The Impact of Air Pollution Control Systems on Operating Costs:

Modern Designs, Components, add-on Equipment Help Reduce Energy use and Improve Profitability

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In real estate, there are three important factors: location, location, location. In manufacturing, there are also three important factors: operating costs, operating costs, operating costs. While the initial purchase price of any piece of capital equipment is certainly a critical element, the costs to run that same equipment will affect profitability for the entire life of the system.

When air pollution controls were first introduced in the 1970's, 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 optimised. It was not uncommon to see little or no heat recovery being utilised on equipment required to heat air from 250°F to 1400°F. This roughly equates to 1.2 million BTUH per 1,000 cfm of treated air!

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.

A Regenerative Thermal Oxidiser (RTO) with secondary air-to-air heat recovery system that is using recovered energy to heat process cure ovens.

New & Replacement Control Options

When considering a green field site or expansion, a company's air pollution control options may be more wide open 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 utilising 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 do) cost justify placing a more efficient control device in a different location. Again, choose a vendor early in the project to evaluate the options and achieve the best overall results.

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 maximised (or de-rated) for specific VOC loadings to reduce auxiliary fuel usage to a minimum. Certain processes can utilise 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 Favorably Impact Operating Costs

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 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% versus 95% 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 optimised.

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.

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Upgrades Possible For Current Emission Controls

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/fuel ratio for optimum performance.
- Regenerative Thermal Oxidiser's (RTOs) that have random packed ceramic media can be retrofit with structured ceramic media to increase heat recovery, reduce pressure drop or increase oxidiser capacity.
- RTOs connected to certain processes can have catalyst added to the ceramic media, thus configuring the unit as a Regenerative Catalytic Oxidiser for operation at a lower energy saving temperature and a reduced pressure drop.

Secondary Heat Recovery Systems Utilise Existing Heat Energy, Lower Fuel Costs

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. If there is sufficient energy available, it can be captured via secondary heat recovery and used elsewhere in a facility. Process heat requirements can be reduced or eliminated by heating air, thermal oil, or water with a heat exchanger using air pollution control system exhaust stack air. In some cases, it can completely replace the need for natural gas fired burners in the manufacturing process itself. In cold weather climates, heated fresh air can be used for building comfort heating. If the stack air is hot enough, the exhaust from the air pollution control system could be routed directly to a low-pressure steam generator.

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. Either a retrofit or an upgrade to a new system could provide substantial operating savings and have a positive impact on a company's bottom line.