E·SAVE TECHNOLOGY

Beyond Today's Soft Starts: Incorporating Intelligent Energy Savings in a Soft Start

Electric motors consume approximately one quarter of the electricity in the U.S. and are the main motive force in our commercial buildings, industrial facilities, and appliances. Everyone knows reducing energy consumption has become a priority for the U.S. Many new methods of reducing electricity are being considered, including new electric motor efficiency technologies.

Many electric motors are equipped with a soft start. A soft start's purpose is to bring an electric motor up to full speed gradually, thereby reducing starting inrush current and relieving mechanical stress on the motor and related equipment. Besides startup, mainstream soft starts do nothing to control the electricity consumed by the motor. A soft start only works from the moment the motor is turned on until it reaches full RPM.

Power Efficiency Corp. manufactures a Motor Efficiency Controller that includes a technology that reduces power (KW) delivered to the motor in order to supply the precise amount of energy required to maintain the motor at normal operating speed (full RPM) and the proper amount of torque to match the motor load. The technology has been tested by utilities and customers on numerous applications, such as granulators, MG set elevators, escalators, stamping presses, jaw crushers and conveyors. This technology frequently qualifies for utility efficiency rebates.

What energy saving options are available for electric motors?

The first option that comes to mind is that low-tech solution: the power switch. There's no denying that the best way to save energy is to shut off the machine. But it's not always possible.

High efficiency motors are another option. Although more efficient than standard motors, high efficiency motors become inefficient when lightly loaded, just like standard motors.

Installing a variable frequency drive (VFD) is another option. By equipping the machine with a VFD, it will slow down or stop when there is no load or when it is lightly loaded and will speed up again when load increases. By slowing or stopping the electric motor, energy is saved. However, there are times when slowing the motor isn't possible or when a VFD is too expensive to be economical based solely on energy savings.

The Power Efficiency Motor Efficiency Controller keeps the motor running at full RPM, in contrast to a VFD, and reduces the power used by the motor when it is lightly loaded. The Motor Efficiency Controller is also comparably priced to other solid state soft starts, which are far less expensive than most VFDs. Furthermore, the energy saving technology in the Motor Efficiency Controller makes high efficiency motors more efficient in the same way it operates on standard efficiency motors – reducing their efficiency at low loads.

Comparison of Standard Soft Start to Power Efficiency's Motor Efficiency Controller

SOFT START *(Solid State Reduced Voltage Starters)*	**Power Efficiency's Motor Efficiency Controller** *(Solid State Reduced Voltage Starter and Energy Saver)*
• Reduces peak starting current • Reduces peak starting torque • Reduces mechanical shock • Reduces maintenance of equipment • Remote start & overload protection	• Reduces peak starting current • Reduces peak starting torque • Reduces mechanical shock • Reduces maintenance of equipment • Remote start & overload protection
No other features	*PLUS* • ***Energy savings*** *(on appropriate applications)* • ***Patented phase balancing technology*** • ***May qualify for utility rebates*** • ***Heat reduction and less wear and tear on contactors for overall reduction in plant maintenance***

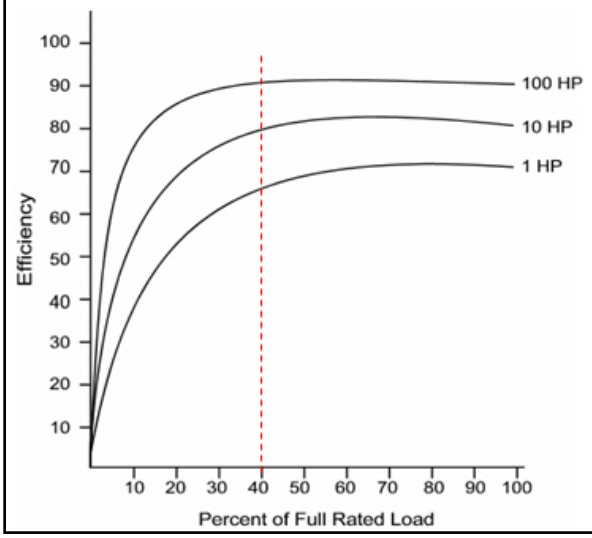
How Power Efficiency's MOTOR EFFICIENCY CONTROLLER Saves Energy

In general, AC induction motors operate most efficiently at around 75% of full rated load. At roughly 50% of full load, a motor's efficiency begins to decrease, and at even lower loads the efficiency drops off precipitously. Numerous motors operate at light loads. According to a Department of Energy study, 44% of motors in industrial facilities operate at 40% or less of full load and are operating inefficiently.

