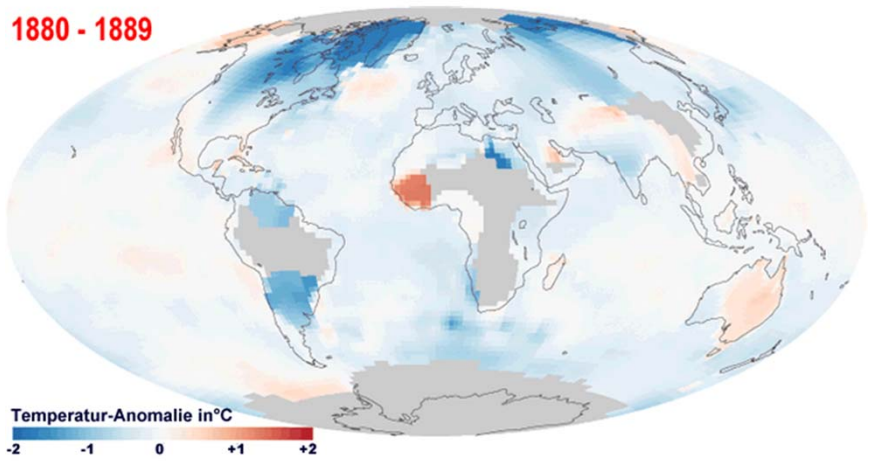
EC Technology & Applications

Mike Hurrie – Systemair Group

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Global-Warming 1880-2009



2

Greenhouse gas emission CO2

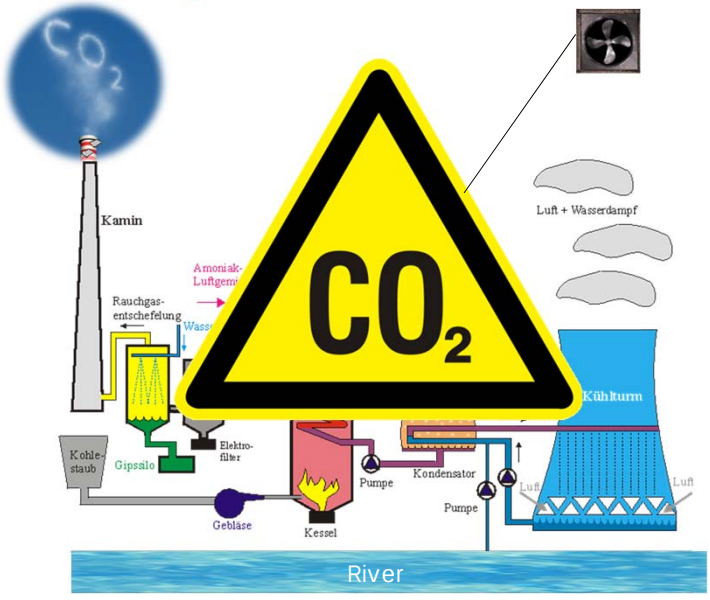
Each fire produces CO_2





3

Coal-fired power station



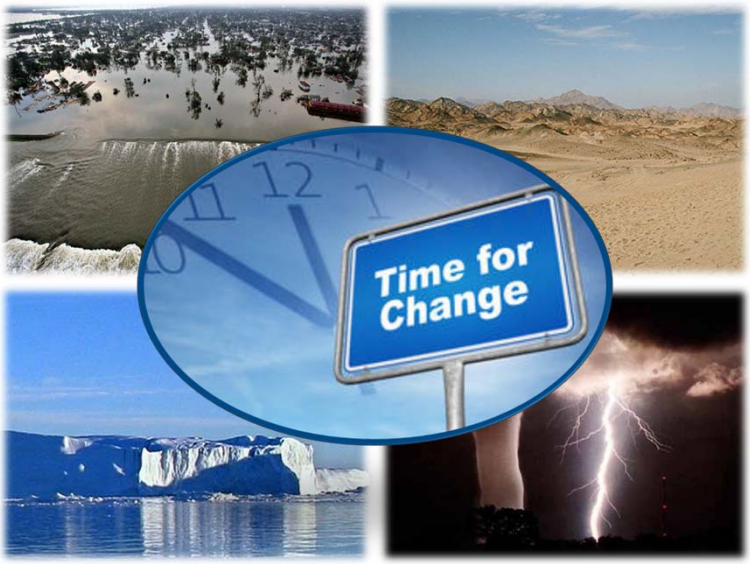
4

Climate change

- Melting at the poles
- Rising sea levels
- Disappearance of the gulf stream
- Hole in the ozone layer
- Shift in climate zones
  desertification
- Higher energy content of the atmosphere

