



**It is a fact that fume cupboards can waste large amounts of energy, but saving the Planet doesn't have to cost the Earth.**

The running costs of a fume cupboard are a combination of:

- The energy required to extract air from the fume cupboard, i.e. to operate the extract fan.
- The energy required to replace and condition (cool/heat/filter) air extracted by the fume cupboard.
- The energy required to power the fume cupboard sockets, alarm panel and lighting. These costs are usually negligible in comparison to the above and will not be considered in this document.

As a example, a 1500mm wide fume cupboard, maintaining an average face velocity of 0.5m/sec across a 500mm high sash opening, operating 24hrs a day, 365 days a year will cost approx. £1,650 per year to run.

There are a number of ways of reducing this energy use. Below are the most common and effective methods, in order of Cost versus Payback:

**1. Reduced Hours of Operation**

Simply by switching off fume cupboards overnight and at weekends the energy cost for the above would drop to approx. £360 per year. BMS systems / time-switches can be used to switch off fume cupboards in the user's absence, however, where experiments are needed to run overnight there should be some method of locally overriding this. Our airflow monitors have built-in controls for remote switching and local override, for just this purpose.

Cost	Energy Saving	Pay back Period	Reliability
None / Negligible	Greater than 70%	Instant	Excellent

Fume cupboards are sometimes used to replace or compliment the general laboratory extraction system. Under these conditions they may be required to run 24hrs a day. However, they rarely need to operate at their full capacity so we recommend the use of an inverter drive (below) to control the extract volume.

**2. Reduced Face Velocity**

Traditionally, fume cupboards have been specified and installed to achieve an average face velocity of 0.5m/sec. Reducing the face velocity to 0.4m/sec instantly saves 20% extract volume, or 40% if reduced to 0.3m/sec, and a modern, well-designed, aerodynamic fume cupboard, such as our own, will continue to provide excellent containment of fumes at these reduced face velocities. However, great care should be taken when designing the laboratory and operating the fume cupboard, as the robustness of containment (the ability to contain the fumes when subjected to air disturbance by the user, equipment inside the cupboard, local air conditioning units etc) can be more easily compromised at reduced face velocities. For this reason some clients are reluctant to run their fume cupboards at lower face velocities.

Cost	Energy Saving	Pay back Period	Reliability
None	40% (0.3m/sec)	Instant	Excellent

### 3. Reduced Sash Opening

The traditional maximum working height of a fume cupboard sash is 500mm from the work surface. By reducing this maximum opening height to 400mm less volume of air is required to achieve the same average face velocity and an instant 20% energy saving is made. However, depending on the use of the fume cupboard, the reduced opening may restrict access and/or be uncomfortable for the users.

Cost	Energy Saving	Pay back Period	Reliability
None	20% (400mm)	Instant	Excellent

### 4. Inverter Driven Extract Fan

The power absorbed by a fan motor varies as the cube of its speed, e.g. slowing a fan motor by 20% saves almost 50% in energy.



Traditional extract systems use a fan motor running at pole speed and adjust/calibrate the airflow at the fume cupboard via a manual volume control damper in the duct. With an inverter driven fan, the volume control damper is not needed (except where multiple branches exist). At commissioning the inverter is used to fine-tune the speed of the extract fan to achieve exactly the required face velocity.

Inverters offer many additional advantages over traditional control systems, including on-board diagnostics, simplified wiring, improved protection and reliability. When used in conjunction with Fumair control systems further features are possible, such as “idle” speeds to maintain a low-level of ventilation through the fume cupboards and any attached storage cabinets when they are not in use.

Cost	Energy Saving	Pay back Period	Reliability
£200+ depending on motor size	Typically 10-50%	Typically less than 6 months	Excellent

### 5. Multi-Speed Control System

The Fumair FlowMaster control system, with inverter drive, reduces the volume extracted from the fume cupboard when the sash is less than half open. With good user discipline energy savings up to 50% are achievable.

Because this control system reduces volume by slowing down the extract fan the extract system is designed to ensure the minimum efflux velocity is achieved at the lower speed setting.

The FlowMaster control system offers additional safety features such as emergency boost and “idle” night speeds. See the FlowMaster datasheet for more information .

The FlowMaster is ideally suited for use with individual extract systems. For shared/common extract systems VAV controls should be used.

Cost	Energy Saving	Pay back Period	Reliability
Approx. £450	Up to 50%	1-2 years	Excellent



## 6. Sash Height/Activity Alarm

Designed for use with the FlowMaster control system above, this system monitors the sash height and activity in front of the fume cupboard via a PIR sensor.

