10 Ways to Stem the Energy Bleeding

Practical Actions for Convenience Store Chains

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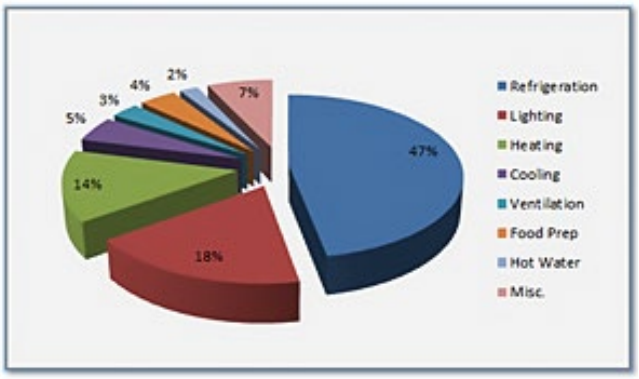
In this white paper, we offer 10 practical actions that can significantly reduce energy use in Convenience Stores of all types and sizes.

Convenience Stores are among the most energy intensive of all businesses. On average, C-Stores use 3 times the energy per square foot of a typical commercial business, tying restaurants for the number 1 spot. However, C-Stores come in many different configurations. Many – but far from all – dispense fuel. Some offer car washes. More and more have added quick serve restaurant (QSR) outlets. Many, but not all, are open 24x7. As a result, energy use varies quite widely, and in some cases runs as much as 7 times the commercial buildings' average on a per square foot basis. HVAC and lighting dominate energy spend for retail stores as a whole, but for most C-Stores the number one energy culprit is refrigeration. Other large energy consumers include:



Typical convenience store energy use breakdown

- Food prep equipment, particularly if it is electric-powered
- Fuel pumps

Water can also be a major utility cost for a C-Store, particularly if there is an irrigation system, and costs are compounded radically if there is a car wash.

However, there is a range of ways to achieve significant energy savings in Convenience Stores – even those with 24x7 operations. Where margins are tight, reducing energy costs becomes a very effective way to increase profits.

1. Enhance

Short of replacing equipment, there are a large number of things that can be done to make equipment more efficient in a convenience store– particularly with respect to the number 1 energy consumer, refrigeration:

- Add strip curtains inside all walk-in units to reduce losses during reloading.
- Add relatively inexpensive anti-sweat heater controls to ensure that these heaters are on only when they are needed.
- Place low emissivity display case shields over refrigeration units when the store is closed or at low demand. These shields reduce energy use by about 8% and help better maintain food product temperature.
- If refrigeration units are more than 10 years old, adding floating head pressure controllers to the condensers can have a significant impact. Floating head controllers change the shut off head pressure as outdoor temperatures go up and down, reducing the time that the compressor runs.
- In terms of HVAC, for all but the most humid climates, Economizers (which bring in outside air and turn off the compressor when the temperature falls below a certain level) can reduce energy use by 10%, or even more can reduce energy use by 10%, or even more in milder climates. You can generally add an Economizer to any Roof Top Unit (RTU). (Note: Economizers have a tendency to stop working over a three- to five-year time period and can actually end up using more energy; a suggestion for how to be alerted to economizer problems and avoid this is made in Action 6 below).

2. Replace

When it is time to replace equipment, looking for more energy efficient alternatives makes good economic sense. Even if the equipment costs more up front, the energy savings will generally more than pay for that over time.