5

Climate change



6

344 TWh = 344 000 000 000 kWh

Actual situation

Total power consumption of fans in Europe: 344 TWh per year

Fans are one of the largest single consumers of produced electrical energy

Energy savings of 10 % = Emissions saving of 16 MT CO_2

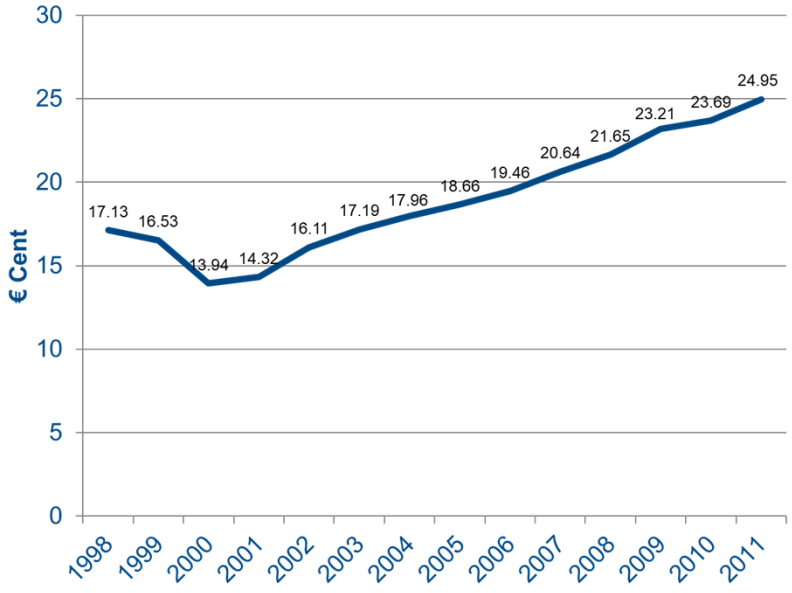
Total power consumption of fans in 2020 will rise to: 560 TWh



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Energy costs



8

Our goal





Energy saving



Reduce CO_2

Save money

9

What is an EC-motor?
A motor which uses less energy, is easily controlled and has built in intelligence

10

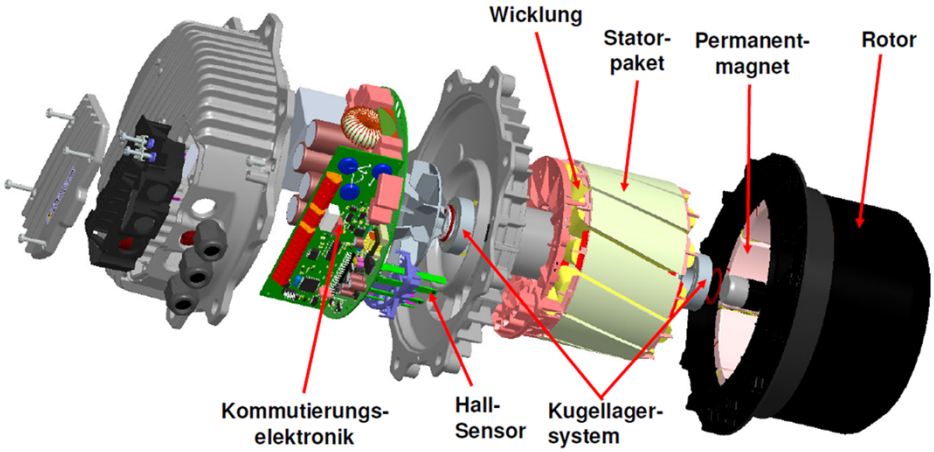
Driven by EC

EC-motor = electronically commutated motor

Definition: Commutation in power electronics describes the process through which a current passes and flows from one branch to another.

