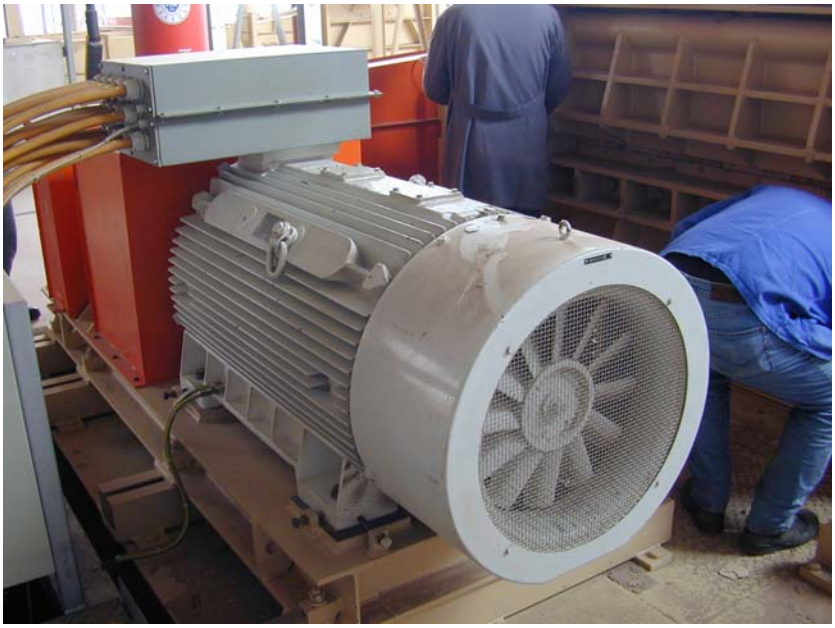
UK Industry is missing out on opportunities for energy saving in it's largest area of operation



Much has been written about the energy saving role of inverter drives in variable speed applications. However, by far the largest number of AC induction motors presently used by UK industry are operated at fixed speeds, and although the potential for saving energy with these units has been largely ignored, worthwhile savings can be achieved using energy optimising soft starters.

The "optimising soft starter" offers the advantage of improving motor efficiency at part loads, which reduces energy consumption during the run phase of motor operation. Although induction motors are relatively efficient machines - motors larger than 11kW, are rarely less than 90% efficient at full load - it is well known that a motor connected to the normal fixed-voltage supply network will experience a worsening power-factor and efficiency as the motor load reduces.

How much energy saving?

In theory, the potential for energy savings can arise in all aspects of a motor's operation, in practice however it is during the motor run phase that the soft starter's optimising function will act to improve the overall efficiency of a motor, giving rise to an opportunity for energy cost reduction.

Nevertheless, it is important to keep in perspective the extent to which reductions in energy consumption are possible in fixed-speed applications since it is an area where many unsubstantiated claims are made.

Much depends on the efficiency of the motor being controlled. As a rule of thumb, larger motors tend to be better designed with more copper and iron, relatively smaller air-gaps etc., making for higher efficiency machines, whereas their mass-produced low kilowatt counterparts can exhibit quite low efficiencies. The following tables can be used to give an approximation of the potential savings to be achieved from motors connected to power supplies whose voltage is in the region of 5% above nominal for the motor design, and whose average load is 50% or less than rated output.

Motor Size (kW)	Estimated Savings (% rated kW)
Less than 5	10
5 – 22	6.5
22 – 55	3.5
55 – 110	2.5
More than 110	1.5

The estimated savings must be modified as follows:-

Motor Poles		Percent Slip	
Number of Poles	**Change to est. Savings**	**% Slip**	**Change to est. Savings**
2	- 0.5 %	0.5	- 0.5%
4	No Change	2	No Change
6	+ 0.5 %	3.3	+ 0.5 %
8	+ 1.0 %	5	+ 1.0 %

To estimate the potential annual cash value of the optimising function the following formula should be used :-

Savings (£) = (Unit cost of electricity/kWh) x (motor rated kW) x (hours run/year) x (% estimated savings for motor size motor poles modifier ± percent slip modifier)

For example, an injection-moulding machine, due to the cyclic nature of the load, typically runs with a load factor of 10% for 90% of the time. So, assuming it is fitted with a 20 HP (15kW) 1450 rpm motor and operated on a 7 days a week, 50 weeks/year, 3-shift working pattern at a unit cost of power of 4.33 pence/kWh, the estimated saving would be:

(£0.0433) x (15kW) x (50 x 7 x 24 x 0.9) hr. x (6.5 + 0 + 0.5)% = **£343.72 per year**.

Depending on the tariff applied, an additional amount in the region of £40 p.a. could arise from a reduction in maximum demand due to the optimising feature. Even allowing for an error factor of 50% (e.g. motor efficiency is higher or load factor is greater), the savings would still represent an attractive rate of return on capital employed in most circumstances.

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