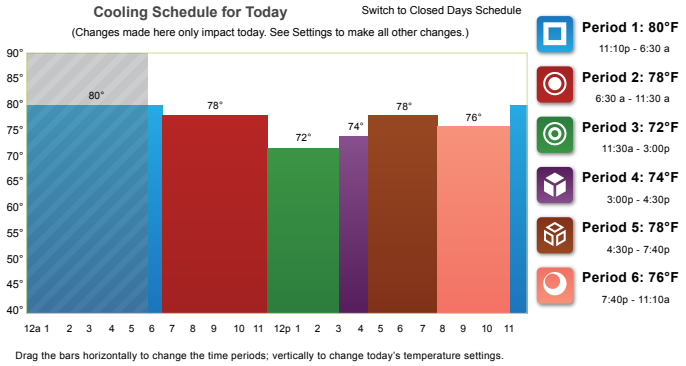
Among the biggest potential savings opportunities:

- Replace RTU's with more efficient HVAC equipment. Many more fuel efficient options are now available. Look for equipment that has a SEER (Seasonal Energy Efficiency Rating) of at least 13.
- Refrigerators and freezers that have the EnergyStar® label can be as much as 35% more efficient than other units, which can make a huge dent in your energy expense. There are also EnergyStar ice machines.
- If you have kitchen equipment, look to replace fryers, griddles, hot holding cabinets and ovens with units that have the EnergyStar label. This equipment will generally use at least 20% less energy, in some cases as high as 70% less. While you are at it, consider replacing electric ovens – including electric pizza ovens - with gas-powered equipment. Gas ovens use considerably less energy.
- Lighting constitutes a major portion of energy usage in a C-Store. If you are still using T-12 lamps indoors, replace them with T-8's, which use 30-40% less energy. (T-12s will no longer be produced or imported into the US starting in July, 2014). Alternatively, Compact Fluorescent Lamps (CFLs) are even more efficient, but will require additional retrofitting. The most efficient lighting of all are LEDs, which are still fairly expensive, but coming down rapidly in price. They last at least 10 times as long as traditional bulbs and use 1/5 the energy for the same light output; with available utility rebates (see Action 9 below) they are well are worth considering. LEDs are particularly cost-effective in Exit signs and inside refrigeration equipment, where they give off much less heat.

Outside, it is time to replace probe start HID (high intensity discharge) lighting with pulse start metal halide lamps. Not only are HID lamps inefficient, but the starting probe tends to blacken the bulb over time, making them even less so. Make sure outdoor lighting has photo-sensors so they automatically turn off when it gets light.

3. Control (Remotely)

Energy Management Systems that address HVAC and lighting can have a significant impact on energy costs. Traditional systems designed for larger facilities have not generally proven cost-effective for C-Stores, but a newer generation of Energy Management Systems has changed the equation.



- HVAC costs vary considerably based on climate, but, as illustrated in the pie chart earlier, represent a considerable percentage of energy costs for C-Stores as a group. While some operators have relied on traditional programmable thermostats in an effort to contain HVAC cost, this approach suffers from two problems. First, programmable thermostats tend to be fairly complex to program, and so often are not. Second, even when they are programmed, they generally do not stop staff from adjusting the temperature for their personal comfort levels. A new generation of low cost wireless, communicating thermostats enables remote, centralized control and has made the task of controlling HVAC costs much more cost-effective for a smaller facility such as a C-Store.

- Internet-based thermostats tend to be much easier to program – most offer access from mobile devices. Some, but not all, come with flexible lock-out controls so you can, for example, allow local store personnel to adjust the temperature by a controlled amount (say 2 degrees) when customers are in the store, but not at all at other times. And, some allow multiple sets of templates – for different regions or operating hours as examples – to be set centrally and sent down to the stores so that each thermostat does not need to be programmed individually. Even for stores open 24x7, centralized HVAC controls will reduce costs because they enforce corporate policies on temperature settings.

- Lighting is the other major energy load that can be readily controlled with a Lighting Control System. In the case of lighting, store hours may get in the way; with a 24x7 operation lighting controls may not be cost-effective. However, for other facilities lighting controls may be extremely effective.

- Some other energy loads may run needlessly during off hours and therefore be candidates for control as well. Examples of this may be an air compressor, car wash glycol system, or submersible turbine pump (STPs).

