case.study

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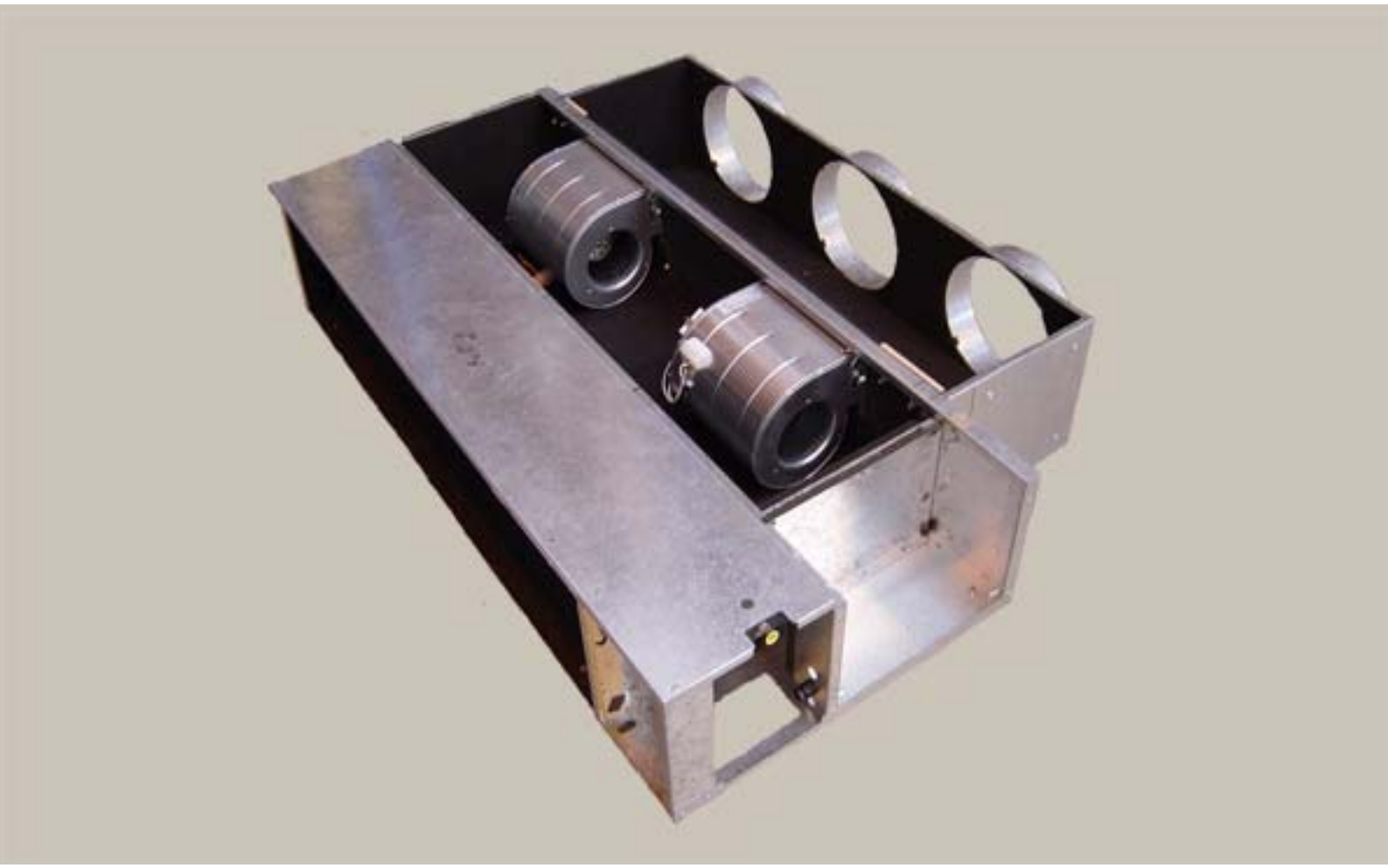

