HIGH EFFICIENCY MOTORS/ ADJUSTABLE SPEED DRIVES

Project Description

Drive-power systems are one of the largest electricity consuming elements in industrial processes. In addition to the electric motor, a drive- system can consists of a number of other electrical components, such as pumps, fans, compressors, piping and ducting, motor drive machine tools. Texas Instruments (TI) has implemented what is referred to as a "systems approach" to its use of drive-power systems as a means to reduce its power consumption and high electricity costs.

Figure 1: High Efficiency Compressor Motor

Figure 2: High Efficiency Drive Motors

A systems approach seeks to increase the efficiency of electric motor systems by shifting the focus from individual components and functions to total system performance. When applying a systems-approach to the design process, the entire system can be optimized. The steps involved in accomplishing a system optimization involve characterizing the process load; minimizing distribution losses; matching the driven equipment to load requirements; controlling the process load in the most optimal manner, considering all cycles of the process load; and properly matching motor and drive to each other, as well as the load.

TI has significantly improved the energy efficiency of its drive systems by reducing the energy losses in the system and by improving the efficiency of the motors. TI further improved the energy efficiency of motors by applying variable frequency drives (VFD) for their electric drive motor systems, replacing

motors with high-efficiency motors and optimizing the size of the motor drives. Adjustable speed drives offer the single largest opportunity for energy savings in drive-power systems.[1]

Energy and Cost Savings

Industrial motor systems represent the largest, single, electrical end use in the American economy—25% of the Nation's electricity consumption and 64% of the electricity consumed in the U.S. industrial sector. High efficiency motors and variable frequency drive systems reduce energy demand, lower emissions, and assist TI to maintain its competitiveness.

Environmental Benefits

Indirect emission reductions occur (at electric generating facilities feeding into the regional New England Power Pool - NEPOOL) as a result of reduced electricity consumption benefits derived from these projects. Variable speed drives and starters (soft starters) result in reduced kWh consumption and to a lesser extent demand kW reductions resulting from lower demand from several drive motors under simultaneous operation. The environmental benefits here are estimated primarily from reduced energy consumption. Annual emission reductions are estimated in the table below.[2]

High Efficiency Motors and Variable Frequency Drives

Total Capital Costs	**$**	
MECo Rebates	**$**	
Net Cost to TI	**$**	
Electricity Savings	**5,888 MWhs/year**	
Cost Savings	**$471,000/year**	
Emissions Avoided		
NOx	**5.6**	**tons/year**
SO_2	**18.2**	**tons/year**
CO_2	**4,381**	**tons/year**
Mercury	**0.023**	**lbs/year**

Figure 3: Variable Frequency Drives

[1] S. Nadel, M. Shepard, S. Greenberg, G. Katz and A.T. de Almeida, *Energy-Efficient Motor Systems: a Handbook on Technology, Program and Policy Opportunities* (Washington, D.C.: American Council for an Energy-Efficient Economy, 1992).

[2] Estimated emission reductions are based on published fossil emission rates feeding into the New England Power Pool (NEPOOL).