

OPPORTUNITY

Why is GSA interested in smart motors?

38% OF ELECTRICITY IS USED BY MOTORS IN U.S. COMMERCIAL BUILDINGS¹

56% OF MOTORS ARE < 5 HP²

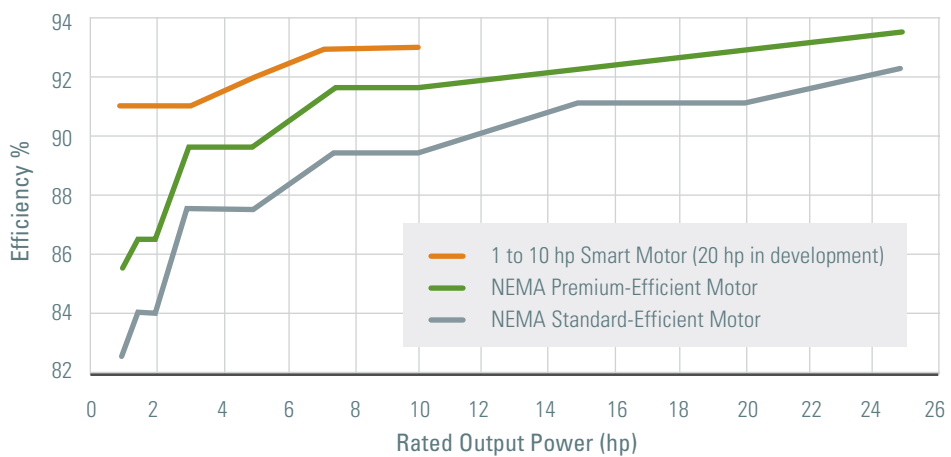
TECHNOLOGY

What are smart motors?

SOFTWARE-CONTROLLED SWITCHED RELUCTANCE MOTOR WITH VARIABLE-FREQUENCY DRIVE (VFD)

REAL-TIME CLOUD-BASED MONITORING AND CONTROL

Smaller motors offer greater relative savings



M&V

Where did Measurement and Verification occur?

OAK RIDGE NATIONAL LABORATORY (ORNL) assessed a 10 hp smart motor on a chilled water pump application at the Land Port of Entry in San Ysidro, California. A concurrent National Renewable Energy Laboratory (NREL) assessment of a 1.5 hp motor took place on condenser fans in a refrigeration system at a Walmart in Lakeside, Colorado. Technology was provided by Software Motor Company.

RESULTS

How did the 10 hp smart motor perform in M&V?

MORE EFFICIENT UNDER ALL CIRCUMSTANCES

4% avg. savings compared to a premium-efficient motor & VFD.³ 33% for 1.5 hp motor compared to a standard-efficient motor & VFD (NREL assessment)⁴

O&M INSTALLATION COMPARABLE

Reduced maintenance. Drop-in motor replacement⁵

REMOTE MONITORING & CONTROL

Possible but not tested. NREL assessment showed successful fault-detection and control⁶

Immediate Payback When Replaced at End-of-Life

44% less expensive than a code-compliant premium-efficiency motor and VFD

	Premium Motor + VFD	Smart Motor (Retrofit)	Smart Motor (End-of-Life)
10 hp motor cost (\$)*	\$4,375	\$2,430	\$1,945 less expensive
Installation (\$)**	\$948	\$948	\$0, no change
Technology electricity use (kWh/yr)	31,700 kWh	30,400 kWh	1,300 kWh annual energy savings
Technology electricity @ GSA avg. \$0.11/kWh (\$/yr)	\$3,516	\$3,371	\$145 annual cost savings @ \$0.11/kWh
Simple payback (yrs)		23	Immediate

*Premium motor (\$1,756) and VFD (\$2,619) cost provided by San Ysidro LPOE. Smart motor cost provided by manufacturer; does not include volume discounts. EISA 2007 mandates 1-to-200 hp premium-efficiency motors. GSA's facilities standards guide, the P100, requires a VFD on all motors larger than 5 hp.

** Labor cost provided by San Ysidro LPOE: 12 hours @ \$79/hr. Pump application requires laser alignment to align pump and motor.

DEPLOYMENT

When does the study recommend deploying smart motors?

END-OF-LIFE REPLACEMENT

Also consider retrofits for: fixed-speed motors; motors < 5 hp; and applications with lower installation costs, such as motors that control fans

¹Energy-Efficiency Policy Opportunities for Electric Motor-Driven Systems, International Energy Agency, Paul Waide and Conrad U. Brunner, 2011, p.11 ²Premium Efficiency Motor Selection and Application Guide, U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, February 2014, p.1-5 ³Laboratory Evaluation and Field Demonstration of High Rotor Switched Reluctance Motor Technology, Brian Fricke, Mahabir Bhandari (ORNL), October 2019, p.32 ⁴Evaluation of High Rotor Pole Switched Reluctance Motors to Control Condenser Fans in a Commercial Refrigeration System, Grant Wheeler, Michael Deru (NREL), June 2019, p.18 ⁵ORNL Report, October 2019, p.37 ⁶NREL Report, June 2019, p.19