4. Maintain

One way to keep energy costs down is to make sure that equipment is properly maintained on an ongoing basis. In addition to having your HVAC/R equipment inspected and serviced at least twice per year, here are some simple tasks you can tackle internally:

- Clean all condenser coils- on both your refrigeration and HVAC equipment- on a quarterly basis.
- Regularly check evaporator coils to make sure there is no ice build-up. Wash HVAC coils thoroughly before (and after) each cooling season.
- Change air filters monthly during the peak heating and cooling seasons.
- Check refrigeration door seals regularly and replace as needed.

5. Use (Only) as Needed

A no cost way to lower energy use is to use equipment only when you need it. Even if you operate 24x7, there are opportunities to turn things off. For example, there could be parts of the store that are not used overnight where lights can be turned off. There may be food prep equipment that can be turned off during periods of low demand.

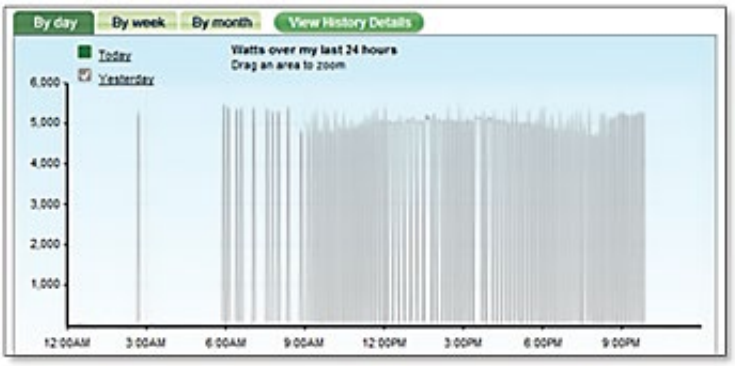
If a store does not operate 24x7, there are often numerous opportunities to turn things off when they are not needed. Savings of 5% of overall energy spend can often be found just by ensuring that equipment on/off items follow a prescribed schedule. For a chain with a $30,000 annual energy spend per store, that's as much as $1,500 per year per unit.

But, you already have rules for what should be on when. How do you get a handle on when equipment is being used and what that is costing you?

Read on.

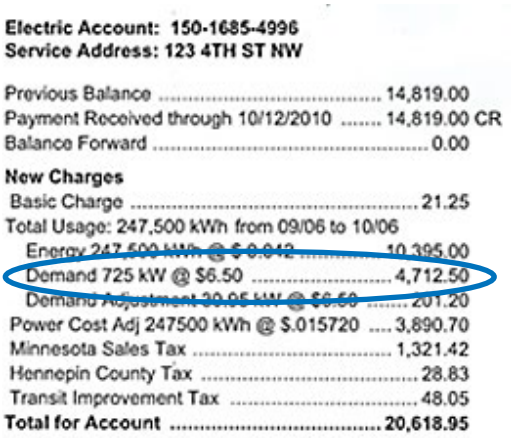
6. Monitor (Everything)

The advent of low cost sensors and wireless communications has made it much less expensive to monitor equipment remotely than it was even a few years ago. Some systems on the market monitor equipment centrally at the electric panel so that all equipment can be monitored at a relatively modest unit cost. A variety of approaches are available for monitoring water and gas usage as well.



Monitoring offers a range of ways to enhance operational efficiencies:

- By monitoring equipment you will know what is on when – and what it is costing you. This lets you create a more effective schedule of equipment operating times – and provides the feedback to ensure that you stick to it. (Clearly the potential benefits are greater when a facility is not open 24x7, but even those facilities that are open all the time can benefit from knowing what is running when and how much it costs).
- Equipment monitoring can also help identify equipment problems – which leads to lower energy costs and lower maintenance costs and can help avoid catastrophic failure. For example, by monitoring electric loads it is easy to spot compressors that are short cycling or overloaded, both of which are signs of problems that should be looked at as quickly as possible. Putting temperature sensors in HVAC supply and return ducts and monitoring the difference can help pinpoint other potential problems. By monitoring an RTU compressor, it is easy to spot an economizer that is malfunctioning so that it can be fixed before it wastes too much energy. Monitoring temperatures in walk-in units can help spot situations where food safety is threatened. And the list goes on.