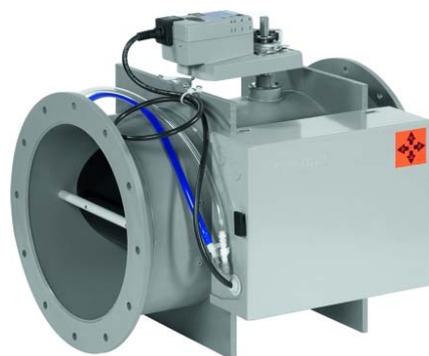
If the sash is in its raised position and no activity is detected for a predetermined time the system will sound an intermittent alarm, designed to encourage nearby users to close the sash and allow the control system to enter energy saving mode. This is an infinitely more cost effective and reliable system than the automatic sash closure system (below).

Cost	Energy Saving	Pay back Period	Reliability
Approx. £140	40-50% when used with above	1-2 years	Excellent

## 7. VAV Control System

VAV control systems provide constant face velocity at the fume cupboard, irrespective of sash height. On multiple fume cupboard installations VAVs offer excellent energy savings, but the initial cost of the equipment is high.

VAV controls are best installed where multiple fume cupboards are served by one extract system.



A VAV system works by controlling the volume of air extracted from the fume cupboard, usually via a fast-response motor-driven damper. The damper continuously modulates and, as such, long term reliability can be a concern. The extract fan serving the cupboards runs at a constant speed, irrespective of the requirements at each fume cupboard and, to maintain the minimum efflux velocity when the majority of the fume cupboard sashes are closed, additional air is introduced into the inlet of the fan via a further modulating “bleed” damper. The additional air is drawn from the atmosphere rather than the laboratory. The cost of the bleed damper is not included in the above indicative price as it will vary depending on the installation.

Note: When calculating the energy savings that VAV systems offer the cost of a large, continuously running extract fan is often overlooked. For example, an installation comprising 5 no. 1500mm wide fume cupboards on a common extract would typically require a 2.2kW fan motor. To run this fan via an inverter for 10hrs a day would cost approx. £580 per annum. The equivalent cost of running 5 no. individual extract fans with the FlowMaster/inverter control systems would be less than £100 total per annum.

Cost	Energy Saving	Pay back Period	Reliability
Approx. £1,250	Typically greater than 50%	Typically 5-7 years	Fair

## 8. Automatic Sash Closure

Designed for use with VAV or similar systems that monitor sash height, automatic sash closure systems monitor activity in front of the fume cupboard, via a PIR sensor or similar. After a period of no activity a motor will slowly drive the sash to the closed position, allowing the VAV system to reduce the volume of air extracted from the fume cupboard.

Although in principle this would appear to be an excellent idea our experience of such systems is that they are unreliable and unpopular with users (who may, for example, be returning to the cupboard with their hands full of equipment and have to put everything down to open the sash again!).

Cost	Energy Saving	Pay back Period	Reliability
Approx. £1,500	Typically greater than 50%	10+ years, often never!	Poor

## 9. Extract Systems

The suitability and performance of many of the above energy saving systems will be determined by the extract system they are connected to. For instance, VAV controls are not cost effective on single fume cupboards served by an individual extract fan, whereas the Fumair FlowMaster control system is not suitable for use with a common extract system serving many fume cupboards.

Below we list the advantages of individual versus common extract systems.

### Individual Extract Systems

Each fume cupboard served by one extract fan.

- Optimum energy efficiency is achieved as the extract fan only operates when the attached fume cupboard is in use, unlike VAV systems where the extract fan runs constantly.
- Should the extract fan fail, or the extract duct become damaged, only the one fume cupboard will be out of service. Unlike a common extract system, all other cupboards will remain operational.
- No VAV control systems means no moving dampers etc, resulting in better long-term reliability.
- Although many individual extract systems would suggest a considerably higher installation cost than one large common system, this is not always the case. Smaller ducts cost significantly less than the larger duct used for common extract systems.
- The most efficient and cost effective way of controlling fume cupboards on separate extract systems is the Fumair FlowMaster multi-speed extract system. The extract systems will be designed so that at the lowest speed setting, the minimum efflux velocity is still achieved at the point of discharge to atmosphere.
- No risk of incompatible fumes from different fume cupboard mixing within the duct.



A common extract system serving multiple fume cupboards

### Common Extract Systems

Many fume cupboards served by one common extract system and fan.

- Smaller number of discharge stacks means planning approval may be easier to achieve.
- Best energy efficiency achieved using VAV fume cupboard controllers and bleed dampers.
- Often easier to route one large duct through the building, rather than multiple smaller ducts.
- Often cheaper to install than many smaller individual extract systems.

**Please contact Fumair if you wish to discuss any parts of this document in greater detail.**

Fumair have been manufacturing and installing fume cupboards and extract systems for over 40 years. Throughout this period we have been servicing, testing and maintaining our equipment, as well as that of other manufacturers. The information given above is our professional opinion, formed from our knowledge and long term experiences.