

2013

NONRESIDENTIAL ALTERNATIVE CALCULATION METHOD

APPROVAL MANUAL

FOR THE 2013 BUILDING
ENERGY EFFICIENCY
STANDARDS



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The Building Energy Efficiency Standards (Standards) were first adopted and put into effect in 1978 and have been updated periodically in the intervening years. The Standards are a unique California asset and have benefitted from the conscientious involvement and enduring commitment to the public good of many persons and organizations along the way. The 2013 Standards development and adoption process continued that long-standing practice of maintaining the Standards with technical rigor, challenging but achievable design and construction practices, public engagement and full consideration of the views of stakeholders.

The 2013 Standards revision and the supporting documents were conceptualized, evaluated and justified through the excellent work of Energy Commission staff and consultants working under contract to the Energy Commission, Pacific Gas and Electric Company, Southern California Edison Company, San Diego Gas and Electric Company, and Southern California Gas Company. At the Energy Commission, Maziar Shirakh, P.E.; and Martha Brook, P.E. served as the project managers and senior engineers. Bill Pennington, Deputy Division Chief of the Efficiency and Renewable Energy Division, provided overall guidance to the staff and consultants. Eurlyne Geiszler served as the Office Manager for the High Performance Buildings Office. Pippin Brehler and Kristen Driskell provided legal counsel to the staff. This document was created with the technical assistance from Martha Brook, PE, Sabaratnam Thamilsaran, PE, David Ware; Nelson Pena, Rob Hudler; and Owen Howlett. Other key technical staff contributors included, Gary Flamm; Patrick Saxton P.E.; Jeff Miller, P.E.; Payam Bozorgchami, P.E.; Tav Commins; and Mark Alatorre. Additional staff input and assistance came from Ron Yasny; the Energy Hotline staff; and the Energy Commission's Web Team. Critical support for the staff in conceptualizing, evaluating, and reviewing this document came from Architectural Energy Corporation, L'Monte Information Services, Gard Analytics, National Renewable Energy Laboratory, Hitchcock consulting, 360 Analytics, Wrightsoft Corporation, Taylor Engineering, McHugh Energy, Gabel Associates, Energy Solutions, E3, PECl, and the Heschong Mahone Group.

The authors are grateful to the many people and organizations that contributed to the development and production of the Standards and the supporting documents. The documents reflect, to a large extent, the comments made by the many people who took time to carefully review earlier versions. Reviewers who significantly contributed to the content include members of CABEC and CALBO. Special thanks go to Panama Bartholomy, the former Deputy Director Efficiency and Renewable Energy Division for his vision and support of the 2013 Standards.

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*The Energy Commission dedicates the adoption of the 2013 Building Energy Efficiency Standards to **Valerie T. Hall**, (November 28, 1952 - December 21, 2010), Deputy Director of the Efficiency and Renewable Energy Division for her more than 32 years of dedication to excellence in the development and implementation of energy efficiency programs in California with the most aggressive energy efficient building standards in the country and for being a model for others to follow.*

ABSTRACT

The 2013 Building Energy Efficiency Standards for Nonresidential Buildings allow compliance by either a prescriptive or performance method. Performance compliance uses computer modeling software to trade off efficiency measures. Computer performance compliance is typically the most popular compliance method because of the flexibility it provides in the building design.

Energy compliance software must be certified by the Energy Commission, following rules established for the modeling software. This document establishes the rules for the process of creating a building model, describing how the proposed design (energy use) is defined, how the standard design (energy budget) is established, and ending with what is reported on the Performance Compliance Certificate (PERF-1). This Nonresidential Alternative Calculation Methods (ACM) Reference Manual explains how the proposed and standard designs are determined. This document also establishes the procedure for performance calculation, necessary rule sets, reference method for testing Compliance Software accuracy and the minimum reporting requirements.

The 2013 Compliance Software is the simulation and compliance rule implementation software specified by the Energy Commission. The Compliance Manager, called California Building Energy Code Compliance (CBECC), models all features that affect the energy performance of the building. This document establishes the process of creating a building model. Each section describes how a given component, such as a wall or fenestration is modeled for the proposed design, standard design, and ends with what is reported on the Performance Compliance Certificate (PERF-1) for verification by the building enforcement agency.

