

Continuous CommissioningSM Guidebook

Maximizing Building Energy Efficiency and Comfort

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AND
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ALL TESTING, USE OF EQUIPMENT, AND RECOMMENDED PROCEDURES DISCUSSED IN THIS GUIDE SHOULD BE COMPLETED BY TRAINED AND QUALIFIED PERSONNEL ONLY. FOLLOW MANUFACTURER RECOMMENDATIONS FOR SAFE OPERATIONS BY PERSONNEL AND BUILDING OCCUPANTS.

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This Continuous CommissioningSM Guidebook was developed under the direction of the U.S. Department of Energy's Federal Energy Management Program (FEMP). The mission of FEMP is to reduce the cost and environmental impact of the Federal government by advancing energy efficiency and water conservation, promoting the use of distributed and renewable energy, and improving utility management decisions at Federal sites. Each of these activities is directly related to achieving requirements set forth in the Energy Policy Act of 1992, the goals that have been established in Executive Order 13123 (June 1999), and those principles that are inherent in sound management of Federal financial and personnel resources.

This guidebook presents a comprehensive ongoing process to resolve operating problems, improve comfort, optimize energy use and identify retrofits for existing commercial and institutional buildings and central plant facilities. Continuous CommissioningSM (CCSM) has produced typical savings of 20% with payback under three years (often 1-2 years) in more than 130 large buildings. The CCSM process focuses on improving overall system control and operations for the building as it is currently used and meeting existing facility needs. It goes beyond an operations and maintenance program, including a comprehensive engineering evaluation that develops operational parameters and schedules to meet occupant needs. An integrated approach is used to implement these optimal schedules to ensure local and global system optimization and to ensure the persistence of the improved operational schedules.

In addition to energy/resource and cost savings, a properly implemented CCSM program will:

- Improve the comfort, health and safety of building occupants by ensuring proper temperature and humidity control with adequate ventilation
- Reduce maintenance costs by ensuring that problems are fixed correctly the first time
- Increase the safety of all staff by improving equipment maintenance
- Facilitate compliance with Federal legislation such as the Clean Air Act and the Clean Water Act

The focus of this guidebook is to provide the Federal Energy Manager and practitioner with information and specific actions that will achieve these savings and benefits.

The guidebook consists of nine chapters and an appendix. The first chapter provides an introduction and overview of the CCSM process. Chapter 2 summarizes the benefits of the CCSM process, illustrated with several short case studies. The third chapter presents several variations on the classical "shut it off if it isn't needed" theme. Chapter 4 presents CCSM Measures for AHU Systems with specific measures for all major AHU types. CCSM Measures for Distribution Sys-

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tems are discussed in Chapter 5 followed by CCSM Measures for Central Chiller Plants in Chapter 6. Chapters 7 and 8 present CCSM Measures for Central Heating Plants and CCSM Measures for Thermal Storage Systems, respectively. Chapter 9 describes specific activities required to ensure that optimized performance is achieved and maintained. The Appendix contains two highly detailed case studies that illustrate implementation of the CCSM process.

The units used throughout this guidebook are those commonly used in the HVAC industry. For example, thermal energy consumption is in millions of Btus (MMBtus) or thousands of Btus (kBtus). Static pressure is commonly in inches of H₂O (in. H₂O), head pressure is in feet of water (ft. H₂O), or pounds per square inch (psi), and motor sizes are expressed in horsepower (hp.). Electrical units are commonly in kilowatt hours (kWh) or megawatt hours (MWh). Gas usage is expressed in millions of Btus (MMBtus) or thousands of cubic feet (MCF). The authors felt that readers would be more comfortable with these units than metric units or dual English and metric units.

The examples given throughout this guidebook have been taken from ESL projects. These projects have been widely documented as indicated in the references cited. Occasional text is nearly verbatim from earlier ESL reports and papers referenced, but this has not been explicitly shown to improve flow of the text. Likewise, many of the figures show data that has been presented in similar formats in earlier ESL publications prepared by TEES or the University of Nebraska. Original publication is noted by references in the text, but not explicitly shown for the figures.

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