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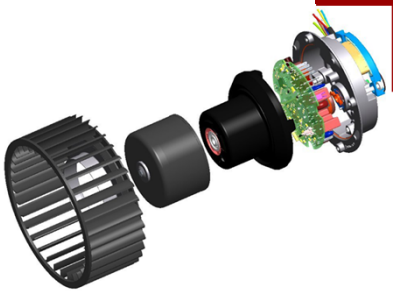
Construction of an EC-Motor

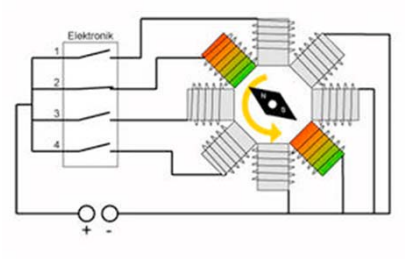


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EC-Motor

EC-motors with integrated electronics can be controlled steplessly at the required air volume while maintaining high efficiency.



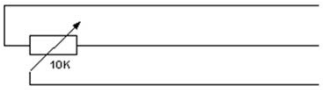


The power saving is not only at maximum power, but especially at lower power operation dependant upon demand due to the fan laws

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An added bonus with EC motors is the ability to speed control using a simple potentiometer or 0...10V input = 0...100% of motor speed







rot	+10V
blau	GND
gelb	0-10V
weiß1	NC
weiß2	COM
blau	L
schwarz	N
grün/gelb	PE

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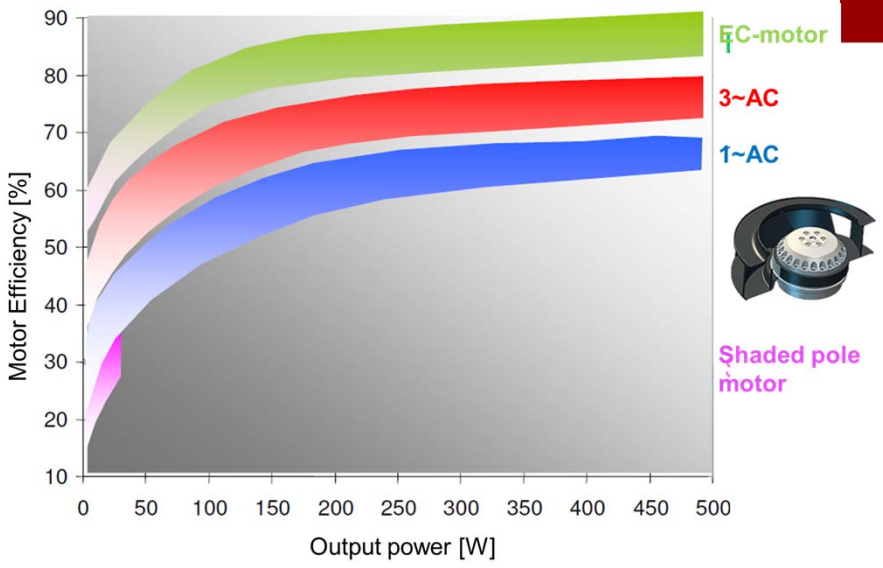
EC motor limitations

NB! EC motors are designed for low torque applicatons only and cannot be used for all applications where motors are required to start under load.

They are of course ideal for all forms of fan applications

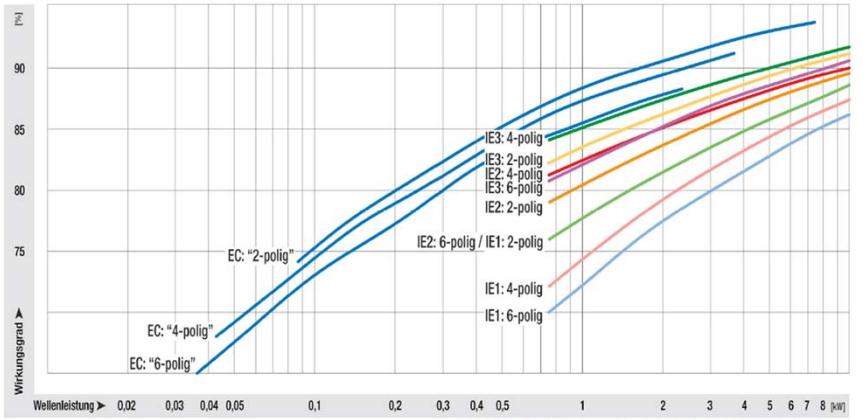
15

Efficiencies of external rotor motors



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Efficiency - IEC motors



*Aus dem Arbeitspapier zur Ecodesign-Richtlinie 2005/32/EC für Motoren.



