Motor Program Strategies

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Market Barriers

- Lack of awareness
- Higher first cost
- Low priority of energy efficiency among capital investment and operating objectives.
- Low level of staffing for facilities maintenance
- Conflicting or “split” incentives for equipment and service providers to promote efficient equipment.
- Lack of awareness of non-energy benefits, such as increased reliability and reduced downtime.

Source : www.cee1.org

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Selecting the "Right" Motors

- Customers should target motors for replacement that offer the best savings opportunities.
  - Motors that operate intermittently may not save enough to justify replacement
  - Replacing motors that operate at a high duty cycle, or continuously with energy-efficient models can result in very rapid payback

Best "Candidates" for Motor Replacement

- Operate at least 4,000 hours a year
- Are 10 years old or older
- Use rewound motors
- Include over or undersized motors
- Operate a critical process

- These types of motors are most commonly found in:
  - Commercial building supply and return fans
  - Industrial process pumps
  - Blowers
  - Process fans
  - Condensate pumps
  - Chilled water pumps

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Problems and Opportunities in Motors

Top Ten Problems in Motor Systems		Top Ten Opportunities in Motor Systems	
10.	Motors that are not energy-efficient	10.	When the motor fails consider replacing it with an energy-efficient model
9.	Motors that have been rebuilt incorrectly	9.	A mismatched bearing or the wrong wire can degrade motor efficiency and hasten repeat failure. In general, do not rewind Open Drip Proof (ODP) motors
8.	Motors that limit production quality or quantity	8.	Motor Systems can and should be problem free. Find and fix the root problem.
7.	Critical production motors that are not standard NEMA	7.	Specify NEMA design motors when purchasing equipment if possible.
6.	Lightly loaded motors that have a poor power factor	6.	If the motor is loaded less than 25%, the power factor and efficiency will be very poor.
5.	Motors that are fed with voltage imbalance	5.	Voltage imbalance places extra stress on the motor and windings and hastens failure.
4.	Motor systems that are mismatched to the load	4.	Match the machine to the load and save 20-50%
3.	Motor systems that run when they don't need to	3.	Turn it off when it's not needed. Save 5- 30%
2.	Motors that are unreliable, or "need" soft starts.	2.	Downtime costs you money and credibility. Fix the problem instead of accepting it.
1.	Motors that overload unless the machine is throttled	1.	Modify the machine to match the flow and pressure that the process needs and save 20-50%.

Source: http://www.productiveenergy.com/calculator/motorpolicy.asp

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Motor Program Strategies

DOE and CEE developed a program called "Motor Management" that establishes a set of ongoing policies and practices that help commercial and industrial facilities effectively manage their motor populations based on life-cycle costing and proactive planning.

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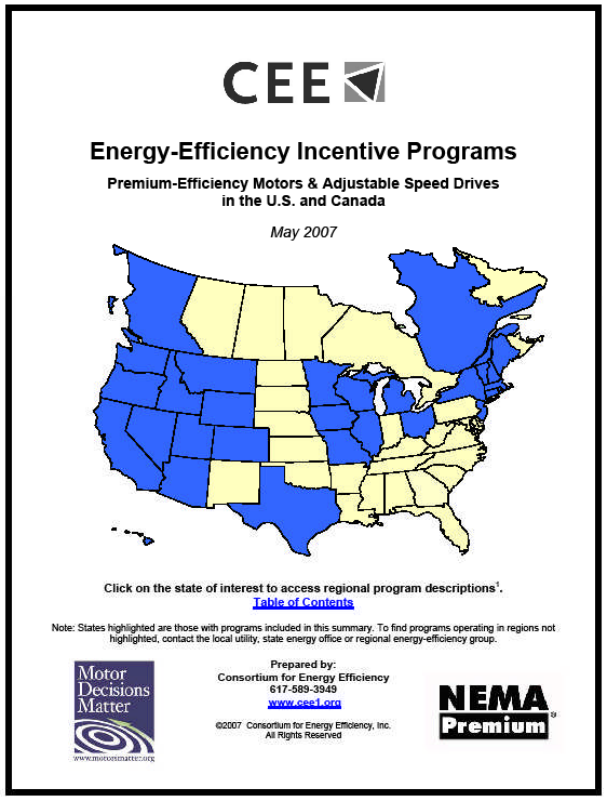
Summary of Energy Efficient Motors and VFD Programs