Electric Account: 150-1685-4996
Service Address: 123 4TH ST NW

Previous Balance	14,819.00
Payment Received through 10/12/2010	14,819.00 CR
Balance Forward	0.00
New Charges	
Basic Charge	21.25
Total Usage: 247,500 kWh from 09/06 to 10/06	
Energy 247,500 kWh @ $ 0.042	10,395.00
Demand 725 kW @ $6.50	4,712.50
Demand Adjustment 30.95 kW @ $6.50	201.20
Power Cost Adj 247500 kWh @ $.015720	3,890.70
Minnesota Sales Tax	1,321.42
Hennepin County Tax	28.83
Transit Improvement Tax	48.05
Total for Account	**20,618.95**

- If you want to determine whether lighting controls make sense, monitor the lighting loads first. That will make it straightforward to identify what is on when it shouldn't be and what savings can be gained by automated controls.
- Even fuel pump dispensers and STPs can be monitored centrally, both to see if they appear to be working properly, and to make sure that they turn off when not in use.
- Water may be a major expense, especially for facilities with irrigation systems or car washes. It's bad enough that electric and gas bills come after the fact, but water bills are often delivered only once per quarter. If there is a leak, thousands of dollars could literally go down the drain before the bill indicates that there is a problem. Real-time water monitoring can help spot leaks quickly so that corrective action can be taken before the bills go sky high.

7. Beware Demand

Demand charges are among the least understood elements of a utility bill. And yet, demand charges can be very significant in some parts of the country, particularly during summer months.

Electric utilities generally charge for the amount of energy you use – measured as kilowatt hours (kWh), and the maximum power you draw in the month over any 15 minute (or sometimes 30 minute) period – measured as kilowatts (kW). The idea behind this charge is to allocate the costs of building peak demand capacity. Demand charges can be $30/kW and higher in the summer months at some utilities – and if a facility uses 100kW at the peak it would be hit with a $3,000 monthly demand charge.

The problem with trying to reduce demand charges starts with not even knowing when the demand peak occurs; it is very unlikely to be on your bill. Nonetheless, there are steps that can be taken to reduce peak demand. (Some utilities have tiered demand rates that go up as demand rises, so curtailing demand could have an even more significant impact on the bill).

- Stagger the likely starting time of your RTU's by at least 15 minutes so that they do not all kick in at once. There is a spike in usage when a compressor turns on, so you want to avoid having them all turn on at the same time.
- A handful of Energy Management Systems monitor demand and automatically adjust HVAC settings during peak periods to moderate demand.

- With a monitoring system as described in Action 6 above, you can pinpoint peak time periods, and use this information to identify ways to adjust equipment schedules to avoid having everything on during the peak periods. For example, assuming you have a large enough ice machine that may be something you turn off during peak periods. One practice that has been used is to avoid scheduling deliveries during demand peaks, since opening walk-in doors will lead to higher power usage.
- Some of these same techniques may be effective if you have time based rates that are higher during peak periods.

Of course, controlling demand does not really reduce energy usage per se. But, it does reduce peak kilowatts used – and, more importantly, reduces your utility bill.

8. Employ Best Practices

There are a variety of relatively simple best practices that can help keep energy costs in check:

- Every degree you lower the set point for cooling adds 3% or more to your bill; every degree you raise it for heating adds at least 2%. Make sure you do not cool or heat more than necessary. If you are closed at night you can adjust the set points by as much as 8 degrees without worrying about having the facility comfortable when it opens. If you have periods when only staff are in the facility, and no customers, consider adjusting the temperature slightly; every degree helps.
- Set refrigeration temperatures no lower than 37 degrees and freezer temperatures no lower than-5. If you monitor temperatures in these units you may determine that you can actually go a little higher and still keep within food safety limits, and know that you will be warned about impending problems.

