

# **Air Pollution Control Systems And Operating Costs**

When air pollution controls were first introduced in the 1970s, fuel costs were low, electronic controls and technologies were primitive compared to today's standards, and the energy efficiency of control devices and their sub-components was not optimized.

As the cost of energy continues to increase, choosing a new piece of emission control equipment often becomes as important as choosing the production machinery itself. And, as existing control equipment ages, replacing it with higher efficiency models not only helps the environment, it also helps reduce energy usage.

While achieving higher thermal efficiency by design has been possible for many years, it was typically considered to be cost prohibitive as a capital purchase. However, advances in pollution control technologies have made highly energy efficient systems more practical and a financial payback analysis now clearly favors a change.

### **New & Replacement Options**

When considering a green field site or expansion, a company's air pollution control options may be greater due to fewer space restrictions. Typically, it's a good idea to get a qualified equipment provider involved early on to avoid limiting technology choices further into the project. Make sure to select a vendor that has experience with multiple types of controls and can make an equipment selection that will meet the emission destruction efficiency requirements while best utilizing the fuel value of the contaminant to be destroyed. If existing air pollution control equipment is due for replacement, the technology choices may be limited by the space of the current unit. However, available space should not totally drive the direction of a project. Future energy savings can (and usually does) justify the cost of placing a more efficient control device in a different location.

Most vendors have "standard" emission control units available that will control a wide variety of processes with one design. To get the most of every energy dollar, ask about a design tailored to the exact process that it is being connected to. Heat recovery can be maximized (or de-rated) for specific VOC loadings to reduce auxiliary fuel usage to a minimum. Certain processes can utilize LFL (lower flammable limit) controllers to vary the airflow through the control device to keep the VOC level high enough to allow the unit to operate virtually fuel-free.

### **Modern Components**

Since electric motors are now subject to more stringent energy efficiency standards than in the past, the use of standard, high, or premium efficiency models will have

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an impact on operating costs. For 24/7 operations, premium efficiency models will easily pay for themselves over the life of the motors. A 100 HP motor operating at 90 percent versus 95 percent efficiency will use approximately 4 KWH more electricity per hour. While this may not seem like much of a difference, when added up over the course of a year, the sum can be significant.

Variable speed fan controls and PLC controls are two ways in which electrical technology has increased the operating efficiency of air pollution control systems (APCS). A variable speed fan can reduce the required flow rate rather than using a damper to limit pressure on a constant speed fan. Fan energy usage is a combination of air volume and pressure requirements. PLC controls can sequence the operations of a piece of equipment with more flexibility than a relay-based unit, allowing tuning parameters to be optimized.

Insulation is an often overlooked area of energy conservation. If the process does not supply enough VOC to fuel the control device, supplemental fuel must be used. Every BTU lost through surface radiation of the equipment must be replaced by a heat source. Additional insulation can be specified, but the equipment footprint will increase as the internal lining thickness increases.

### **Upgrade Possibilities**

If a current emission control system is in good condition but additional energy savings are desired, several different equipment upgrade options are available:

- Any fan with a volume damper can be refit with a variable speed drive and pressure control loop.
- Any relay-based control panel can be replaced with a PLC-based system.
- Burners and/or burner controls can be replaced with more efficient models that automatically adjust the air/fuels ration for optimum performance.
- Regenerative Thermal Oxidizers (RTOs) that have random packed ceramic media can be retrofit with structured ceramic media to increase heat recovery, reduce pressure drop, or increase oxidizer capacity.
- RTOs connected to certain processes can have catalyst added to the ceramic media, thus configuring the unit as a Regenerative Catalytic Oxidizer for operation at a lower energy-saving temperature and a reduced pressure drop.

### **Secondary Heat Recovery Systems**

No matter how efficient an air pollution control system might be, there is always some heat energy left over that would typically be vented out the exhaust stack. Depending upon the air pollution control system design, exhaust stack temperatures can vary between 250 and 1,500 degrees F. To take advantage of this heat, secondary add-on energy saving systems can be retrofitted into an existing system. The heat exchanger can be designed for minimal pressure drop so as not to affect the operation of the oxidizer while returning temperature controlled fresh air for a variety of uses including building comfort heating, process make-up air (ovens/dryers, kilns, curing zones, etc.), heating water, making steam or, in some

cases, completely replacing the need for natural gas fired burners in the manufacturing process itself.

Using the same idea of capturing heat from the exhaust stream, a hot water or thermal oil heat transfer coil can be installed in the oxidizer exhaust stack. Hot water can again be used for building comfort heating or can be returned to the process for use (air preheat, condensation control, etc.). This coil could also be used as a preheat section to preheat cool water for a steam generator. Thermal oil is used as a main process heat source where direct flame heating is not desired. Adding a coil in the exhaust stream can reduce or even remove the heat load required from the thermal oil heating system. Depending on the stack temperature, the exhaust from the oxidizer could be routed directly to a low-pressure steam generator.

Another option is to install an adsorption chiller in the exhaust stream. Many plants use chilled water for various reasons (air conditioning, chill rolls, condensers, etc.). While the initial capital cost is higher than a conventional chilled water system, the “free” energy provided (from the oxidizer exhaust) to run the system can make in an economical choice.

### **Regenerative Thermal Oxidizer**

For companies that have replaced older air pollution control systems with new, energy efficient technology, the results have more than justified the initial investment. For example, to handle a steadily increasing business volume, an experienced heat set and cold web commercial printer in the Midwest added two new printing lines to their operation.

However, expanding their pressroom also meant using more printing ink in the presses and adding to the amount of VOC-laden exhaust emissions that had to be controlled. The company’s existing catalytic oxidizer originally installed on the roof of the building many years ago was in no shape to handle the increased emissions. In addition, there were mounting concerns over steadily increasing maintenance costs and rising energy prices, particularly the cost of natural gas.

After a thorough review of the technology options available to them, the company decided to install a regenerative thermal oxidizer. Since its installation, the unit has been tested at destroying over 99 percent of the VOC emissions generated from the company’s printing operations. More importantly, from an energy saving standpoint, the modern, energy-efficient design of the RTO has reduced the company’s monthly gas consumption by over 50 percent— despite the addition of two printing lines.

### **Don’t Let Profits Go Up In Smoke**

In summary, to offset operating costs and help maintain profitability, companies should consider all available options to help reduce the energy costs associated with an air pollution control system. Retrofitting a secondary heat recovery system to an older air pollution control unit can generate significant savings, while replacing an older system with one of today’s high efficiency systems can now offer a short-term payback on a company’s capital investment.

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