

1. Overview of Process

This Manual explains the requirements for approval of Alternative Calculation Methods (ACMs) used to demonstrate compliance with the Energy Efficiency Standards for nonresidential buildings, hotels & motels, and high-rise residential buildings. The approval process for nonresidential Alternative Calculation Methods (ACMs) is specified in Title 24, Part 1, Chapter 10, Sections 101-110 of the California Code of Regulations. Nonresidential Alternative Calculation Methods (ACMs) are used in the performance approach to demonstrate compliance with the Energy Efficiency Standards for nonresidential buildings as outlined in Title 24, Part 6, Subchapter 5, Section 141. The Energy Commission develops and implements the Energy Efficiency Standards.

The purpose and policy of this ACM Approval Manual is to specify the California Energy Commission approval process for nonresidential ACMs and to define the assumptions and procedures of the reference method against which ACMs will be evaluated. The performance compliance requirements and procedures apply to nonresidential buildings, hotels & motels, and high-rise residential buildings. A separate ACM Approval Manual addresses low-rise residential buildings. The procedures and processes described in this manual are designed to preserve the integrity of the performance compliance process.

The reference procedures and method described in this manual establish the basis of comparison for all ACMs. The approval process ensures that a minimum level of energy efficiency is achieved regardless of the Alternative Calculation Method (ACM) used. This is accomplished

- by having candidate ACMs pass a series of Reference Method comparison tests,
- by specifying input which may be varied in the compliance process for credit and which inputs are fixed or restricted,
- by defining standard reports output requirements, and
- by ACM vendor-certification to the requirements in this manual.

The reference calculation engine includes reference procedures described in this manual and the *reference computer program*, which is *version 110 of the DOE 2.1E* computer program.

Optional capabilities are a special class of capabilities and user inputs that are not required of all ACMs but may be included at the option of the vendor. The optional capabilities included in this manual have minimal testing requirements. Additional optional capabilities may be proposed by vendors. For both cases, the Commission reserves the right to disapprove the certification application for a specific optional capability if there is not compelling evidence presented in the public process showing that the optional capability is sufficiently accurate and suitable to be used for compliance with the Standards. In addition, energy efficiency measures modeled by optional capabilities shall be capable of being verified by local enforcement agencies.

The Commission's purpose in approving additional optional capabilities is to accommodate new technologies which have only begun to penetrate the market and new modeling algorithms. Optional capabilities which evaluate measures already in relatively common use shall have their standard design for the measure based on the common construction practice (or the typical base situation) for that measure since common practice is the inherent basis of the standards for all measures not explicitly regulated. For example, the Commission has no interest in an optional capability that evaluates the energy impacts of dirt on windows unless a new technology produces substantial changes in this aspect of a building relative to buildings without this technology. The burden of proof that an optional capability should be approved lies with the applicant and will be influenced by the ability of the reference computer program, DOE 2.1E to model the optional capability.

Companion documents which are helpful to prepare an ACM for certification include the latest editions of the following Commission publications:

- *Energy Efficiency Standards*
- *Appliance Efficiency Regulations*

- *Nonresidential Manual*
- *Residential Alternative Calculation Manual (ACM) Manual*

In this manual the term "Standards" means the 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 "Standards" and meets the requirements described for building designs therein.

- *Compliance Options Approval Manual for the Building Energy Efficiency Standards*

There are a few special terms that are used in this Manual. The Commission **approves** the use of an ACM for compliance. Commission approval means that the Commission accepts the applicant's certification that an ACM meets the requirements of this Manual. The proponent of a candidate ACM is referred to as a **vendor**. The vendor shall follow the procedure described in this document to publicly certify to the Commission that the ACM meets the criteria in this document for:

- *Accuracy* and *reliability* when compared to the DOE-2.1E reference program; and
- *Suitability* in terms of the accurate calculation of the correct energy budget, the printing of standardized forms, and the documentation on how the program demonstrates compliance.

