GREENHOUSE GAS AND BUILDINGS

To sustain a comfortable environment within buildings we have to use energy in order to provide heating, cooling and ventilation. Reducing a building's energy usage will ultimately reduce greenhouse gas and carbon emissions, as well as save cost for the building occupant.

Electricity as generated in NSW, Australia, produces approximately 0.99kg of greenhouse gas (CO^2) for every kWh (1.3kg in Victoria); each kg contains approximately 272 grams of carbon. If we assume a fan runs for 10 hours/day, 200 days per year, then the table shown below can be used to calculate the greenhouse gas and carbon output attributable to any installation.

kW	kWh/pa	Greenhouse gas, tonnes	Carbon, tonnes
1.0	2000	1.98	0.54
2.0	4000	3.96	1.18
3.0	6000	5.94	1.62
4.0	9000	7.92	2.15

MINIMISING THE ENERGY USED BY FANS

Fans are a significant energy consumer but the energy that goes into running them can be minimised with careful and appropriate fan selection, ducting design and installation.

To achieve the best power saving solution:

- Select the most suitable fan for the specified duty. But remember, this may not always be the lowest cost fan. Refer to "Fan Selection - First Cost versus Life Cycle Cost" on this page.
- Ensure the fan is given a chance to operate to its fullest potential. Space restraints can result in negative system effects.
- Even without space restrictions, a lack of attention to detail can result in negative effects. For example, a slack or misaligned flexible connection on the fan inlet can cause serious loss of capacity and efficiency.
- Systems should be designed to minimise the pressure drop by paying particular attention to bad practices such as:
  - Slack or excessive length of flexible ducting.
  - Locating high pressure drop fittings close to bends or other disturbances in airflow.

Refer to *Section P* of this catalogue which provides a comprehensive array of tips and advice on appropriate fan installation practices.

An energy efficient fan and system combination is not necessarily expensive. Indeed, when running costs are considered, which they should, it generally works out to be more economical after a short running time.

FAN SELECTION - FIRST COSTS VERSUS LIFE CYCLE COST

A cheap fan often means that while you think you have a bargain, it may end up costing you more in the long run.

For example, we have chosen a duty of 12,000L/s @ 300Pa. Using the Fans by Fantech Product Selection Program, the lowest cost in-line duct mounted fan selection is a model AP1004GP6/29: a 1000 diameter fan absorbing 9.91kW with an 11kW motor running at 24r/s.

An alternative selection is a model AP1254GP6/16: a 1250 diameter fan, absorbing 7.54kW with a 7.5kW motor (in air-stream rating) at 24r/s. This difference in list price between the two fans is approximately $400, with the second one being the more expensive and 250mm larger in diameter.

If the fan is to run for 10 hours a day, 200 days/year, then the running power used for the first selection is 22mWh and 16.7mWh for the second (using fan absorbed power (AkW) and motor efficiency @ 90%). At approximate Sydney, Australia electricity prices, this equates to an annual running cost of $3380 and $2500 respectively, with greenhouse gas being 21.8 tonnes and 16.6 tonnes and carbon usage being 5.9 tonnes and 4.5 tonnes.

In the period of one year, the second fan, while more expensive on first cost, will have already saved the difference in running cost against the cheaper fan. Fans have a normal life of 10-20 years, which means that the more expensive fan will save the building occupant a considerable amount over its working life. In addition, the saving in greenhouse gas and carbon will be substantial. With responsible selection of fans, energy use can be optimised.

FAN EFFICIENCY VERSUS FAN POWER

Fan efficiency is the energy needed to drive a fan as a comparison of the energy imparted to the air. It is usually expressed as a percentage and is traditionally based on the motor output energy. Fan efficiency is important but only has meaning when comparing fans of the same size. Here the fans showing higher efficiency levels consume less energy.

When comparing fans of different sizes, selecting on the basis of the efficiency percentage is unlikely to give the most energy efficient fan. The figure to focus on when fans of different sizes are involved is the AkW (Fan absorbed power).

Given a duty of 40,000 L/s @ 500Pa, and using the Fans by Fantech Product Selection Program, the selection AP1404CA9/30, a 1400 diameter in-line fan with a total efficiency of 82% appears to be the most efficient selection, consuming 46.3kW. However, the AP1806DA9/21, and 1800 diameter fan with a lower total efficiency of 77% consumes only 35.2kW – almost 25% less!

The difference comes about because of the impact the velocity pressure has on the total pressure: with the same air flow passing through each fan the velocity pressure through the 1400 dia unit will be much greater than that through the 1800 dia fan.

MANDATORY ENERGY EFFICIENCY MEASURES

According to the Australian Building Control Board (ABCB) energy used in buildings accounts for almost 27% of all energy related greenhouse gas emissions. The inclusion of energy efficiency measures for commercial and residential buildings in the Building Code of Australia (BCA) publication is part of a broader strategy being undertaken by state and federal governments to reduce greenhouse gas emissions attributable to the building sector. The ABCB states that minimum energy efficiency provisions are being incorporated into the BCA to eliminate "poor or less than acceptable" practice from industry, and it is intended that they help reduce the greenhouse gas emissions. The building must comply with all the deemed-to-satisfy provisions included in Part J to comply with the BCA. There is also a performance approach that allows for elements to be traded off against each other as part of an alternative solution.

Spec J5.2a, Volume 1 of the BCA contains requirements for the design and installation of air conditioning and ventilation systems in commercial buildings, and is intended to ensure that these systems are designed so that they can be used in a responsible manner and prevent excessive energy usage patterns. In relation to fans, Spec J5.2a outlines energy efficiency ratio and maximum energy consumption requirements for ventilation systems delivering above 1000L/s air volume flow.

The criteria outlined in this section will be subject to on-going review with the objectives of reducing allowable energy usage and refining its practical application.

For more information refer to the Australian Building Codes Board web site - http://www.abcb.gov.au .

ENVIRONMENT IMPACT RATING SCHEMES FOR BUILDINGS

There are currently 2 accepted rating methods of tracking the environmental impact of buildings in Australia:

- The Australian Greenhouse Rating scheme (ABGR)
  The ABGR is a performance based rating scheme which measures actual energy related greenhouse emissions attributable to a building.
- The Green Star environmental rating scheme (Green Star)
  Green Star is a design and construction based rating scheme which takes a broader approach by measuring a range of factors in a building such as energy and water efficiency, indoor environment quality, resource conservation, materials and transport.

Participation in these schemes is voluntary, however, many authorities are now imposing a minimum ABGR in development approvals for commercial buildings. In addition many government departments require a minimum Green Star Rating before they will occupy a commercial building as a tenant.

For more information refer to the Green Building Council of Australia web site - http://www.gbcaus.org .

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