Efficiency Improvements for AC Electric Motors
A Pacific Energy Center Factsheet

How This Technology Saves Energy

Energy-efficient AC motors produce the same output as standard motors with less electrical input, because they generally are better designed, with closer tolerances, and better materials and manufacturing quality.

Characteristics of Energy-Efficient AC Motors

The induction motor is the dominant type in use today, accounting for over 90 percent of installed horsepower—largely because it is rugged, simple, reliable, and cheap. Nearly all energy-efficient motors are induction motors, available in a wide variety of sizes and configurations.

Manufacturers improve motor efficiency by:

?? Increasing the thickness of the copper wires wound around the core of the motor. This reduces both the electrical resistance losses in the wires and the temperature at which the motor operates.

?? Using more and thinner high-quality steel sheets for the main fixed and rotating parts of the motor. This also minimizes electrical losses.

?? Narrowing the air gap between the spinning and stationary motor components, increasing the strength of its magnetic field. This lets the motor deliver the same output using less power.

Opportunities to specify energy-efficient rather than standard motors may exist if the customer is:

?? Designing new facilities.
?? Modifying existing installations or processes.
?? Obtaining pre-packaged equipment or systems with electric motor components.
?? Considering repairing failed motors.
?? Replacing oversized (underloaded) motors.
?? Starting an energy management or preventive maintenance program.
?? Able to obtain utility rebates.
Benefits and Pitfalls

In many commercial and industrial applications, energy-efficient motors quickly pay for themselves in lower energy costs and reduced maintenance. Occasionally, though, they may not justify the additional cost, or may be inappropriate choices. Both benefits and pitfalls should be considered before selecting efficient motors.

Benefits

Energy-efficient motors are usually 1-6 percent more efficient, with greater differences for small and lightly loaded motors. Table 1 below shows typical efficiency differences for several sizes of motors at various loads. Actual energy savings depend greatly on load factors and operating hours.

?? Motors typically consume four to 10 times their cost in energy each year, so energy-efficient models often make economic sense.

<table>
<thead>
<tr>
<th>Size</th>
<th>Motor Type</th>
<th>Load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Full</td>
</tr>
<tr>
<td>100-hp</td>
<td>Efficient</td>
<td>95.3</td>
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<tr>
<td></td>
<td>Standard</td>
<td>92.9</td>
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<tr>
<td></td>
<td>Spread</td>
<td>2.4</td>
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<tr>
<td>10-hp</td>
<td>Efficient</td>
<td>90.8</td>
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<tr>
<td></td>
<td>Standard</td>
<td>87.0</td>
</tr>
<tr>
<td></td>
<td>Spread</td>
<td>3.8</td>
</tr>
<tr>
<td>1-hp</td>
<td>Efficient</td>
<td>84.7</td>
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<td></td>
<td>Standard</td>
<td>77.2</td>
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<tr>
<td></td>
<td>Spread</td>
<td>7.5</td>
</tr>
</tbody>
</table>

?? Retail prices for motors vary greatly, and it is sometimes possible to find energy-efficient models costing only slightly more or perhaps even less than corresponding standard motors.

?? Energy-efficient motors typically run cooler, reducing winding failures and forced outages, and increasing bearing life and scheduled maintenance intervals.

?? Energy-efficient motors usually withstand stalling and overloads better. They also generally run quieter and operate with lower no-load losses.

?? Energy-efficient motors better tolerate abnormal conditions such as impaired ventilation, under- and over-voltage, and phase imbalance.
**Pitfalls**

- Energy-efficient motors generally cost about 15-30 percent more than comparable standard motors.
- Replacing an infrequently run standard motor with an energy-efficient one may not be economic.
- Energy-efficient motors sometimes generate less torque when they first start up. They may also have lower power factors, which can aggravate problems with electric power quality at a facility.

**For More Information**

Contact your PG&E representative or call 1-800-468-4743 for more information about PG&E's energy efficiency programs and other services.

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