- Provides detailed description of motor/VFD programs currently in place
- Identifies the types of program strategies they are using
- Website:

www.motorsmatter.org/tools/programs2007.pdf

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Benefits of Using a Motor Management Strategy

- Fosters greater awareness and adoption of higher efficiency products and services by customers
- Provides opportunities to work proactively with customers to improve the efficiency of their installed base of motors
- Promotes long-term policy changes within customer organizations
- Increases awareness of motor management benefits among vendors and other trade allies
- Builds more cooperative relationships with vendors and other allies

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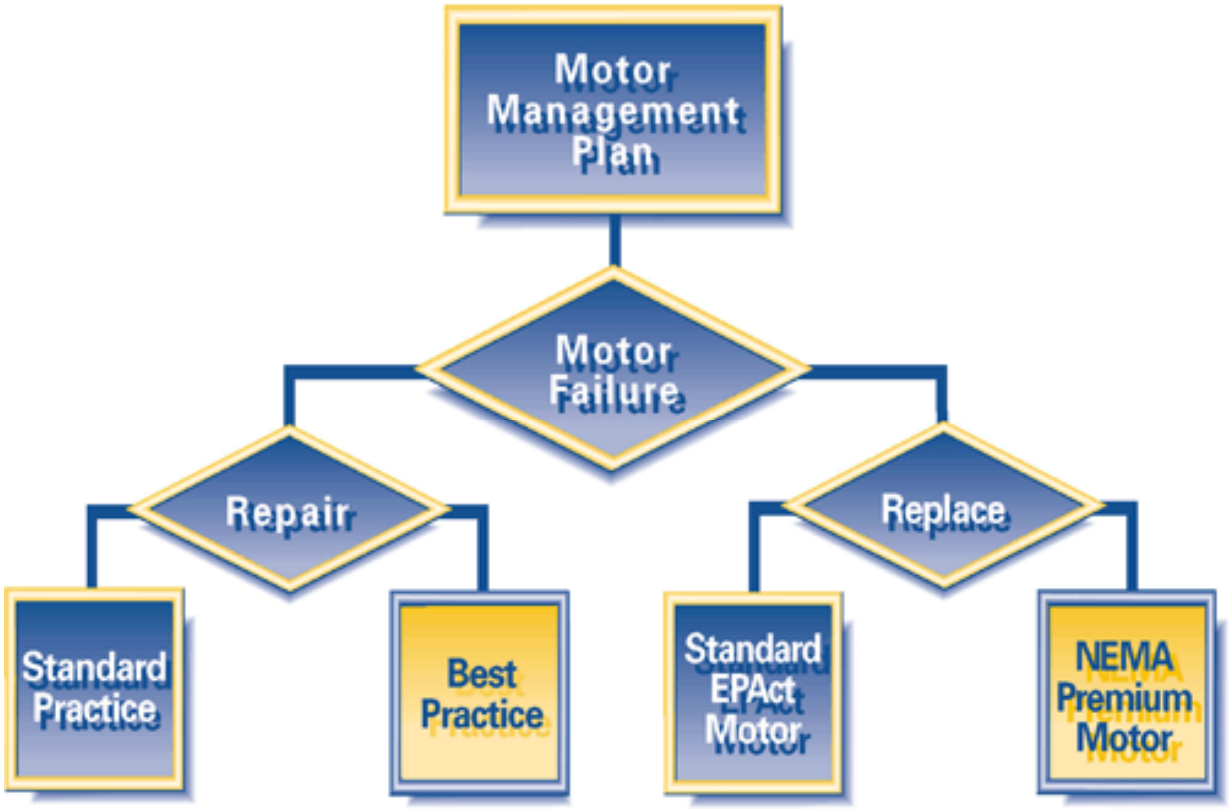
Motors Decision Tree



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Conduct Motors Survey

- Collect Nameplate information
- Obtain field measurements under typical operating conditions
  - voltage,
  - amperage,
  - power factor,
  - operating speed

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Estimate Operating Costs

- The motor operating cost calculator* can estimate the cost to operate the motor. The software is MotorMaster+.
- Software will be provided to all attendees