The efficiency curve for typical AC motors is shown in Figure 1 below. As a rule of thumb, the larger the motor, the flatter this curve is, and the lower the load percentage has to drop before the efficiency starts to drop.

The technology in Power Efficiency's Motor Efficiency Controller attacks the energy wasted when motors are lightly loaded – to the left of the dotted line in Figure 1. There is no opportunity for savings with the Motor Efficiency Controller technology when the motor is heavily loaded and operating efficiently.

Figure 1



To save energy, the Motor Efficiency Controller constantly monitors the voltage and current going to the motor. When the voltage and current sine waves diverge greatly – when the phase lag increases – the motor is lightly loaded and operating inefficiently. When this happens, the Motor Efficiency Controller technology reduces the current and voltage appropriately, while always maintaining the motor at a constant (full) operating speed. When the load on the motor increases, the Motor Efficiency Controller reads this condition and increases the power to the motor so it does not stall.

Although the theory of making motors more efficient in this manner was introduced many years ago, the process has been very difficult to perfect so the maximum amount of savings is realized across multiple applications and the motor receives full power when the load on it increases. Power Efficiency has created new technologies to optimize the operation of the Motor Efficiency Controller.

Energy Savings Technology Test Results

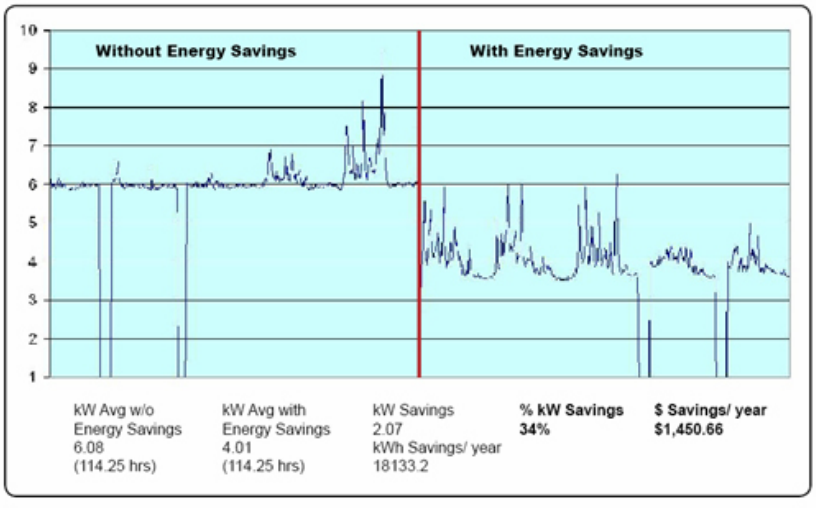
Power Efficiency's energy saving soft start technology has been proven to save up to 40% of the energy consumed by an electric motor, depending on the load and operation of the machine. For example, in a recent test by Nevada Power Company, the electric utility for Southern Nevada, on an escalator motor at a major casino on the Las Vegas Strip, the device reduced the average power consumption by 34%.

The following table and graph represent the kilowatt usage of the escalator over a period of 10 days - 5 days with and 5 days without the energy savings technology activated.

Up Escalator Annual Savings

	Avg kW x 8760 hrs/yr	Annual kWH Use	Annual kWH x Cost per kWH	Annual kWH Cost
Without Energy Savings	6.08 x 8760	53,260.80	53,260.80 x 0.08	$4,260.86
With Energy Savings	4.01 x 8760	35,127.60	35,127.60 x 0.08	$2,810.21
Annual Savings	**34%**	**18,133.20**		**$1,450.66**

Up Escalator kW



Below is a table that shows tests of the energy saving technology on various applications:

Application/ HP	Average Annual Power Savings %	Estimated Kilowatt Hours Saved
Stamping Press/ 10HP	23%	1,351
Elevator/ 15HP (MG sets)	35%	5,037
Elevator/ 60HP (MG sets)	20%	4,905
Granulator/ 5hp	33%	1,445
Escalator/ 15HP	36%	10,717
Escalator (Up)/ 20HP	34%	18,133
Escalators/ 40HP	36%	20,148

Other applications for Power Efficiency's energy saving soft start technology include rock crushers, compressors, conveyors, pumps, saws, mixers, shredders, and injection molding machines.

With energy prices on the rise and increasing concerns about green house gas emissions, Power Efficiency introduces a smart option for energy savings on electric motors. Power Efficiency's patented technology and intelligent product features represent significant advancements in soft start capabilities for electric motor efficiency and the environment.