United States Department of Agriculture
Natural Resources Conservation Service

2011 Ranking Period 1

Energy Enhancement Activity – ENR09 - Variable Frequency Drive Electric Motors

Enhancement Description
This enhancement activity is for upgrading of existing single speed electric motors through the addition of variable frequency electric drives. A motor replacement may also be included in some cases. The primary use of this enhancement is for water pumping whether for irrigation, drainage or livestock watering. This enhancement is not intended for farmstead or animal housing applications.

Land Use Applicability
Cropland, pastureland, rangeland and forest land.

Benefits
Motor-drive systems are matched to the pump or other machinery which performs the work that needs to be done. Each motor-drive system must be sized to meet the maximum expected load even if that maximum load only occurs infrequently. This maximum output condition is rarely the most efficient operating point of the motor-drive system. A variable frequency drive improves the system's energy efficiency under most operating conditions by matching the motor speed to the load. In contrast, the output of a single speed motor-drive system will rarely match the actual demand and is controlled in some way that often wastes a large part of the power it produces. Single speed electric motor-drive systems use more electricity during startup and as operating requirements vary during the run cycle. A variable frequency drive can start a motor slowly and ramp up to full speed reducing wear and tear on the motor.

Variable frequency drives achieve higher energy savings in applications with long annual run-times and when the system operates outside its best efficiency point for long periods of time. Equipment which operates with frequent on/off cycles or uses some kind of mechanical throttling (dampers on air systems or valves in liquid systems) are typically good candidates for a variable speed drive.

Motor-drive systems which generally operate under steady load conditions are not good candidates for variable speed drives.

Criteria
1. Determine current and anticipated requirements in terms of peak and typical load conditions (as the load varies daily and by season, crop, or other appropriate activity).
2. Retrofit single speed electric motors with a variable frequency drives or replace single speed electric motors with an efficient motor and variable speed drive.

Documentation Requirements

1. Documentation of the installation of variable frequency drives such as receipts or pictures.

References

GREENING FEDERAL FACILITIES: An Energy, Environmental, and Economic Resource Guide for Federal Facility Managers and Designers; SECOND EDITION. Part V Energy Using Systems, 5.7.2 Variable-Frequency Drives [FEMP DOE/GO-102001-1165, NREL/BK-710-29267, May 2001; www1.eere.energy.gov/femp/pdfs/29267-5.7.2.pdf]

This activity may NOT be used with the following enhancements: ANM21, ANM22, ANM23, ENR03, SOE02.

Potential duplicate practices: 533 - Pumping Plant