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ENERGY SAVE

Ecoflow

## Energy Conservation Calculations

It is a simple calculation to compare the energy consumption of an installation using traditional fume cupboards and an installation utilizing Chemical Systems Control new "Chemflow Auto Energy Save" fume cupboards.

The following calculations are based on a typical installation employing five 2m wide fume cupboards.

The volume of air consumed by a traditional fume cupboard is a constant figure calculated by:-

Sash open width (m) x sash open height (m) x face velocity (m/sec).

So for a 2m wide cupboard:-

$$1.68 (m) \times 0.5 (m) \times 0.5 (M/sec) = 0.42 m3/sec.$$

The total extract volume from a laboratory equipped with five traditional fume cupboards would therefore be:-

$$5 \times 0.42 m3/sec = 2.10 m3/sec (7,560 m3/hour).$$

This volume of air will be replaced by the supply air system plus a small quantity of air drawn from adjacent areas to maintain a negative pressure within the laboratory. This air would be heated/cooled from the ambient air temperature to the desired laboratory air temperature (typically 21°C).

Assuming an average day time temperature for the Ireland of 9°C (source met eireann) over the whole year, the average energy consumption per hour is given by the formula:-

$$\text{Volume (m3/sec)} \times \text{temperature rise (t°C)} \times 1.0 \text{ (SHC constant for air)}$$

In this case:-

$$\text{Average Consumption} = 2.10 m3/sec \times 12°C \times 1.0 = 25 kW \text{ (per hour)}$$

Assuming a fume cupboard usage of 8hrs/day, 5 days/week and 51 weeks/year, the average annual energy consumption for a traditional fume cupboard would be:-

$$\text{Annual Consumption} = 25 kW/hr \times 8 hrs/day \times 5 days/week \times 51 weeks/yr = 51,000 kWh/year.$$

As the "Chemflow Auto Energy Save" fume cupboard operates on a 70 % reduced air flow when the sash is close the amount of energy saved in the fume cupboard is formidable.

Taking that a in a typical working laboratory the fume cupboard with automatic sash will be closed 70% of the time in typical working laboratory.

This equates to a 51% energy saving over a typical day.

$$\text{Therefore: Average Energy Consumption} = 51,000 kWh/year \times .49 = 24990 kWh/yr$$

These figures are based on actual working laboratory recorded figures which are stored in the CSC controller which is installed on all energy save fume cupboards. The typical cost per kWh used in the Ireland as of Dec 2009 is € 0.17 cent and (sourced from the energy regulator)

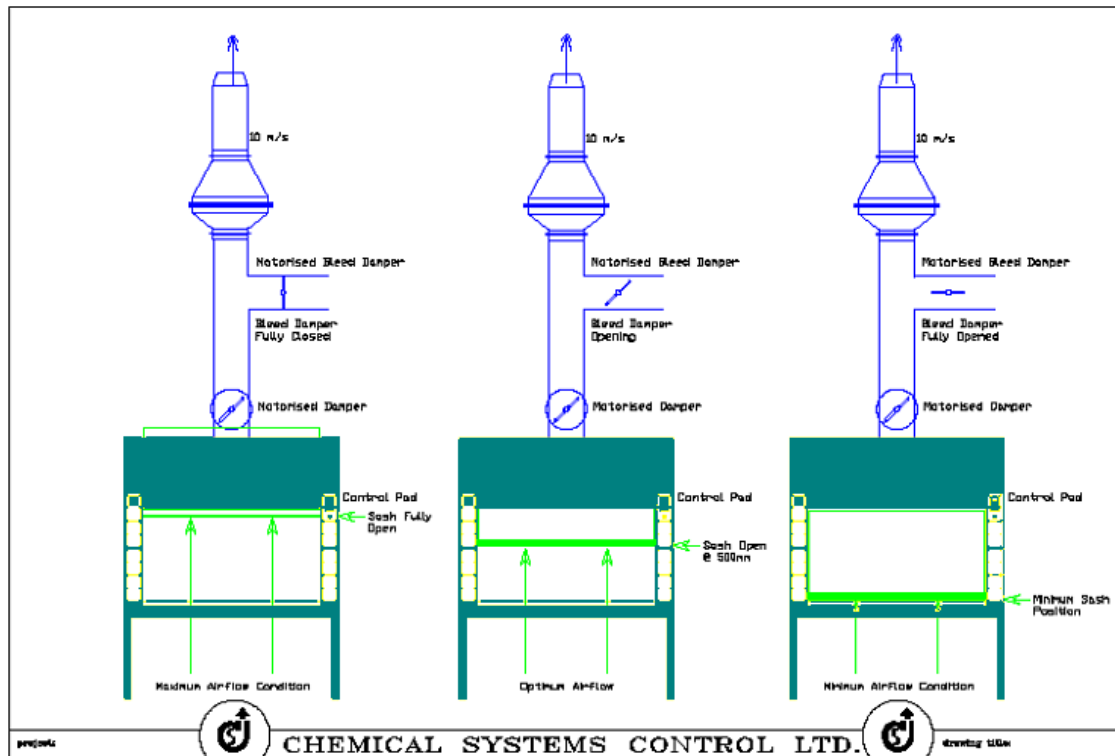
$$\text{Therefore the saving accruing to the CSC fume cupboards per year is € 4,248.30 Or per fume cupboard € 849.00.}$$

These calculations do not take the additional costs involved in cooling and dehumidifying air in a typical A/C system.

Chemical systems control fume cupboards are containment tested at 0.5 m/sec and achieve excellent results for both containment levels and robustness. (robustness is the ability of the fume cupboard to withstand air disturbances caused by movement in the laboratory . ie in appropriate supply air system, human traffic in and around the fume cupboards etc.

**How Does it Operate**

1. The **Chemflow air velocity monitor** reads the air velocity entering the **fume cupboard** to within 1% accuracy
2. The airflow monitor communicates this data by means of a **0-10 volt** signal to the **actuator** on the **motorised damper**.
3. The actuator responds to this information by modulating the damper to the position corresponding to the voltage signal level.
4. The airflow monitor has a preset target velocity typically 0.5m/sec
5. When the **sash** is raised or lowered the Chemflow monitor reads the changing velocity of the air passing through the sash opening.
6. The chemflow monitor sends a voltage signal to the actuator to adjust the damper to a position that corresponds to a velocity across the sash opening of the preset target velocity.
7. The requirement however for a minimum **purge** of air through the fume cupboard prevents the reduction of air through the fume cupboard from falling below 33% of its initial air volume. This initial volume is calculated as being the volume through the fume cupboard at a sash opening of 0.5m at a velocity of 0.5m/sec by the internal width of the fume cupboard. I.e.  $0.5 \times 0.5 \times \text{internal width of the fume cupboard}$ . The minimum volume therefore is  $0.33 \times 0.5 \times 0.5 \times \text{internal width of the fume cupboard}$ .



8. The Chemflow monitor prevents the volume from going below the minimum required by presetting a minimum volume within the tracking program.
9. This ensures that the containment and purge levels of the fume cupboards are maintained at a safe operating level at all times.
10. The energy cost saving in operating this system is dependent on the vigilance of the operator in lowering the sash to its minimum position when the fume cupboard is in operation as best practice advises.
11. The energy savings can be further improved by the use of an automatic sash operating system
12. This system uses a PIR indicator to detect movement at the fume cupboard work area. If no movement is detected after a preset period of time (30 seconds) the sash will automatically close and the fume cupboard extract will set back to its minimum volume condition.