IE-Classification for IEC-Motors:

- 16.June 2011, all motors between 0,75…375kW must fulfill the IE2 efficiency requirements.
- 1.Jan. 2015, all motors between 7,5...375kW must fulfill the IE3 requirements.
- 1.Jan. 2017, all motors between 0,75...375kW must fulfill the IE3 requirements.

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Proportional laws of fans

The Airvolume (V) changes proportional to the fan speed

V1/V2 = n1/n2

The Pressure (p) changes proportional with the second power to the fan speed

p1/p2 = (n1/n2)²

The Power (Pw) changes proportional with the third power to the fan speed

Pw1/Pw2 = (n1/n2)³

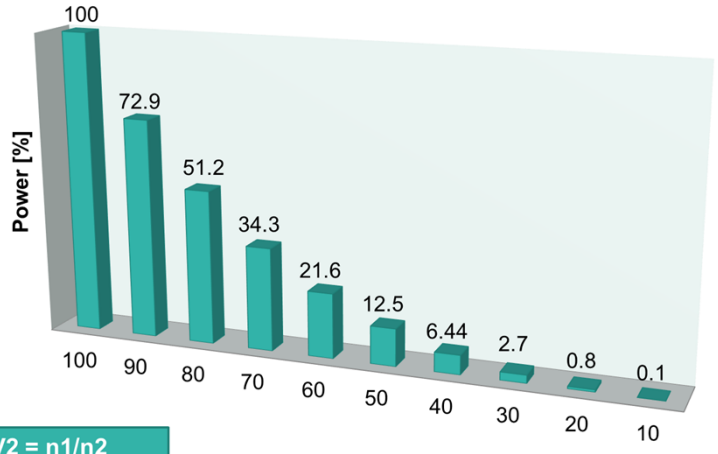
The Noise (Db) changes proportional with the eighth power to the fan speed

Db1/Db2 = (n1/n2)8

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Power – Speed / Air Volume



V1/V2 = n1/n2

Pw1/Pw2 = (n1/n2)³

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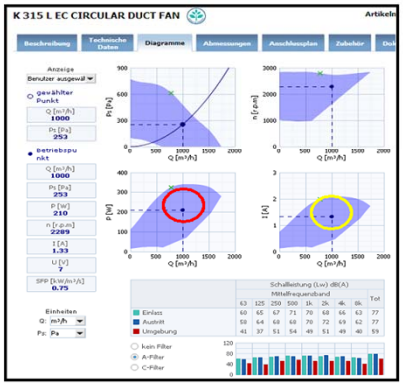
Example K 315L-EC

V1/V2 = n1/n2
p1/p2 = (n1/n2)²
Pw1/Pw2 = (n1/n2)³

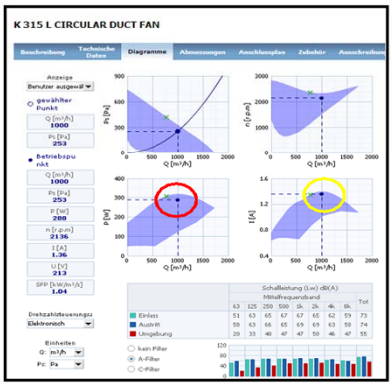
Speed [1/min]	Airvol. [m³/h]	Pressure [Pa]	Power [W]	Savings
2289	**1000**	**250**	**220,00**	**(100%)**
2060	900	203	160,38	-27%
1831	800	160	112,64	-49%
1602	700	123	75,46	-66%
1373	600	90	47,52	-78%
1145	**500**	**63**	**27,50**	**-88%**
916	400	40	14,08	-94%