Keywords: ACM, Alternative Calculation Method, Building Energy Efficiency Standards, California Energy Commission, California Building Energy Code Compliance, CBECC, Performance Compliance Certificate (PERF-1), compliance manager, compliance software, computer compliance, energy budget, Time Dependent Valuation (TDV), energy standards, energy use, prescriptive compliance, performance compliance, design, proposed design, standard design

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Overview of Process

This Manual explains the requirements for approval of Nonresidential Alternative Calculation Methods (also referred to as Compliance Software) used to demonstrate compliance with the 2013 Energy Efficiency Standards for nonresidential buildings (Standards), hotels & motels, and high-rise residential buildings. The approval process for nonresidential Compliance Software is specified in Title 24, Part 1, §10-101 through §10-110 of the California Code of Regulations. Nonresidential Compliance Software is used to demonstrate compliance with the performance approach to the Standards as outlined in Title 24, Part 6, Subchapter 5, §140.1. In this manual the terms "Standards" or "Efficiency Standards" means the 2013 Building Energy Efficiency Standards, Title 24, Part 6 of the California Code of Regulations. The term "compliance" means that a building design in an application for a building permit complies with the Efficiency Standards and meets the requirements described for building designs therein.

The purpose of this Nonresidential Alternative Calculation Method (NACM) Approval Manual is to specify the California Energy Commission approval process for nonresidential Compliance Software. The performance compliance requirements and procedures apply to nonresidential buildings, hotels & motels, and high-rise residential buildings. A separate Residential ACM Approval Manual addresses low-rise residential buildings.

Nonresidential Compliance Software that implements the 2013 Standards must use the energy simulation and compliance rule implementation software specified by the Commission. This open source software, called the Compliance Manager in this document, will be made available at no cost to potential Compliance Software vendors. The ACM tests submitted by the vendor as part of the application package (for Compliance Software certification) will confirm that the Compliance Manager has been successfully integrated into the vendor software.

This chapter presents the general requirements for nonresidential compliance software. Chapter 2 describes the required content of the Compliance Supplement. The certification tests are documented in detail in the Nonresidential ACM Reference Manual, a document that is developed and maintained by the Energy Commission to document the details of the performance compliance modeling implemented in the Compliance Manager software, and to explain the certification tests all Compliance Software must pass. The Nonresidential ACM Reference Manual is approved by the Commission after the adoption of each Building Energy Efficiency Standards update, and updated as necessary to resolve issues identified during the implementation of the performance compliance approach using Compliance Software.

Compliance Software Application Checklist

The following is a list of items that shall be included in an application package for Compliance Software certification by the Commission:

- **Compliance Software Vendor Certification Statement.** A statement from the Compliance Software vendor certifying the reliability and accuracy of the software when used for Standards compliance purposes (see Nonresidential ACM Approval Manual Appendix A).
- **Computer Runs and Summary Sheets.** Copies of the computer runs with content and format as specified in the Nonresidential ACM Reference Manual, including complete input and output files, provided electronically to the Commission in computer readable form. Summary sheets of all the required computer runs also provided electronically to the Commission.
- **Compliance Supplement and User's Manual.** A copy of the Compliance Supplement discussed in Chapter 2. The Compliance Supplement and the Compliance Software User's manual may be combined into the same document.
- **Copy of the Compliance Software.** An executable version of the Compliance Software for the Commission's use during the software certification process.

- **Application Fee.** An application fee of \$1,000.00 (one thousand dollars) is required to cover the costs of evaluating the application. The total fee shall cover the Commission's cost of reviewing and analyzing the application. Within 75 days of receipt of an application, the Commissions will provide an estimate of the total maximum cost to review and analyze the application. After the Commission determines the total costs, if the costs exceed the initial fee, the Commission shall assess an additional fee to cover the total costs. If actual cost is less than the initial or any estimated maximum fee, the Commission shall refund the difference to the applicant.

The application package should be sent to:

Compliance Software Nonresidential Certification
California Energy Commission
1516 Ninth Street, MS-26
Sacramento, CA 95814-5512

Following submittal of the application package, the Commission may request additional information pursuant to Title 24, Part 1, §10-110. This additional information is often necessary due to complexity of Compliance Software. Failure to provide such information in a timely manner may be considered cause for rejection or disapproval of the application. A resubmittal of a rejected or disapproved application will be considered as a new application, including a new application fee.

