

Ways to Reduce Your Oven Operating Costs

By Mike Grande, Wisconsin Oven Corp.

Here are 13 simple things to consider that could save you thousands over the operating life of your process oven.

Whether you currently use ovens in your manufacturing operation or are considering a new oven purchase, take a close look at the operating cost of the equipment. Due to the energy-intensive nature of process heating, energy costs can take a huge bite out of your bottom line. The good news is that there's a lot you can do about it.

Choose the Best Heating Method

Gas or electric?
Infrared or convection? A careful choice -- made with your application in mind -- can save you big money in energy costs.

Gas or Electric?
Gas ovens usually cost less than electric to operate because the price per unit of energy typically is less, but this must be

balanced against the initial purchase price. For example, on a small oven that is used infrequently, electric may be a better choice because the energy savings probably cannot justify the higher initial purchase price of gas. By contrast, large high temperature ovens are most often gas fired due to the significant energy requirement of these units.

Infrared or Convection? Despite claims to the contrary, infrared is not inherently more efficient than convection heating. In a typical infrared oven, only 25 percent to 30 percent of the energy used by the oven is actually absorbed by the parts. With convection, this number is in the 60 percent to 70 percent range. The exception is with heavy, thick parts -- engine blocks, for example -- where infrared saves money because it heats only the surface of the part while convection must heat the entire part to get the surface up to temperature.

Look at the Numbers. Do not accept claims of higher efficiency at face value. Efficiency can be defined in many different ways. Find out your unit costs for gas and electricity and ask the oven suppliers to estimate the energy consumption and compare the operating costs. This, of course, applies to both convection and infrared.

Choose Features That Enhance Efficiency

TABLE 1. ENERGY-SAVING FEATURES			
Below are examples of energy savings resulting from various oven design features, based on a "typical" batch oven operating at 500°F (260°C).			
	Savings Per Hour	Savings Per Year ¹	Savings Lifetime ²
2" Thicker Insulation	\$0.07	\$292	\$7,000
Door Limit Switch ³	\$0.36	\$1,498	\$36,000
Direct-Drive Fan (7.5 hp)	\$0.06	\$250	\$6,000
High Efficiency Blower Motor (20 hp)	\$0.12	\$500	\$12,500
Burner Cleaning And Maintenance	\$0.15	\$324	\$15,000

¹ Based on two-shift operation, five days per week (4,160 hrs/yr)
² Based on 25-year equipment life
³ Assumes the oven door is open for 10 min of every hour

Table 1. Adding energy-saving components can pay big dividends over the operating lifetime of your process oven.

Consider optional features that reduce energy costs. Most of them are inexpensive and easily pay for themselves (table 1). For new purchases, find an oven supplier that offers a “high efficiency” option package. They should be able to estimate the potential savings for you. A few examples of energy-saving features are as follows.

More Insulation. If you are considering a new oven, add 1" or 2" of additional insulation to the oven walls. This will make the oven more efficient and is not very expensive. It can save you several thousands of dollars over the life of the equipment. An additional benefit is improved temperature uniformity of the heated workspace and, therefore, your product.

Door Limit Switch. When the door on a batch oven is opened and closed to load and unload the parts, the temperature drops temporarily as heat is lost out the opening. This causes the burner (or heaters, in the case of electric heat) to go to high-fire for several minutes while the door is open. This wastes a great deal of heat and fuel. A door limit switch can be used to turn the burner to low fire (or turn the electric heaters off) while the door is open, which can save tens of thousands of dollars over the life of the equipment. Considering the low cost of this device (\$300 or so), it is a must-purchase item.

Direct-Drive Recirculation Blower. The oven recirculation blower is an often-forgotten source of energy consumption on convection ovens. Look for an oven supplier that offers direct-driven blowers rather than belt-driven. Belt-drive losses are commonly in the 5 percent to 10 percent range, which translates into roughly \$0.06 per hour for a 7.5 hp blower operating at 500°F (260°C), or \$250 per year assuming two-shift operation. Because a direct-drive blower is driven directly off the motor shaft, there is no belt drive. Another benefit of this blower style is low maintenance as there are no belts to replace. It is also much quieter than belt-driven blowers.