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Driven by EC





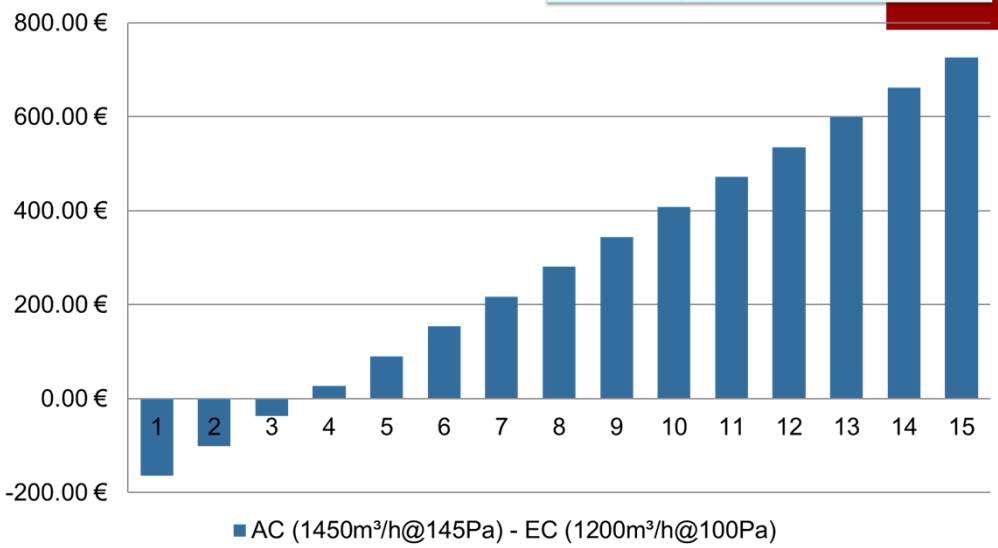


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Payback time

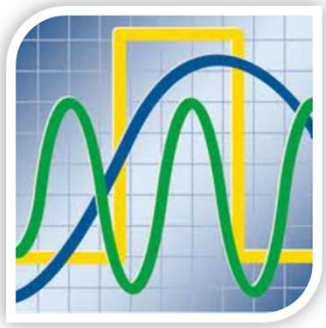


Fan	K 315 L, K 315 L-EC
Running time	10h/day, 5 days/week, 52 weeks
Energy costs	20 cents/kWh
Duty point	1200 m³/h @ 100 Pa



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Energy saving with:



Demand Control

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Demand control applications

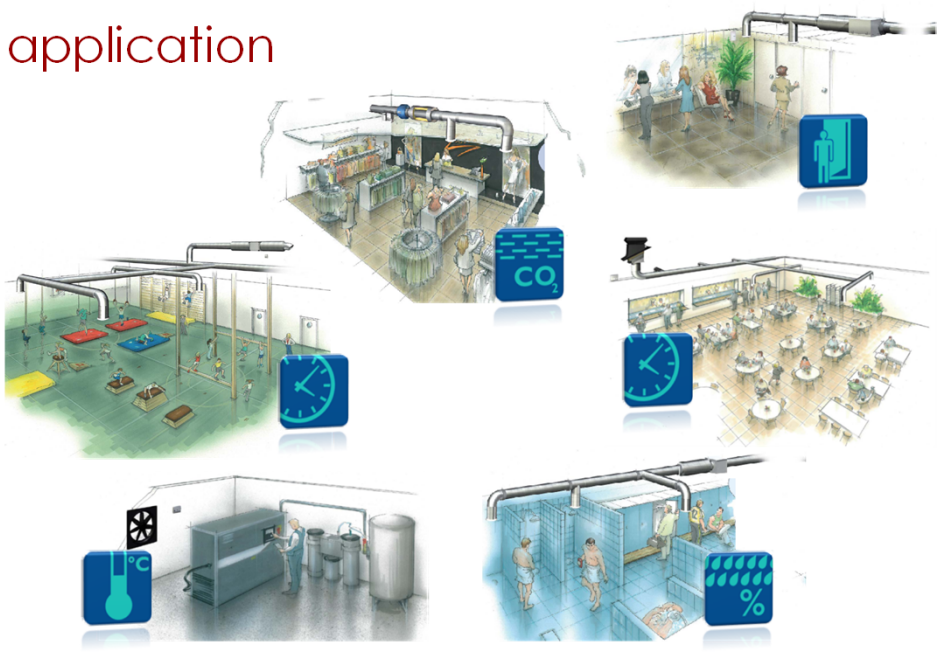


Energy saving

for the power consumption of fans in heating or cooling

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Ventilation application examples



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CO2 controlled ventilation

When the CO_2-concentration increases, the fan speed will automatically increase for increased ventilation. Suitable for all areas where occupancy levels change throughout the day.