# Achieve huge carbon savings using EC technology

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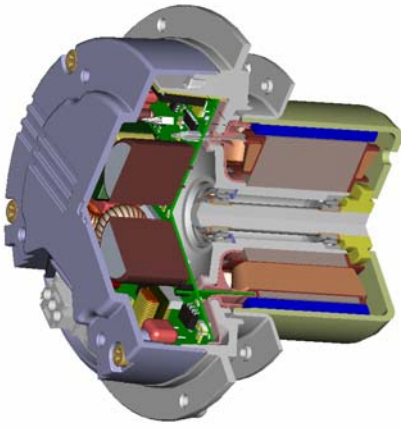
EC fans can reduce the power consumption of Fan Coils by a factor of four. A typical fan coil installation can save 60 tonnes of $CO^2$ per year. Further savings can be achieved with careful commissioning of the units.

Fan coils are used to provide conditioned air. They are either local units, mounted on the wall, that recirculates the air within the space continually, or are part of a system where a remote Air Handling Unit (AHU) provides ventilation. The fan coil consist of an inlet filter, hot and cold water coils to facilitate adjustment of the local environment and fans to overcome the resistance of the filter, coils and ducting. Fan coils used as part of a ventilation system are normally mounted within the ceiling void where they draw in conditioned air supplied by the remote AHU. Their controls will adjust the flow of hot and cold water to adjust the local conditions as required by the local sensors and building management system (BMS). The fans discharge into a plenum within the fan coil where it is then distributed to a number of ceiling mounted outlets. Separate ceiling mounted terminal boxes are connected by ducting back to the AHU to extract the stale air.

*Figure 1 cut away view of AC external rotor motor with single inlet impeller*

*Figure 2 cutaway view of EC external rotor motor*



Fan coils in ventilation systems typically use forward curved double inlet direct drive fans. The market is evenly split between a fan deck where a motor drives a number of impellers on a common shaft, and external rotor motor fans where there is one motor coupled to each impeller. This case study considers external rotor motor driven fans.

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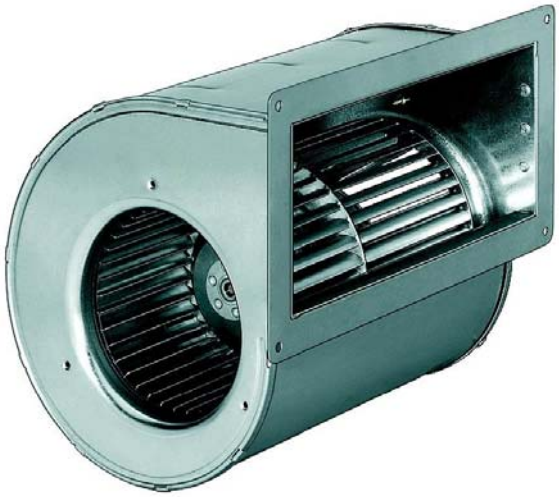
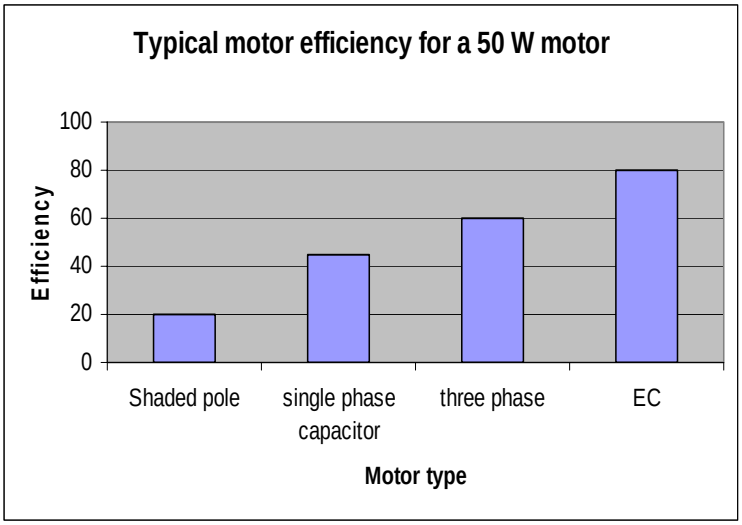