High Efficiency Recirculation Motor. Use a high efficiency motor on your recirculation blower, especially if it is 20 hp or larger. A typical high efficiency motor is 6 percent more efficient than a standard-efficiency motor and will provide significant savings. For example, a 20 hp high efficiency motor can save \$0.10 to \$0.15 per hour and usually will pay for itself within the first year of operation.

Reduce Unnecessary Heat Spillover. On conveyor ovens, it is always a challenge to properly seal the area where the conveyor and parts enter and exit the oven heating chamber. Block off around these areas with a high-temperature curtain material such as silicone rubber (figure 1), or with sheet metal. Even a small amount of heat spillover will consume a substantial amount of energy over the long run. On ovens that require large openings for the parts to pass through, or where the parts are coated with paint or powder, curtains may not be an option. In this case, use a powered air seal or a vestibule (dead zone) at each opening.

Keep Load Carts and Racks as Light as Possible. If your parts are carried into the oven on a load cart or racks, design them to be as light as possible. The cart or rack is heated along with your parts, and this requires additional heat energy. The heavier the cart or rack, the more heat energy will be required, and the higher your operating cost.



Figure 1. Profile curtains seal the area above a conveyor but let the product pass through, resulting in reduced heat losses out the openings.

Follow a Regular Maintenance Schedule

The importance of maintaining and properly adjusting your oven equipment cannot be overemphasized and will significantly impact your energy costs.

Be Sure Your Burner Is Adjusted Properly. A burner that is firing too rich (too high gas/air ratio) will consume more gas. Set up the burner with the correct gas pressure and combustion airflow rate as stated in the equipment manual. The burner should be adjusted so you see blue flame with only slight yellow.

Clean the Burner and Combustion Blower Regularly. Over time, the combustion blower will become dirty and inefficient, resulting in improper combustion. This will make your burner fire at a higher rate, to maintain the oven setpoint temperature, and consume more gas, which costs you money. Consider a combustion air filter to help keep the blower clean (figure 2).



Figure 2. A combustion filter is a low-cost item that will keep the burner clean and operating at peak efficiency.

Replace Worn Door Gaskets. Worn door gaskets can leak hot air, which wastes money. Keep replacement gasket material in stock and replace it whenever necessary. This also will improve your oven temperature uniformity by preventing cold air from leaking into the heating chamber and affecting your product. Considering the low price of gasket material, it is money well spent.

Adjust Your Exhaust Blower Properly. Most exhaust blowers have a manual damper to adjust the flow. To meet National Fire Protection Agency (NFPA) codes, the damper should be designed with a stop or cut-away to prevent it being fully closed. You should only open it more than this if necessary for your specific heating process (to exhaust moisture from the heating chamber, for example). If the damper is open more than necessary, you will be wasting energy.

Your oven doesn't have to cost a fortune to operate. With a little planning and the use of energy-saving features, a properly designed oven system will save you money.

Sidebar: Ways to Save if You Have an Electric Oven

While many of the tips offered apply to both gas-fired and electrically heated ovens, there are a few other things you can do if you have an electric oven to further reduce your operating costs.

Work with Your Utility. Check with your local utility supplier about your energy costs. Many utilities offer direct technical support to their industrial and commercial customers as well as financial incentives.

Consider Off-Peak Operation. To reduce the price you pay for electricity, consider off-peak operation of your electric heated oven. You can sometimes get a lower energy rate by running the equipment during second or third shift, as opposed to first.

Beware of the Demand Charge. A demand charge is a premium you must pay for the electricity based on the oven's peak consumption, regardless of the frequency you use it. You pay for the peak demand even if you only run the oven once a month.

Ask About Rebate Programs. Power companies will sometimes pay for a portion of your oven if you use their choice of energy source. This can amount to 50 percent -- yes, 50 percent -- of the purchase price, for example, simply by selecting gas instead of electric.

These programs are not well advertised, so you have to inquire about them.