  Put occupancy sensors in rest rooms, mechanical rooms, or other locations that are unoccupied for considerable periods of time.
- Many operators maximize outdoor lighting wattages to attract customers at night. An alternative approach is to paint pump islands a bright color and make sure the lighting is directed towards the island. This can have the desired effect – without increasing energy costs.
- You have upgraded equipment, installed a control system and monitoring system, and put operating procedures in place around equipment schedules and set-points. Now what? Now you need to make sure that employees get the proper training in running an energy efficient operation, so that employee turnover does not undermine the great progress you have made.

9. Get Money Back

Okay, this does not really count towards directly lowering energy use. However, you may qualify for rebates from some utilities for equipment upgrades and replacements as well as for the installation of Energy Management Systems. If some of your retrofits end up costing you less because of the rebates, you can afford to do more of them, and therefore reduce energy use indirectly- and save even more.

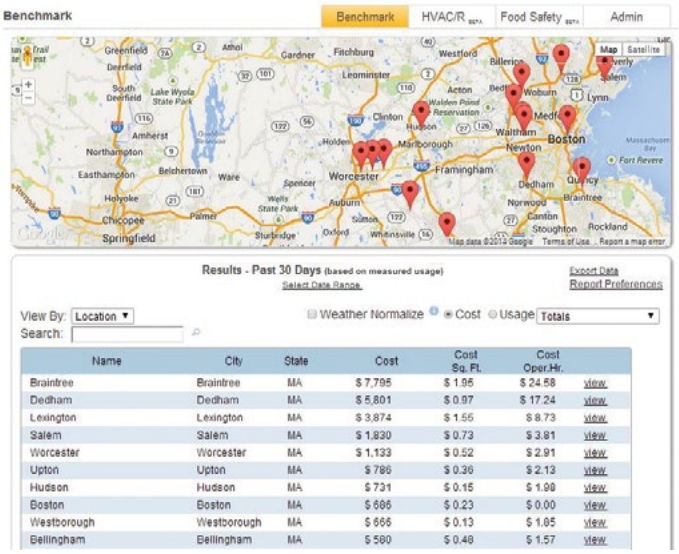
Unfortunately, the rules for getting rebates are somewhat complex, and vary from utility to utility. The good news is that there are consultants who will take the lead role in getting rebates in exchange for a share of the rebates. You can also check the Database of State Incentives for Renewables and Efficiency for rebates and incentives available in each state.

10. Benchmark

And, finally…

You have many facilities. Some will do a better job than others at managing energy use and equipment. Make sure you can leverage best practices and weed out the worst.

- Benchmark the energy and water use and cost of your facilities, using key performance indicators such as cost per square foot or cost per operating hour so you are comparing apples to apples. More sophisticated benchmarking software platforms will even perform "weather normalization" to take into account the impact of weather on energy bills. Using this approach, you can spot the best and worst performers easily.



- If you have different types of facilities – i.e. some with quick serve restaurants, some without, others with car washes – organize the facilities into like groups so that you are comparing similar facilities.
- If you adopt equipment monitoring as described earlier, you will be able to drill down and benchmark at the equipment level. Is it refrigeration that is causing one facility to use much more energy than the others? Is it heating and cooling? Has a facility figured out how to keep lighting costs down, resulting in lower overall energy usage per square foot than its peers? What can your best-performing locations teach the rest?
- If you are monitoring equipment, you can also benchmark equipment centrally, quickly spotting problem HVAC or refrigeration equipment anywhere across the country.

In Conclusion

OK, we cheated a little. There were 10 groups of Actions, not 10 Actions. But, that is really the point. There are lots of things that owners of Convenience Stores can do to have a significant impact on energy (and water) usage, and thereby increase profits. Some are very inexpensive or free – others will cost some more. But it is not necessary to do everything on this list – and certainly not at the same time. Make the effort to put together a plan. Take a series of steps, and watch the savings follow.