* www.productiveenergy.com/calculator/motor.asp

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Payback Examples

HP	Standard Efficiency Motor			Replace with EPAct Motor					
	Eff. At 75% of Load	Annual Energy Use (kWh)	Annual Energy Cost (@.07 cents per kWh)	Motor Cost	Eff. At 75% of Load	Annual Energy Use (kWh)	Annual Energy Cost (@.07 cents per kWh)	Annual savings	Payback Period
5	84.0%	26,644	$1,865	$233	88.20%	25,374	$1,776	$89	2.62
10	86.8%	51,653	$3,616	$375	90%	49,773	$3,484	$132	2.85
15	87.6%	76,771	$5,374	$562	91%	73,780	$5,165	$209	2.68
20	89.3%	100,206	$7,014	$666	92.60%	96,626	$6,764	$251	2.66
25	89.9%	124,457	$8,712	$800	93.10%	119,952	$8,397	$315	2.54
50	91.6%	244,211	$17,095	$1,617	93.90%	238,027	$16,662	$433	3.74

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Payback Examples

HP	Standard Efficiency Motor			Replace with NEMA Premium Motor					
	Eff. At 75% of Load	Annual Energy Use (kWh)	Annual Energy Cost (@.07 cents per kWh)	Motor Cost	Eff. At 75% of Load	Annual Energy Use (kWh)	Annual Energy Cost (@.07 cents per kWh)	Annual Savings	Payback Period
5	84.0%	26,644	$1,865	$303	90.5%	24,729	$1,731	$134	2.26
10	86.8%	51,653	$3,616	$518	92.2%	48,547	$3,398	$217	2.38
15	87.6%	76,771	$5,374	$677	92.6%	72,815	$5,097	$277	2.44
20	89.3%	100,206	$7,014	$824	93.4%	95,846	$6,709	$305	2.70
25	89.9%	124,457	$8,712	$1,065	94.0%	119,043	$8,333	$379	2.81
50	91.6%	244,211	$17,095	$1,794	94.5%	236,825	$16,578	$517	3.47

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Establish as Motor Repair/Replace Policy

The Motor Repair/Replace Policy maker lays out simple rules to follow when a motor breaks down based the electric rate and operating hours.

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Establish an Inventory System

An established inventory system systematically increases the efficiency of motor populations, which will cut costs by avoiding emergency motor repairs and statistically increasing the time between failures.

Target Critical Motors First

If the cost of downtime per hour exceeds twice the purchase price for a new motor in any particular application, a new motor should be purchased and installed at the earliest scheduled downtime. These motors should be replaced on a regular basis to prevent unscheduled shutdown.

To Rewind or Not Rewind

- Although failed motors can usually be rewound, it is often worthwhile to replace a damaged motor with a new energy-efficient model to save energy and improve reliability.
- Motors should be rewound only at reliable repair shops that use low temperature (under 700°F) bakeout ovens, high quality materials, and a quality assurance program based on EASA-Q or ISO-9000.
  - Ask the repair shop to conduct a core loss or loop test as part of their rewind procedures

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When to Replace Rather than Rewind

- The motor is less than 40 hp.
- An energy-efficient motor payback is four years or less, depending upon hours of use
- The cost of the rewind exceeds 65% of the price of a new motor.
- The motor was rewound before 1980.

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Three Categories of Motors

- ***Replace Immediately — Motors Offering Rapid Payback through Energy Savings, Improved Reliability, or Utility Rebates.*** These include motors that run continuously (typically 8,000 or more hours a year), are currently inefficient (including oversized motors), must be reliable, or are covered by attractive utility rebate programs.
- ***Replace at Time of Failure — Motors with Intermediate Payback.*** When these motors fail, they should be replaced with a cost-effective energy-efficient model.
- ***Leave Present Situation as is — Motors with Extended Payback.*** These motors are already reasonably efficient or are used less than 2000 hours each year. They can be rewound or replaced with a similar motor. Motors and drive systems have a long useful life. The cost of running a motor may increase significantly in the future.

Source: Motor Challenge Fact Sheet, DOE

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Most Cost-Effective Savings Opportunities

- Facilities with less than 500 motors
- The facility should operate at least two shifts/day.
- Facilities with a large number of general-purpose motors of the same size and type, sized between 10 and 200 horsepower, running similar applications.
- Easily accessible motors.

Demand-Side Management Technology Workshop: Motors and Variable Frequency Drives

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