In addition to explicit and technical criteria, Commission approval will also depend upon the Commission's evaluation of:

- *Enforceability* in terms of reasonably simple, reliable, and rapid methods of verifying compliance and application of energy efficiency features modeled by the ACM and the inputs used to characterize those features by the ACM users.
- *Dependability* of the installation and energy savings of features modeled by the ACM. The Commission will evaluate the probability of the measure actually being installed and remaining functional. The Commission shall also determine that the energy impacts of the features that the ACM is capable of modeling will be reasonably accurately reflected in real building applications of those features. In particular, it is important that the ACM does not encourage the replacement of actual energy savings with theoretical energy savings due to tradeoffs allowed by an ACM.

For the vendor, the process of receiving approval of an ACM includes preparing an application, working with the Commission staff to answer questions from either Commission staff or the public, and providing any necessary additional information regarding the application. The application includes the four basic elements outlined below. The Commission staff evaluates the ACM based on the completeness of the application and its overall responsiveness to staff and public comment.

The four basic requirements for approval include:

1. Required capabilities:

- The ACM shall have all the required input capabilities explained in Chapter 2.
 - Alternative Calculation Methods (ACMs) may be approved for additional optional capabilities such as those described in Chapter 3.

2. Accuracy of simulation:

- The ACM shall demonstrate acceptable levels of accuracy by performing and passing the required certification tests discussed in Chapter 5.
- The ACM vendor performs the certification tests in Chapter 5. The vendor conducts the specified tests, evaluates the results and certifies in writing that the ACM passes the tests. The Commission will perform spot checks and may require additional tests to verify that the proposed ACM is appropriate for compliance purposes.
- When energy analysis techniques are compared, two potential sources of discrepancies are the differences in user interpretation when entering the building specifications, and the differences in the ACM's algorithms (mathematical models) for estimating energy use. The approval tests minimize

differences in interpretation by providing explicit detailed descriptions of the test buildings that must be analyzed. For differences in the Alternative Calculation Method's (ACM's) algorithms, the Commission allows algorithms that yield equivalent results.

3. User's Manual or Help System:

- The vendor shall develop a user's manual and/or help system that meets the specifications in Chapter 4.

4. Program support:

- The vendor shall provide ongoing user and building department support as described in Chapter 6.

The Commission may hold one or more workshops with public review and vendor participation to allow for public review of the vendor's application. Such workshops may identify problems or discrepancies that may necessitate revisions to the application.

Commission approval of Alternative Calculation Methods (ACMs) is intended to provide flexibility in complying with the Standards. However, in achieving this flexibility, the ACM shall not degrade the standards or evade the intent of the Standards to achieve a particular level of energy efficiency. The vendor has the burden of proof to demonstrate the accuracy and reliability of the ACM relative to the reference method and to demonstrate the conformance of the ACM to the requirements of this manual.

1.1 Application Checklist

The following items shall be included in an application package submitted to the Commission for ACM approval:

- **ACM Vendor Certification Statement.** A copy of the statement contained in Appendix NA, signed by the ACM vendor, certifying that the ACM meets all Commission requirements, including accuracy and reliability when used to demonstrate compliance with the energy standards.
- **Computer Runs.** Copies of the computer runs specified in Chapter 5 of this manual on machine readable form as specified in Chapter 5 to enable verification of the runs.
- **Compliance Supplement and User's Manual.** The vendor shall submit a complete copy of their ACM user's manual, including material on the use of the ACM for compliance purposes.
- **Copy of the ACM and Weather Data.** A machine readable copy of the ACM for random verification of compliance analyses. The vendor shall provide weather data for all 16 climate zones.
- **TDV Factor Documentation.** The ACM shall be able to apply the TDV multipliers described in ACM Joint Appendix III.
- **Application Fee.** The vendor shall provide an application fee of \$1,000.00 (one thousand dollars) as authorized by Section 25402.1(b) of the Public Resources Code, made out to the "State of California" to cover costs of evaluating the application and to defray reproduction costs.

