Electric Motors - When to Repair or Replace

A failed motor puts immediate stress on the plant maintenance team. Several factors converge on the decision about what to do next. **Is it better to rewind, repair, or replace? And how much will operator downtime cost?**

Is the motor standard? What's the horsepower of the unit, and what's the nominal efficiency? It's not hard to see why the people tasked with getting a facility back up and running as quickly and cheaply as possible might do what's always been done -- take the failed motor in to be rewound or repaired.

In the decades before 1997, repairing and rewinding a failed motor was as easy of a decision as there was. In 1997, the Energy Policy Act (EPAct) of 1992 took effect. The Act covered far more than just electric motors, including building efficiency, appliance standards, electric vehicles, global climate change, radioactive waste disposal, renewable energy, and more.

Over 50% of all Electricity Used in the US Runs Through Motors.

The decision about what to do when a motor fails in your facility is important.

Part of what was affected by the implementation of EPAct in 1997 was motor efficiency. As a result, **the electric motors of today are considerably more efficient than the pre-legislation motors,** transforming motor efficiency into a major consideration when determining whether to repair or replace.

In fact, it's not uncommon for plant maintenance and engineering teams to have standard rules of thumb governing the repair or replace decision, such as:

- **Standard motors** that are 25 hp or less are cost-effective to have the bearings replaced but not to be rewound. Motors that are greater than 25 hp can have the bearings replaced and be rewound if the cost to rewind is less than 60% of a new premium efficient motor.

- For a **non-standard motor**, the rules are different. Taking into account the higher initial costs and potential lead times might put a greater emphasis on replacing the bearings and/or rewinding the unit. Some shops choose to rewind a motor if the cost is less than 75% of the cost of a new premium efficient motor.

Then there's always an individual motor consideration: is that failed motor causing downtime to a significant portion of the plant? The concealed costs in that scenario mean that the cost of a new, premium efficient motor is well worth it.

HP (1800 rpm)	Rewind Cost	Rewound Efficiency	Premium Efficient Motor Price	Premium Efficiency	New Price OVER Rewind Cost	Overall Energy Savings Per Year	Payback Months for Premium OVER Rewind
2	$485	76.7%	$520	86.5%	$35	$135	3
5	$500	80.4%	$611	89.5%	$111	$289	5
10	$625	83.0%	$814	91.7%	$189	$522	4
25	$1000	86.1%	$1690	93.6%	$690	$1062	8
50	$1600	89.7%	$2470	94.5%	$870	$1332	8
100	$2650	90.3%	$4841	95.4%	$2191	$2703	10
200	$4500	91.4%	$9676	95.8%	$5176	$4588	14

How Important is an Energy Efficient Motor?

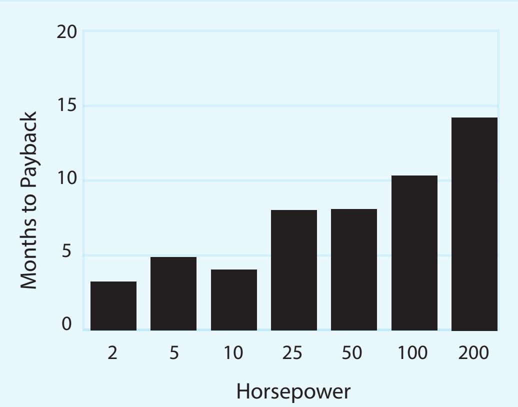
As with the water efficiency gains of a urinal or the energy efficiency gains of an ENERGY STAR refrigerator, the amount of money your facility can expect to save by implementing a premium efficient motor can be difficult to grasp.

The table shown above displays a comparison of several motors and the average performance for a rewound motor VS a premium efficient unit. The final column shows what the simple payback period would be for the added cost of the premium model.

The motors used for the purpose of this comparison are standard, general purpose motors operating at 1800 rpm. The chart shows the price and efficiency differences between a rewound motor and a premium efficient motor. The final three columns provide concrete results that can be used to make a sound decision about whether to rewind a motor or replace it.

For instance, a standard, general purpose 10 hp motor, operating 120 hours per week for 51 weeks will cost approximately $625 to rewind, but a new, premium efficient version will cost $814 shipped free to your loading dock. At almost $200, it may seem that a rewind is the better decision - saves money, guaranteed fit, and more. Look further, and the efficiency of the rewound motor is 83%, but the new, premium electric motor is 91.7%. That difference means the premium efficient motor will cost $522 less per year to operate than the rewound motor. At that rate, the simple payback period for the added expense of the new motor would be a mere four months, and from that point, your facility will save on operating costs for the rest of the motor's service. The overall payback period for the total cost of the motor, at $814, would be 1.5 years.

Electric Motor Simple Payback Period in Months

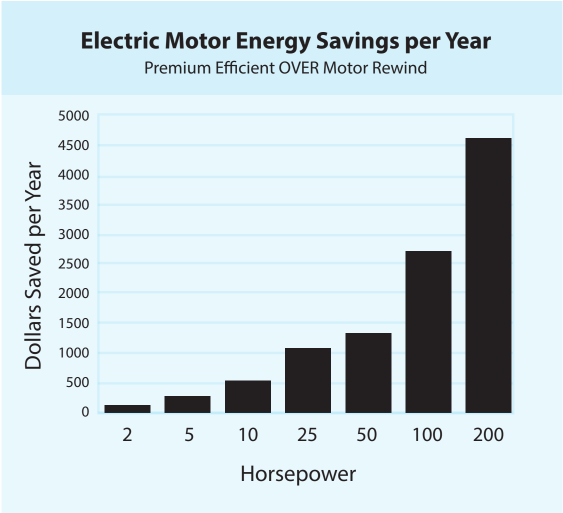


Electric Motors - When to Repair or Replace

The Importantce of Motor Replacment Plans

Even though a failed motor might be the perfect candidate for rewinding, a new, energy-efficient motor will produce significant energy savings and improved reliability. In fact, the U.S. Department of Energy recommends considering an energy-efficient model for any of the following circumstances:

- All new installations
- As part of an equipment package (compressors, HVAC systems, pumps)
- During large modifications being made to facilities or processes
- In place of rewinding an older, standard efficient motor
- Replacement of oversized and underloaded motors
- As part of a preventative maintenance or energy conservation program



Once your team has outlined the plan for what to do when a motor unexpectedly fails, it's also a good idea to develop a proactive plan. A growing number of building management teams recognize the savings potential of replacing not just failed motors, but older inefficient models that are still operating.

It's worth it to note that a premium-efficient, general-purpose 25 hp motor costs $690 more to replace than to rewind. But that motor saves $1062 per year to operate, leaving just 1.5 years to recoup the total cost of the motor. Also, saving $1000 per year may seem small when spread across the entire facility's operating budget, but consider those savings across many motors operating in your facility and small savings become quite considerable.

A motor efficiency improvement plan should include the following:

- Survey all motors and gather nameplate information.
- Obtain performance measurements from motors in operation.
- Prioritize those units already exceeding operation duration criteria.
- Divide your motors into the following categories to determine when to replace:
  - –Replace immediately - rapid payback, improved reliability, or utility rebates
  - –Replace at the time of failure - intermediate payback period
  - –Leave as is - extended payback, used less than 2000 hours per year

Once you have developed repair or replacement plans for the motors in operation at your facility, the next step is to identify where to make the purchase and how long the individual lead times and installation requirements may be. The answers to those questions will inform the decision about whether to keep a spare on the shelf or wait to replace once the current unit fails.