*Figure 3 Double inlet direct drive external rotor motor fan*

133mm double inlet forward curved blowers are used to meet the tight space constraints of fan coils. The motors are circa 50 Watt output with an efficiency of 50% at the optimum point of operation. The nature of fan coils is to provide a wide range of volume flows and pressure development, therefore it is unlikely that the fan is operating at 50% and will be operating at a lower efficiency level.

*Figure 4 comparison of efficiencies of different motor technology*




As noise is critical in the application the fans are run at low speed. With AC motors the speed reduction is achieved by voltage reduction. This method of speed control increases the losses within the motor to effect a reduction in speed. Not surprisingly the inefficiencies increase.

EC fans offer a significant improvement in energy efficiency. The size used in fan coils is typically 80% efficient, but importantly it maintains its efficiency across its range of operation and under speed control. This explains the significant reduction in energy of 1:4 seen in table 1.

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| EC fan (two fan unit) | | | | | |
|---|---|---|---|---|---|
| **Volume flow (l/s)** | **External pressure (Pa)** | **Input power, 2 fans (W)** | **Specific fan power (W/l/s)** | **Power saving vs AC (W)** | **Ratio EC vs AC** |
| 60 | 5 | 9 | 0.15 | -21 | 1:3 |
| 60 | 30 | 13 | 0.23 | -34 | 2:7 |
| 63 | 50 | 20 | 0.32 | -43 | 1:3 |
| 190 | 5 | 31 | 0.16 | -85 | 1:4 |
| 187 | 30 | 46 | 0.25 | -91 | 1:3 |
| 187 | 50 | 53 | 0.28 | -92 | 1:3 |
| 305 | 5 | 95 | 0.31 | -141 | 2:5 |
| 305 | 30 | 127 | 0.42 | -121 | 1:2 |
| 305 | 50 | 132 | 0.43 | -134 | 1:2 |
| **AC fan (two fan unit)** | | | | | |
| **Volume flow (l/s)** | **External pressure (Pa)** | **Input power, 2 fans (W)** | **Specific fan power (W/l/s)** | | |
| 60 | 5 | 30 | 0.50 | | |
| 60 | 30 | 48 | 0.80 | | |
| 60 | 50 | 63 | 1.04 | | |
| 190 | 5 | 116 | 0.61 | | |
| 190 | 30 | 137 | 0.72 | | |
| 190 | 50 | 145 | 0.76 | | |
| 305 | 5 | 236 | 0.77 | | |
| 305 | 30 | 248 | 0.81 | | |
| 305 | 50 | 266 | 0.87 | | |

*Table 1 energy consumption measurements of a 2-fan fan coil unit.*

Table 1 demonstrates the significant improvement in energy reduction achieved with use of EC fans. Taking a typical duty of 190 l/s with an external resistance of 30 Pa the EC solution provides a power saving of 91W and reduces the Specific Fan Power (SFP) from 0.72 w/l/s to 0.25 w/l/s.

Fan coils are often used in office applications where they operated 12 hours per day, 3120 hours per year. Using the above energy saving of 91W then there is an annual saving of 384 kWh and 122 kg of $CO^2$. A typical installation of 500 units will save 61 tonnes of $CO^2$ per year.

Other benefits of using EC are longer operating life with the motor bearings running at a lower temperature and energy savings in the central refrigeration plant. A 91W reduction in electrical power input is also 91W less heat energy into the air stream that needs to be cooled by the central refrigeration plant.

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**Notes**

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