Improving Motor and Drive System Performance:
A Sourcebook for Industry

Produced by the National Renewable Energy Laboratory Golden, Colorado

This sourcebook is designed to provide those who use motor and drive systems with a reference that outlines opportunities to improve system performance. It is not meant to be a comprehensive technical text on motor and drive systems; rather, it provides practical guidelines and information to make readers aware of potential performance improvements. Guidance on how to find more information and assistance is also included.

Plant engineers, facility managers, operations personnel, and others whose work involves motor and drive systems will find this sourcebook helpful in assessing the efficiency of their motor and drive applications. Discussions of improvement opportunities in this sourcebook emphasize the connection between operating efficiency and system reliability. For example, a plant project that increases the overall efficiency of a motor and drive system often reduces plant downtime, as well. This is one of several important benefits of efficiency improvements.

This sourcebook is divided into four main sections, as outlined below.

Section 1: Motor and Drive System Basics
For readers who are unfamiliar with the basics of motor and drive systems or would like a refresher, this section briefly describes important terms, relationships, and system design considerations. It also describes key factors involved in motor and drive selection and system design, and provides an overview of the different types of motors and drives and their applications. Readers who are already familiar with key terms and parameters used in selecting motors and drives, designing systems, and controlling their operation might want to skip this section and go on to the next one.

Section 2: Performance Opportunity Roadmap
This section describes the key components of a motor and drive system as well as opportunities for performance improvements. A systems approach is emphasized, rather than a focus on individual components. Guidance is provided in a set of efficiency opportunities, which cover the following topics in separate subsections for easy reference:

- Assessing Motor and Drive System Operating Conditions
- Establishing a Motor Management Program
- Providing Basic Maintenance
- Selecting the Right Motor
- Using Variable Frequency Drives
- Addressing In-Plant Electrical Distribution and Power Quality Issues
- Using the Service Center Evaluation Guide

Section 3: Motor System Economics This section provides recommendations on how to propose projects like those described in Section 2 by highlighting for management the favorable economics of motor and drive system improvements. Topics include understanding and

identifying corporate priorities, relating those priorities to efficiency, and clarifying the financial aspects of efficiency improvements, including life-cycle costs and payback periods.

Section 4: Where to Find Help Section 4 provides a directory of associations and other organizations associated with motors and drives and their markets. This section also lists helpful resources for more information, tools, software, videos, and training opportunities.

Appendices
This sourcebook contains five appendices:

- Appendix A is a glossary of terms used in discussing motor and drive systems; these terms appear in bold type when they are first mentioned in the text.
- Appendix B contains a series of motor and drive system tip sheets. Developed by the U.S. Department of Energy (DOE), these tip sheets discuss opportunities for improving the efficiency and performance of motor systems, but in less detail than the efficiency opportunities described in Section 2.
- Appendix C provides Energy Policy Act (EPAct) efficiency levels for motors up to 200 horsepower (hp) in size, along with National Electrical Manufacturers Association (NEMA) Premium® motor efficiency levels.
- Appendix D includes a checklist for motor repair facilities.
- Appendix E provides guidelines for submitting suggested changes and improvements to the sourcebook.

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