Types of Approval

This NACM Approval Manual addresses four types of compliance software approval: full approval, streamlined approval, approval by notification, and amendments to full approval.

Full Approval

Full program approval is required when a Compliance Software product has never been previously approved by the Commission or when the Compliance Software vendor makes a change that significantly affects the results. The Commission may also require that all Compliance Software be approved again when the Standards are updated or whenever substantial revisions are made to the Standards or to the approval process. When re-approval is mandated by the Commission, all Compliance Software vendors will be notified of the renewal timetable. Full approval is required for all Compliance Software changes, unless they qualify for the streamlined approval process discussed below.

Streamlined Approval

Changes to the Compliance Manager (CM) completed by the Commission must be incorporated in all certified Compliance Software. This streamlined approval process shall be used whenever the Commission issues a new version of the Compliance Manager. Streamlined approval shall also be used whenever the Commission determines that it is necessary to review and approve changes to Compliance Software made by software vendors, which are identified through the Approval by Written Notification process (see below, Section 1.2.3). For streamlined approval,

- When the Energy Commission makes a * change to the CM, Compliance Software vendors can update their Compliance Software voluntarily upon release of the modified CM software, and must update their Compliance Software within 30 days of the CM release date, unless otherwise stated by the Energy Commission in the CM release notice.
- The Compliance Software vendor prepares an addendum to their Compliance Supplement, when appropriate, describing the change to the Compliance Software.
- The Compliance Software vendor provides the Commission with an updated copy of the Compliance Software
- The Commission responds in 45 days. The Commission response may take several forms. The Commission may approve the updated software, request additional information, refuse to approve the change, or require that the Compliance Software vendor make specific changes to either the Compliance Supplement addendum or the Compliance Software.

- With Commission approval, the vendor may issue new copies of the Compliance Software with the Compliance Supplement addendum and notify Compliance Software users and building officials.

Approval By Written Notification

For all Compliance Software changes not requiring full or streamlined approval, vendors shall provide a written notice to the Commission whenever a new version of the Compliance Software is released. The vendor may release the new Compliance Software version if the Commission has not responded to the written notification within three days. The Commission may at any time gather evidence and determine whether a full or streamlined approval process is required for any Compliance Software change implemented through this written notification process. The vendor must provide the Commission and all building departments the version numbers for all changes made to Compliance Software using this written notification process, such that it is clear which software versions are approved for Standards compliance.

Amendments

Compliance Software approval shall be amended when optional modeling capabilities are added. The vendor shall provide the additional computer runs required for the optional modeling capability. It is not necessary to include computer runs previously submitted. An amendment to approved Compliance Software shall be accompanied by a cover letter explaining the type of amendment requested, and copies of other documents as necessary. All items on the application checklist should be submitted, when applicable. The timetable for approval of amendments is the same as for full approval.

When Approval Is Not Required

Changes that, as determined by the Commission, do not significantly affect compliance with the Standards do not require full, streamlined or notification-type approval. However, the Compliance Software vendor shall notify the Commission and provide the Commission with an updated copy of the program and user manual. Re-approval is required for any Compliance Software change that, as determined by the Commission, significantly affects the compliance results, the format and/or content of compliance forms, or any other change that would significantly affect a building's compliance with the Standards. Any questions regarding applicable approval procedures should be directed to the Commission.

Challenges

Building officials, program users, program vendors, Commission staff or other interested parties may challenge any nonresidential Compliance Software approval. If any interested party believes that a Compliance Software program, an algorithm, or method of calculation used in a Compliance Software, or other aspects of a program provide inaccurate results, the party may challenge the program.

Decertification of Compliance Software

The Commission may *decertify* (rescind approval of) Compliance Software through various means:

- All Compliance Software programs are decertified when the Standards undergo substantial changes, usually occurring with each Standards update.
- Any Compliance Software can be decertified by a letter from the Compliance Software vendor requesting that a particular version (or versions) of the Compliance Software be decertified. The decertification request shall briefly describe the nature of the program errors or "bugs" which justify the need for decertification.
- Any "initiating party" may commence a procedure to decertify Compliance Software product according to the steps outlined below. The intent is to include a means whereby serious program errors, flawed numeric results, improper

forms and/or incorrect program documentation not discovered in the certification process can be verified, and use of the particular Compliance Software version discontinued. In this process, there is ample opportunity for the Commission, the Compliance Software vendor and all interested parties to evaluate any alleged problems with the Compliance Software program.