Examples:
- Shops with great variation in number of customers
- Conference halls, theatres, assembly halls and similar premises
- Gymnasiums, training halls
- School classrooms and lecture rooms

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Presence indicator



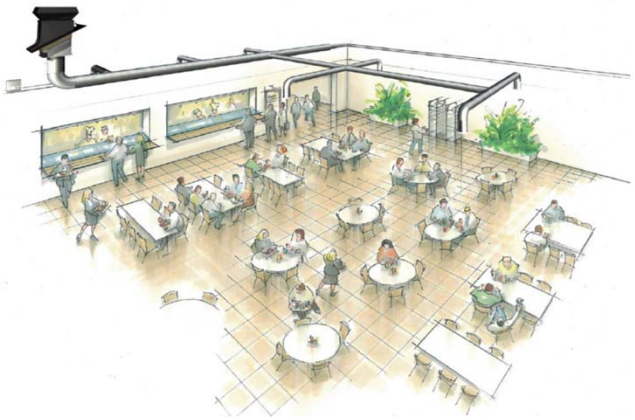
Ventilation control via presence indicator, so called PIR, is a good alternative for demand controlled changing of the fan speed, especially when you want an instant change between high and low fan speed. The fan automatically changes from low to high speed when the sensor detects movement in the room, i.e. as soon as a person enters the room.

Example:
- Public toilets

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Weekly Timer

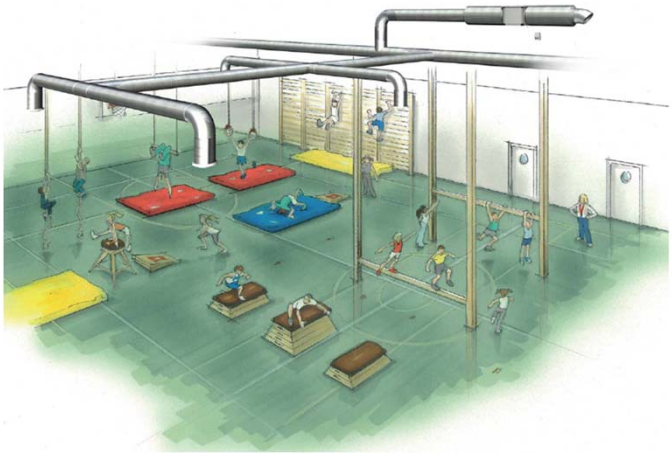
For premises where it is known in advance at what times the premises are used and approximately how many people will be there, ventilation control with time clock is an excellent alternative. The time clock is set to let the fans run at high speed when many people are present in the premises and low speed when
few or no people are present.



Examples:
- Offices
- Day care centres
- Schools
- Lunch restaurants, school kitchens and similar

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Count Down Timer



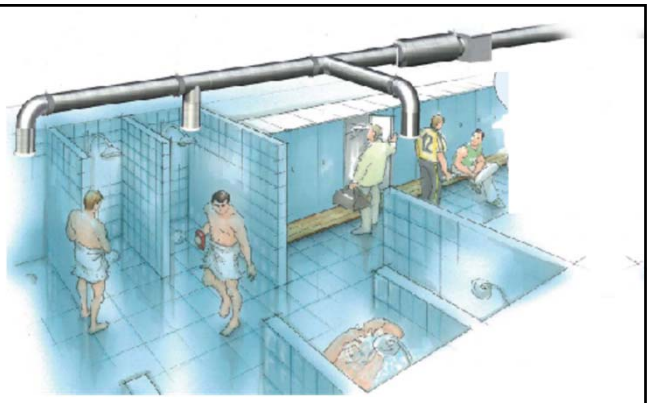
With a count down timer, the change of fan speed to high speed is manual. It will switch back to low speed after a time has been set.

