

Procedures for Commercial Building Energy Audits

Second Edition



PROCEDURES for COMMERCIAL BUILDING ENERGY Audits

SECOND EDITION

*This publication was prepared under the auspices of
ASHRAE Technical Committee 7.6, Building Energy Performance.*

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The primary authors and reviewers of this document include Steve Carlson, David Eldridge, Keith Emerson, Michele Friedrich, Dakers Gowans, Bruce Hunn, Michael Levinson, Kendra Tupper, and Megan Van Wieren. Reviews and supporting content were provided by Adrienne Thomle, Bernt Askildsen, Dave Moser, Ron Nelson, Rob Risley, Mark Case, Eric Harrington, Fredric Goldner, Stanton Stafford, and Greg Towsley.

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Michael Deru
Chair, ASHRAE Technical Committee 7.6

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PREFACE— How TO Use This Book

The goals of this edition of *Procedures for Commercial Building Energy Audits* are to

- define levels of effort for energy audits;
- provide a reference guide for building owners, managers, government entities, and other consumers illustrating best practices for conducting energy assessments and the associated deliverables; and
- serve as an introductory guide to best practices for energy auditors.

The intended scope of this volume is for existing commercial and institutional buildings. However, many of the procedures herein will be applicable to industrial or multifamily residential facilities as well.

Part 1 of this book discusses Level 1, Level 2, and Level 3 energy audits as defined by American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). The procedures outlined are the minimum requirements for the levels. These definitions have changed only slightly from the first edition of this book.

Part 2 outlines recommended audit procedures and best practices. This section is intended only as a reference and does not define required audit procedures. The intent of this section is to provide guidance to auditors and those who would like to hire professional energy assessors.

Part 3 includes additional useful resources, such as sample data collection forms and templates, unit conversions, a list of abbreviations and acronyms, and a references section.

The sample data collection forms and templates included in Part 3 may be downloaded and used as the bases for data collection and reporting results from energy audits from **www.ashrae.org/PCBEA**. The forms and templates are in Microsoft Excel® spreadsheet format. The Web site also includes pdfs of an energy auditor checklist reprinted with permission from Washington State University and a list of energy efficiency measures (EEMs) to consider when performing an energy audit.

ENERGY AUDIT SAMPLE FORMS AND TEMPLATES

Gathering the right data with the appropriate amount of detail is a key component to achieving the maximum benefits of an energy audit. However, the

process for audit data collection is not standardized and, often, crucial data may be overlooked.

To facilitate the data collection effort, sample energy audit forms and templates are provided in Part 3 and at www.ashrae.org/PCBEA. These include data collection forms for all components of a commercial building that contribute to heating and cooling loads or consume energy and are organized by building system (e.g., glazing, cooling towers, etc) and template procedures for completing the Preliminary Energy-Use Analysis (PEA), end-use breakdowns, and EEM summary tables. The purpose of these sample forms and templates is to assist building energy auditors in collecting the data required to complete comprehensive energy and financial analyses of proposed modifications to a building.

HOW TO USE THE FORMS AND TEMPLATES

The data collection forms, which are best suited to Level 2 and Level 3 audits, may be used to aid the auditor in gathering data at the site. They are very comprehensive and are intended to support the collection of data needed for a detailed audit of a facility. It may not be necessary to collect all the data covered by the forms for every facility; therefore, auditors will need to use their judgment as to what data is and what level of investigation are appropriate for each specific site. Auditors can use the following guidelines to determine which forms to use:

- Identify which information listed in the sample forms is needed for a specific project.
- Identify the anticipated source for each piece of data. Typical data sources include
 - facility managers,
 - as-built drawing sets,
 - utility bills,
 - building automation system (BAS) trend data,
 - on-site spot measurements,
 - temporary logger data, and
 - occupant surveys.
- Collect and organize as much data as possible prior to a site visit.
- Print the sample forms (sometimes multiples of each) and take them to the site (or take the electronic versions).

Some of the forms contain “guidance” sample forms and show examples and potential data sources of information that should be collected.

The sample template procedures for completing the PEA, end-use breakdowns, and EEM summary tables include basic unit conversion calculations and financial calculations that are consistent with the guidelines in this book. See the following sample spreadsheets:

- The file “ASHRAE PEA Template.xls” includes a sample format for the PEA methods in the Preliminary Energy-Use Analysis sections of Part 1 and 2.
- The file “ASHRAE Sample End-Use Breakdown.xls” includes a sample end-use breakdown consistent with the methods of the Level 2—Energy Survey and Engineering Analysis section of Part 1 and the Energy End-Use and Cost Allocation section of Part 2.
- The file “ASHRAE EEM Summary Table.xls” is a sample EEM summary table for reporting energy audit results with common financial performance metrics and economics consistent with the Level 2—Energy Survey and Engineering Analysis section of Part 1 and the Audit Reports section of Part 2.

Note that the forms and templates available on the Web site may be revised from time to time, so users should refer to the Web site for the most up-to-date version of any form or template they wish to use for their audit projects. When a file is revised, it will be posted to www.ashrae.org/PCBEA with a new date at the end of the file name; this revised file will replace any versions previously available on the Web site.

THE TERM *ENERGY Audit*

The term *energy audit* is an established term within the industry. It is widely used and understood by many. Ultimately we decided to retain the word *audit* for this publication because of its wide industry usage and to maintain a consistent title for the book, which is referenced in multiple publications and standards. However, we have chosen to use the terms *energy audit* and *energy assessment* interchangeably throughout. Also in popular use are the terms *energy analysis*, *energy survey*, *energy evaluation*, *energy investigation*, *energy assessment*, and others. We have used these terms within this publication as well. Many of these terms have achieved some common use in the industry and they may be more descriptive than the term *energy audit*.

For many reasons, *assessment* is preferable to *audit*—*assessment* carries none of the negative connotations of the word *audit*, which is commonly associated with an involuntary investigation of finances or taxes, where the perceived goal is to uncover mistakes and assess monetary penalty, and is often seen as a precursor to some kind of enforcement action or punishment. If we are to gain market acceptance for energy assessment, such negative connotations are best avoided. *Assessment* also conveys more accurately the activity at hand—that is, assessing the current state of a building and making recommendations to improve its performance. Our hope is to move toward a wider use of *assessment* yet maintain reference to the term *audit*.

Similarly, throughout this book we’ve used the terms *auditor*, *analyst*, and *assessor* interchangeably.