Following is a description of the process for challenging Compliance Software or initiating a decertification procedure:

1. Any party may initiate a review of Compliance Software's approval by sending a written communication to the Commission's Executive Director. (The Commission may be the initiating party for this type of review by noticing the availability of the same information listed here.)

The initiating party shall:

- a) State the name of the Compliance Software and the program version number(s) which contain the alleged errors;
 - b) Identify concisely the nature of the alleged errors in the Compliance Software which require review;
 - c) Explain why the alleged errors are serious enough in their effect on analyzing buildings for compliance to justify a decertification procedure; and,
 - d) Include appropriate data electronically (in a format agreed to by the the Commission staff) and/or information sufficient to evaluate the alleged errors.
2. The Executive Director shall make a copy or copies of the initial written communication available to the Compliance Software vendor and interested parties within 30 days. Comments from interested parties must be received within 60 days of the acceptance of the original application.
 3. Within 75 days of receipt of the written communication, the Executive Director may request any additional information needed to evaluate the alleged Compliance Software errors from the party who initiated the decertification review process. If the additional information is incomplete, this procedure will be delayed until the initiating party submits complete information.
 4. Within 75 days of receipt of the initial written communication, the Executive Director may convene a workshop to gather additional information from the initiating party, the Compliance Software vendor and interested parties. All parties will have 15 days after the workshop to submit additional information regarding the alleged program errors.
 5. Within 90 days after the Executive Director receives the application or within 30 days after receipt of complete additional information requested of the initiating party, whichever is later, the Executive Director shall either:
 - a) Determine that the Compliance Software need not be decertified; or,
 - b) Submit to the Commission a written recommendation that the Compliance Software be decertified.
 6. If the Commission approves the Compliance Software decertification, it shall take effect 60 days later. During the first 30 days of the 60-day period, the Executive Director shall send out a Notice to Building Officials and Interested Parties announcing the decertification.

All initiating parties have the burden of proof to establish that the review of alleged Compliance Software errors should be granted. The decertification process may be terminated at any time by mutual written consent of the initiating party and the Executive Director.

The Compliance Software vendor may use the 180- to 210-day period outlined here to update the Compliance Software program, get it re-approved by the Commission, and release a revised version that does not have the problems initially brought to the attention of the Commission.

Compliance Software Tests

The Commission will approve the Nonresidential ACM Reference Manual as a guidance document for the implementation of this Nonresidential ACM Approval Manual. The Nonresidential ACM Reference Manual will set forth the specific modeling rules to be used by Compliance Software, The Nonresidential ACM Reference Manual also sets forth the

specific testing and reporting requirements that must be met by Compliance Software to be certified by the Energy Commission for use in the Standards compliance process.

Other technical details guiding the development, performance, and certification of Compliance Software may be added to the NACM Reference Manual, with approval of the Commission, as is necessary to achieve the goals of the Compliance Software approval process.

The Compliance Software vendor may propose alternate tests when the vendor believes that one or more of the standard tests are not appropriate for the Compliance Software. Alternate tests will be evaluated by the Commission and will be accepted if they are considered reasonable. If accepted, the alternate test(s) will be added to the Nonresidential ACM Reference Manual as an addendum and the alternate test(s) will be available for use by all Compliance Software.

Approval of New Exceptional Methods

The Commission may approve new exceptional methods. Exceptional methods are special modeling capabilities or calculation methods necessary to recognize building features that cannot be adequately modeled with existing Compliance Software. When an Exceptional Method is approved, a new optional capabilities test may be approved as part of the process. To be approved for the new optional capability, vendors shall amend their Compliance Software approval.

Even if the Compliance Software already incorporates the Exceptional Method, the vendor shall receive approval to use the Exceptional Method in the compliance process. The Compliance Software vendor shall demonstrate that the Compliance Software automatically uses the correct fixed and restricted inputs for the Exceptional Method and that the standard reports identify the building feature(s) recognized by the Exceptional Method. Additionally, the ACM compliance supplement shall be updated, referencing the use of the new Exceptional Method.

