve a system’s performance so that it not only gets the job done, but gets it done at less cost, with improved stability and capacity as well. Immediate reduction in energy cost of 4% to 8% from this kind of “energy tune-up” on a rack refrigeration system is common.

Where does a 4% to 8% boost in efficiency come from? Ultimately, from the same place athletes find performance improvement. By looking closely at technique a sprinter can find all sorts of ways to eliminate unnecessary motion and internal resistance so that more energy input is converted into useful output. Same goes with refrigeration. A closer



look at a refrigeration system highlights areas where the heat load can be reduced, evaporator coils can be more fully used, condenser fans can remove heat with less energy input, and compressors don't have to work against such a high discharge pressure. Lower energy cost – often ranging from \$400 to \$1,400 per month – isn't the only benefit. Peak refrigeration capacity of the system is often increased and unanticipated downtime is reduced.

Details of the process vary depending on system type and configuration, but the basic approach for a common rack system typically includes:

- Adjusting condenser holdback valves, condenser fan sequencing, and head pressure control settings. Together, these determine the refrigerant pressure in the condenser, and thus, at the discharge from the compressor. Lower is better from an energy standpoint, because it takes less work to compress refrigerant gas to, say, 150 psi, than it takes to go up to 200 or 250 psi. It's easier on equipment, too.
- Measure superheat values and adjust thermostatic expansion valves at the cases to a target superheat. Using actual temperature measurements to adjust the superheat of the refrigerant as it exits the evaporator coil dramatically improves the effectiveness of heat transfer in the coil, which reduces compressor workload and runtime.
- Once the first two steps are done, the setpoint for suction pressure on some of the refrigeration circuits may now be lower than it needs to be. Where this occurs, the suction pressure setpoint may be raised. As a rule of thumb, each 1 psi increase in suction pressure reduces compressor energy use by 2%.

In newer systems equipped with electronic valves, sensors, and controllers, some of this can be done simply through programming. Older equipment requires manual intervention with wrenches and screwdrivers.

Once this process has been completed and the system has been set up to perform efficiently, be sure to write down the setup information and post it in the machine room in a clear, obvious manner. Immediate access to system setup information and to a description of the intent behind it is extremely helpful to contract service mechanics and in-house maintenance staff. Often this information is not readily available to mechanics, and after a year or two you find that half the benefits of optimizing the system have dissipated. This is because mechanics on emergency call-outs must do whatever they can with the information they have on-hand to resolve the urgent problem that triggered the call. Without a clear view of the overall setup and the intent behind it, they have no way to tell whether the fix-of-the-moment reinforces overall system efficiency or (more likely) undermines it. Make sure they have the information they need to keep the setup optimized over time.

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## 2. VERIFY OPERATION OF ECONOMIZERS AND OUTDOOR AIR DAMPERS ON HVAC UNITS.

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Experience shows that economizers and outdoor air dampers frequently quit working, stick in place, or simply have never been set up to accomplish the designer's intent. This can lead to the introduction of far more outside air than is needed for ventilation, especially if it happens 24 hours a day. In the Northwest, this extra outside air must be heated most of the time, driving up gas and electric bills. (In some NW locations during the heat of summer, cooling load is driven up also.) In addition, humidity that rides in with outside air adds to the load on the

refrigeration system by condensing on evaporator coils inside the refrigerated cases, which adds to the work the system must do, but provides no benefit.

The solution is to repair linkages and set up the controls to admit the intended amount of outdoor air at all times. The “intended amount” will vary, depending on business hours, outdoor ambient conditions, the level of customer traffic, and building pressurization needs. In general, though, it will be desirable to minimize the introduction of outdoor air whenever it isn’t actually required for ventilation purposes if it adds to the heating or cooling load.

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### 3. BLOCK THE ENTRY OF WIND-DRIVEN OUTSIDE AIR.

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Another major driver of gas and electric bills is the undesired flow of wind-driven air into the building through open doors, worn door seals, and free paths for airflow between the back room and the sales floor. A store is supposed to be slightly pressurized by the HVAC system, so that conditioned indoor air will be pushed out through the cracks and gaps in the walls and ceiling. You don’t want outside air pushing its way in through open doors or getting sucked in by the HVAC fans through cracks and gaps in the building envelope.



Unfortunately, however, buildings are often quite permeable in practice, and if there are points of entry for outside air on opposing sides of a building, even a slight wind will drive a lot of air into a building. There may not be much you can do about front doors, but you can cut down on the cross-flow effect by:

- closing both front and back doors when not in active use
- making sure door seals are in good shape
- stopping up any gaps in the back of the building with expanding foam or caulk sealant
- ensuring that strip curtains or swing doors between the back room and the sales floor are sealing well, especially if the back rooms are not conditioned to the same temperature as the sales floor

Yes, outdoor air can still stream in from the front, but the effect is reduced if that air meets a dead end inside the building instead of flowing right through and slipping out the back.

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### 4. MAINTAIN STRIP CURTAINS.

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Over half your electric bill each month is driven by the refrigeration system in the store. You buy electricity for it and it uses the electricity to remove heat from the air and products in the refrigerated cases and the walk-ins. Once you have gone to all the effort and expense of paying for energy to cool and dehumidify air, it makes sense to keep that air right there in the cases and walk-ins where it can do some good. That’s the job of the strip curtains, door gaskets, and door closers.

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However, one often finds strip curtains and door gaskets in poor condition, no longer up to the job of stopping cold air from escaping out the bottom of a door opening. Even in the absence of a perceptible breeze, that's what happens. The cold air, being denser than the warmer air outside the walk-in or display case, "falls out" the bottom half of the open door, spreading across the floor of the warmer space. This leaves a slight vacuum inside the cooler space, so warm air from the outside flows in through the top half of the door opening to replace the cold air that spilled out the bottom.

For an example of this close-to-home, try playing Monopoly on the living room floor on a cold winter evening. Ask someone to open the front door. Even if you are twenty feet away, you soon feel a current of cold air creeping across the floor. Meanwhile, warm air from inside the house streams out the top half of the door, heating up the neighborhood. Again, it doesn't require any wind to do this. It's the difference in density between cold and warm air that causes the air masses to change places.

It's a subtle, but powerful effect that not only drives up the heating load – and the gas bill; it also means you must cool another mass of warm air down to the refrigerated case temperature. This gets expensive, especially for doors that are opened frequently, where you get to pay again and again and again to bring a fresh load of warm air down in temperature each time the door is opened.

It's more effective all-around to make sure strip curtains and door gaskets stay in good working order.

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