NCPC
NATIONAL CLEANER PRODUCTION CENTRE
SOUTH AFRICA

BEST PRACTICE GUIDE

Fans

Fans are rarely used on their own in industry. Most often they are a component in a system of ducts, dampers and other equipment such as heat exchangers. The performance of a fan is dependent on the system in which it is installed. Changes in the system affect fan performance and any change in fan operation affects how the system works.

When a system is first designed, a fan is selected to meet the given system's operating conditions. These conditions cannot be determined precisely beforehand, therefore fans are usually sized to operate at the most demanding condition that the designer reasonably thinks may occur. This is done by adding a performance margin to each element in the system, and the fan is selected against this 'worst case' total. In most installations, these 'worst cases' do not arise and the fan is thus oversized for the actual, and not the estimated, performance required. As a result, many fans operate short of their best efficiency point and waste energy while doing so. Fan efficiencies below 50% are not uncommon. This compares with the possibility of operating at close to 80% for certain fan types.

It is a good strategy to assume that most fans in a plant can be replaced or altered in some way to ensure greater energy efficiency. Start the assessment with the largest fans first as this is where the most gains are likely to be made.

CONSIDERATION	GOOD PRACTICE
Plant has a significant number of fans or fans of significant power.	• Make a record of all the significant fans, including their drive motors. Leave the ones with variable speed drives for another time, unless you suspect they only run at a single speed. • Ensure that the fans only operate when required by the process.
Measure operating performance of each fan	• Engage a fan specialist to measure the performance of the fans found on-site. • This involves measuring, and not assuming, all the operating parameters for each fan. • Calculate the fan efficiency for the installation.
Measured operating efficiency	• If the measured efficiency is significantly (>15%) below the maximum possible for the fan type, there are some options for improvement below.
Duct configuration	• Replacing excessively small ducts and/or tortuous routes should be considered. The additional loss of pressure that this produces may be costlier because of the additional electricity charges after a few years as compared with the replacement price. • Mark fixed position dampers, i.e. throttling devices, for removal once the fan has been replaced or modified. • Mark movable dampers that are necessary for process flow control and retest the duct flow and pressure conditions over the range of damper operation.

Fan changes	• Engage a specialist (preferably a reputable fan supplier) to comment on the suitability of the installed fan for the operating conditions. A simple 'fix' is to reduce the fan speed to meet the required operation. However, it may be possible to modify the impeller and/or the casing. Should the 'fixes' not be sufficient in increasing the new efficiency to maximum, the entire fan will have to be replaced with an appropriate one. • This is not a 'trial and error' process as the effect of each proposed change can be calculated.
Fan drive	• If the assessment above shows that a slower fan speed is all that is required for improved efficiency, this can often be achieved simply by changing the V-belt pulley ratios. • A single-speed motor manufactured for a lower speed may be possible if the motor and fan are coupled directly. Otherwise, try converting the arrangement to a V-belt and pulley drive. • Where the process controlled movable dampers, these can be removed and replaced by a variable speed drive to the motor to achieve better running costs. However, not all motors can be converted to VSD.
Variable speed	• Varying process loads are best met by using variable speed fans or motor drives since these are more energy efficient than controllable dampers in the ducts. • VSDs can also start a fan slowly which reduces the electrical load.
Financial evaluation	• By using the power requirements, i.e. the running hours and the appropriate electricity charge(s), compare the running cost saving between existing and proposed against the cost of providing the new installation. If the internal rate of return is higher than the business requires, replace the existing arrangement.
Motor	• If a motor is to be replaced, use only the highest available efficiency model of the correct power (not greater).
Maintenance	• Vibration, noise, and heat are indications of wasted energy. Maintenance reports should report these for early investigation and action.