

RECP Best Practice Catalogue

Variable speed drives for ventilation fans and blowers

*Developed within the framework
of MED TEST II*



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION



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Best Practice - Variable speed drives for ventilation fans and blowers

SECTOR:	Food & Beverage
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SUBSECTOR:	Bakery and farinaceous products
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PRODUCTS	Bread, cakes, muffins, Arabic sweets, petit-four, kaak
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CATEGORY	Technology upgrade/Eco-innovation
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APPLICABILITY	Utilities
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COMPANY NAME	NOT DISCLOSED
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COMPANY SIZE	SME
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Description of the problem (Base scenario):

Ventilation equipment in this plant always operated at full speed disregarding occupancy and level of activity. The electrical capacity of centrifugal ventilation fans installed is 100 KW with an estimated energy consumption of 375,000 KWhr/year based on an average of 5,000 hours of operation at 0.75 load factor. The load factor is considered because readings have shown that the electric motors of the fans draw on average 75% of full load current.

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Description of the solution

Savings in electricity consumption could be achieved by varying the speed of the fans when part load is possible mainly during night time or when production floors are not running at full capacity. During such periods it may not be recommended to turn off the ventilation but reducing the ventilation rate is possible.

The table below shows how air flow and energy consumption vary as function of centrifugal fans speed in percentage terms.

Rotational speed as percent of rated speed	Air flow as percent of rated flow	Drawn power as percent of rated power
100%	100%	100%
90%	90%	73%
80%	80%	51%
70%	70%	34%
60%	60%	22%
50%	50%	13%
40%	40%	6%

Therefore when centrifugal fans run at 50% of rated speed, the delivered flow is 50% of rated flow while energy consumption is only 13% of rated energy consumed. Basically flow varies proportionally to fan speed and power drawn varies to the cube.

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Description of the solution It is estimated that on average it is possible to reduce fans speed to 60% of rated speed during 1000 hours of operation, consequently the energy consumption of the fans will drop to

$$(5000 - 1000) * 100 * 0.75 + 1000 * 100 * 0.22 = 30000 \text{ KWhr/year}$$

Therefore achieving 20% reduction in electrical energy consumption related to ventilation equipment. These results are very conservative.

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Economic Benefits	Base case estimated electricity consumption for ventilation system: 375,000 Kwhre/year Improved electricity consumption for ventilation system: 300,000 Kwhre/year Savings achieved from chiller system upgrade: $(375,000 - 300,000)/375,000 = 20\%$ Cost of electricity: 0.14 EUR/KWhr Cost savings achieved after intervention: $75,000 \times 0.14 \sim 10,500$ EUR/year
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Environmental Benefits	Specific CO ₂ emissions of electricity: 1 kgCO ₂ /Kwhre
Other benefits	Avoided CO ₂ emissions: $75,000 \times 1 = 75,000$ kgCO ₂ /year (<1% of overall plant CO ₂ emissions)
Health and safety impact	Not applicable

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Capital investments & financial indicators

Cost of intervention: 30,000 EUR
Return on investment (simple payback): 3 years

Suppliers

Other aspects

Variable speed drives are the source of harmonics that could be harmful to the electrical system of the plant, however in this case it is not an issue because the combined rating of the drives is very small with respect to the overall electrical load of the plant.

Implementation

This measure was implemented gradually in 2017 as company has more fans.