User's Manual including Compliance Supplement

Each Compliance Software vendor is required to publish a User's Manual that includes a Compliance Supplement as a component of the user's manual. The user's manual may also exist in electronic form. The document shall contain sufficient information so that users can develop an understanding of how to run the program and correctly prepare building project information required by the software. The Compliance Supplement shall describe the specific procedures for using the Compliance Software for compliance with the Building Energy Efficiency Standards. This includes instructions for preparing the software inputs and explanations of the fixed and restricted inputs. In addition, the compliance supplement shall include a list of all error messages and information on how to resolve them. The compliance supplement requirement may be met with a user's manual incorporated into the software, however, a printed version of the user's manual that includes all help items must be submitted as part of the Compliance Supplement. Procedures for generating the standard reports and documenting the compliance analysis must also be included in the Compliance Supplement. A sample of a properly documented compliance analysis shall be included. All Compliance Supplements shall be written in a clear and concise manner and with an organization and format that will allow users to quickly locate the topic and understand the instructions. Also, vendors of approved Compliance Software are required to make copies of the Compliance Supplement available to all building departments in California. The following sections describe the information that shall be included in all Compliance supplements.

Energy Commission Approval

This section includes a copy of the official Energy Commission notice of approval for the Compliance Software. The notice may include restrictions or limitations on the use of the Compliance Software. It will also include the date of approval, and may include an expiration date for approval as well. The notice will indicate any restrictions on its use for Standards compliance. The Energy Commission will provide this notice upon completion of evaluation of the Compliance Software application.

Software Capabilities

This section shall discuss the program capabilities, with supporting material explaining, as necessary, how the Compliance Software treats each one. Reference may be made to non-compliance sections of the Compliance Software user's manual for more complete descriptions, if appropriate.

Standard Input/Output Report

Inputs files shall be organized so that data is presented in the same order as that used by the required output reports.

Fixed and Restricted Inputs

Approved Compliance Software shall automatically use the standard fixed and restricted inputs for the standard design run. It shall also default to the standard assumptions for the proposed design run. When alternative fixed and restricted inputs are used for the proposed design run, the Compliance Software shall report this in the Special Features and Modeling Assumptions sections of the standard reports. This section of the Compliance Supplement shall explain the fixed and restricted inputs and how they are invoked in the Compliance Software. This is especially important if the Compliance Software offers the possibility of non-compliance runs which can deviate from the fixed and restricted inputs.

Preparing Basic Input

This section shall cover the basic use of the Compliance Software for compliance. Reference may be made to the Compliance Software user's manual, but this section shall include a complete summary of all inputs and/or commands necessary for Standards compliance.

Special Features and Modeling Assumptions

This section shall explain the use of the Special Features and Modeling Assumptions listing to highlight the importance of verifying the special features and the aspects of those features that were modeled to achieve compliance.

Field Verification

This section shall explain the use of the Field Verification and Diagnostic Testing listing to highlight the special features that require diagnostic testing by licensed or approved professional (see Part 1 Section 10-103 (a) 1 for compliance documentation) to assure proper installation and verification. This section may rely on the information provided in Nonresidential Appendices NA1 through 9, and other sections of this manual, or may refer to other Commission documents.

Checklist for Compliance Submittal

This section shall contain a concise checklist of all items that will be included in a compliance submittal to a building official using the Compliance Software.

Sample Compliance Documentation

This section shall include a complete set of compliance documentation for a sample building. The example shall include all documentation and standard reports that would normally be submitted to a building department. This example will serve as a model to Compliance Software users and building officials of what a proper compliance submittal should look like.

Compliance Statement

The following statement shall appear within the first several pages of the Supplement:

[Compliance Software Name] may be used to show compliance with California's 2013 Building Energy Efficiency Standards.

Related Publications

The User's Manual shall refer users to the following related Energy Commission publications and where to obtain them:

2013 Building Energy Efficiency Standards (publication number unknown at time of printing)

2013 Nonresidential Alternate Calculation Method Reference Manual (publication number unknown at time of printing)

2013 Nonresidential Compliance Manual (publication number unknown at time of printing)

- 2010 Appliance Efficiency Regulations (CEC-400-2010-012.pdf)
- Reference Nonresidential Appendices (publication number unknown at time of printing)

- Reference Joint Appendices (publication number unknown at time of printing).