Example:
- training halls
- Conference rooms
- Changing rooms and similar

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Control with humidistat

In certain applications, one of ventilation´s most important tasks is to guarantee that the humidity in the premises does not reach very high levels. The fan runs on high speed when it is required to reduce the humidity and can run on a lower speed when the humidity is lower, thereby saving energy.

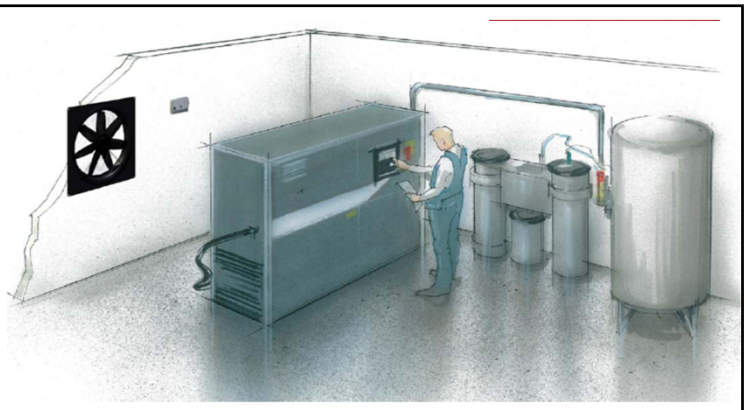


Example:
- Shower rooms
- Laundry rooms
- Sauna- and Spa relaxation establishments

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Temperature control

Considerable savings can be achieved with temperature control in many applications, especially where excess heat is available from various processes.



Example:
- Compressor rooms in industries
- Computer or server rooms
- Transformer rooms
- Engine rooms

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Example: Energy saving in the air conditioning sector

And here's another fact: Even at varying speeds, EC fans maintain their extremely high efficiency levels, whereas there is a sharp drop in the already inferior efficiency of AC motors. In the case of condensers/evaporators operating with EC fans for example, energy savings of more than 10 % can be achieved even just at nominal speed. The relative and absolute savings become yet more apparent with infinitely variable control. As compared to EC technology, conventional phase control may require more than twice as much energy depending on the operating point.



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Other Examples of Energy Control in Buildings

- Lighting
- Escalators
- Refrigeration Plant
- Airconditioning
- Lifts
- Heating
- Car Park Ventilation
- Irrigation Systems

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EC is easy



How does this affect energy efficiency?

EC fans can also contribute to increasing the overall efficiency of an application. In a cooling system for example, keeping the refrigerant pressure constant rather than having it rise and fall as fans switch on and off has been found to reduce the load on the compressor resulting in even greater energy saving.
If two motors are producing the same output but one has a greater power input then you can be sure that the surplus energy is being dissipated as heat. If an application is designed to remove heat then it will have to do extra work just to remove the heat produced by the fan motor itself, so ECs fans will improve the efficiency of the entire system.

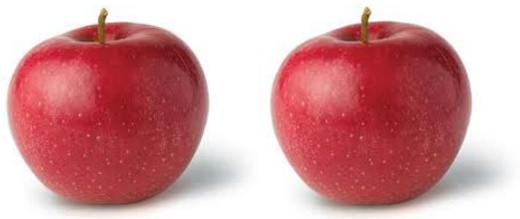
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EC vs AC cost comparison

	EC	AC
Motor protection	Included	Not included
Phase failure detection	Included	Not included
Shielded wiring	Not required	Required
Interference protection filter	Included	Not included
Motor and noise filter	Not required	Required
Power factor controller/mains choke	Not required	Not incuded
Manual potentiometer – speed setting	Included	Required

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Apples with Apples



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	EC	AC
Fan	USD	USD
Controller	Included	USD
Wiring	Not required	USD
Overload protection	Included	USD
Labour	Not required	USD

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Summary


EC-motors use less energy


Less energy means lower CO_2 emissions


Less CO_2 emissions means lower global warming


Less Energy means lower energy costs


Energy saving with demand control


Less heating-cooling energy


Easy control by integrated controller

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Thank you for your attention!
Are there any Questions?