Kimberly-Clark PROFESSIONAL*

Energy Efficiency

A Guide to Reducing HVAC Energy Cost

Panel filters were originally developed in Switching to a lower pressure drop HVAC filter is one of the easiest changes building owners and facility managers can make to reduce energy costs. That's because with a lower pressure drop filter, the HVAC system motor needs to overcome less resistance to deliver the required air flow, thus reducing the motor's energy consumption.

Ask Your Filter Supplier

Most building owners and facility managers would agree that filtration efficiency comes first. Beyond the minimum efficiency reporting value (MERV), buyers and specifiers often use filter price as the next decision-making criteria. However, after examining life cycle cost and energy saving opportunities, it is evident that the key criteria should be energy consumption, as indicated by the initial pressure drop of the filter. When considering the energy costs of various filter technologies, ask your filter supplier the following questions:

- At a given performance level, how much money could be saved by using a lower pressure drop filter?
- What pressure drop reduction offsets the difference in initial filter price?
- How much of my initial filter costs does that energy cost savings offset?

Focusing on total life cycle costs versus initial price and maximizing filtration efficiency while minimizing pressure drop will allow you to reap the largest value for your organization and will help you achieve good IAQ, reduced equipment maintenance, and the lowest possible energy costs.

1. Annual Energy Outlook 2004 with Projections to 2005. Energy Information Administration. Available online at http://www.eia.doe.gov/oiaf/archive/aeo04/index.html.

Did You Know...

There are 95% efficiency synthetic media filters that have the same pressure drop as 65% efficiency glass media filters, providing the ability to increase filtration efficiency by 30% without increasing energy costs at all.

Air Filters and Energy

Air filters play a key role in the HVAC system: they remove contaminants from air that passes through the system to building occupants, and they protect the HVAC equipment from dust. Air filters also play a significant role in the energy consumed to operate the system. The energy used by HVAC systems is based on the resistance of the air passing through the filter; the lower the filter's resistance, the lower the energy consumption will be. However, even though one speaks of filters, it is really the filter media that has the biggest effect on minimizing energy consumption.

To look at HVAC filters as energy conservation tools, it's first important to understand that the cost of energy used by filters far outweighs the cost of the filter itself. In fact, energy costs can be 10 times the initial filter cost for a standard pleated filter and four to five times the initial filter cost for higher efficiency final filters.

Life Cycle Costs

Life cycle costs, energy costs and filter pressure drop should all come into play during the filter selection process. The three major components of life cycle cost for HVAC filters are: initial investment and maintenance, energy consumption, and disposal. On average, energy cost accounts for an astounding 81 percent of the total life cycle cost of a filter system. The initial investment and maintenance accounts for 18 percent, and disposal accounts for one percent.

How can life cycle costs of filters be applied to energy efficiency? Development of new materials has given the filter industry a chance to produce lower pressure-drop filter media while maintaining high particle capture efficiencies, thereby providing the ability to improve indoor air quality (IAQ) and reduce electricity costs simultaneously. Electret technology and electrostatic filter media have been the key technologies enabling this seemingly contradictory concept to become a reality.

Switching to a lower pressure drop HVAC filter is one of the easiest changes building owners and facility managers can make in an effort to reduce energy costs. That's because, with a lower pressure drop filter, the HVAC system motor needs to overcome less resistance to deliver the required air flow, thus reducing the motor's energy consumption.

The initial cost and energy cost of various filters can be seen in the following table. Notice that energy costs are greater than 80 percent of the total cost in both cases.
The following figures illustrate the effect of a filter's pressure drop on annual energy costs. Note that the two filters are identical except for the initial pressure drop. In a typical

	Initial Cost	Energy Cost	Initial Cost % of Total	Energy Cost % of Total
MERV 6-11 Pleated Filter	$4	$46	8%	92%
MERV 11-15 Final Filter	$70	$304	19%	81%

scenario, one might use initial cost as the primary criteria in choosing one of these filters over the other. However, as the example shows, this might not result in the correct filter choice for maximizing long-term energy savings. In this example, initial costs are kept the same to illustrate the effect of pressure drop on operating costs.

	Filter A	Filter B
Efficiency	MERV 14	MERV 14
Filter Style	12″ Deep Rigid	12″ Deep Rigid
Media Area	120 sq. ft.	120 sq. ft
Initial Cost	$70	$70
Initial sP	0.45″ Water Gauge (WG)	0.65″ WG
Final sP	1.50″ WG	1.50″ WG
DHC	300g	300g
Filter Life	12 months	12 months
Energy Cost	$276/year	$305/year

Calculation: Energy Consumption = Q*dP*t/n/1000
Assumes 24/7/365 operation, energy cost of $.08/kWh, fan, motor, drive efficiency (n) of 58 percent

Filter A provides a lower initial and average pressure drop and therefore saves approximately $29 in energy costs annually – about a 10 percent reduction in energy consumption. While an energy cost savings of $29 per year may not sound like a lot, keep in mind that those cost savings are per filter, not for an entire HVAC system. Multi-story office buildings contain many filters in each air handling unit, so savings can quickly add up. Another way to look at the information is to consider that $29 saved with Filter A offsets 41 percent of the initial filter price. That's equivalent to getting nearly half of your filters free each year.

To see how the energy consumption of your HVAC filters compare with other filters, try the interactive online calculator at www.kcfiltration.com.

The Macroscale Effect

From a macroscale standpoint, the overall effect of energy consumed by commercial building HVAC systems can be estimated by considering that commercial buildings account for just over 30 percent of the energy consumption in the U.S., and that heating and cooling accounts for 40 percent of a commercial building's total electricity bill.

Annual Electricity Sales	$216 billion
Commercial Building Share	x 30%
Commercial Building Electricity Consumption	$65 billion
Commercial Building HVAC Share	x 40%
Commercial Building HVAC Consumption	$26 billion
Average Energy Cost ($/kWh)	/ $0.08
Commercial Building Energy Consumption	325 billion kWh

The effect of a change in filter pressure drop on total energy consumption can be estimated by assuming that the average pressure drop in every commercial building air filter is reduced by just 0.025″ WG. Assume it changes from 0.700″ WG to 0.675″ WG in this example. By applying a simple ratio to the energy formula, the total energy used in the reduced pressure drop scenario is 313 billion kWh, resulting in a 12 billion kWh energy savings. At an energy cost of $0.08/kWh, this translates into cost savings of $960 million.

Did You Know...

According to the U.S. Department of Energy, total energy demand in the country is projected to increase 1.5% per year until 2025. For commercial buildings specifically, energy use is projected grow by 1.7% per year.1 Now consider that HVAC systems account for approximately 40 percent of the energy used in the U.S., commercial and residential buildings, and you can quickly see that HVAC is a prime target for energy savings opportunities.

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