A cover letter acknowledging the shipment of the completed application package should be sent to:

Executive Director
California Energy Commission
1516 Ninth Street, MS-39
Sacramento, CA 95814-5512

Two copies of the full application package should be sent to:

ACM 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, Section 10-110. This additional information is often necessary due to complexity of many Alternative Calculation Methods (ACMs). 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 a new application, including a new application fee.

1.2 Types of Approval

This Manual addresses two types of ACM approval: full program approval (including amendments to programs that require approval), and approval of new program features and updates.

If ACM vendors make a change to their programs as described in 1.2.1 or 1.2.2, the Commission shall again approve the program. Additionally, any ACM program change that affects the energy use calculations for compliance, the modeling capabilities for compliance, the format and/or content of compliance forms, or any other change which would affect a building's compliance with the Energy Efficiency Standards requires another approval.

Changes that do not affect compliance with the standards such as program changes to the user interface may follow a simplified or streamlined procedure for approval of the changes. To comply with this simpler process, the ACM vendor shall certify to the Commission that the new program features do not affect the results of any calculations performed by the program, shall notify the Commission of all changes and shall provide the Commission with one updated copy of the program and User's Manual. Examples of such changes include fixing logical errors in computer program code that do not affect the numerical results (bug fixes) and new interfaces.

1.2.1 Full Approval & Re-Approval of Alternative Calculations Methods (ACMs)

The Commission requires program approval when a candidate ACM has never been previously approved by the Commission, when the ACM vendor makes changes to the program algorithms, or when any other change occurs that in any way affects the compliance results. The Commission may also require that all currently approved Alternative Calculation Methods (ACMs) be approved again whenever substantial revisions are made to the Standards or to the Commission's approval process.

The Commission may change the approval process and require that all Alternative Calculation Methods (ACMs) be approved again for several reasons including:

- a) If the standards undergo a major revision that alters the basic compliance process, then Alternative Calculation Methods (ACMs) would have to be updated and re-approved for the new process.
- b) If new analytic capabilities come into widespread use, then the Commission may declare them to be required ACM capabilities, and may require all ACM vendors to update their programs and submit them for re-approval.

When re-approval is necessary, the Commission will notify all ACM vendors of the timetable for renewal. There will also be a revised *ACM Approval Manual* published with complete instructions for re-approval.

An ACM program must be re-approved for new optional modeling capabilities when the vendor adds those optional capabilities. The vendor shall provide a list of the new optional capabilities and demonstrate that those capabilities are documented in revised user documentation. This may not include computer runs previously submitted.

Re-approval shall be accompanied by a cover letter explaining the type of amendment(s) requested and copies of other documents as necessary. The timetable for re-approval of amendments is the same as for full program approval.

1.2.2 Approval of New Features & Updates

Certain types of changes may be made to previously approved nonresidential Alternative Calculation Methods (ACMs) through a streamlined procedure, including implementing a computer program on a new machine and changing executable program code that does not affect the results.

Modifications to previously approved Alternative Calculation Methods (ACMs) including new features and program updates are subject to the following procedure:

- The ACM vendor shall prepare an addendum to the Compliance Supplement or ACM user's manual, when new features or updates affect the outcome or energy efficiency measure choices, describing the change to the ACM. If the change is a new modeling capability, the addendum shall include instructions for using the new modeling capability for compliance.
- The ACM vendor shall notify the Commission by letter of the change that has been made to the ACM. The letter shall describe in detail the nature of the change and why it is being made. The notification letter shall be included in the revised Compliance Supplement or ACM user's manual.
- The ACM vendor shall provide the Commission with an updated copy of the ACM and include any new forms created by the ACM (or modifications in the standard reports).
- The Commission will respond within 45 days. The Commission may approve the change, request additional information, refuse to approve the change or require that the ACM vendor make specific changes to either the Compliance Supplement addendum or the ACM program itself.

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

1.3 Challenges

Building officials, program users, program vendors, Commission staff or other interested parties may challenge any nonresidential ACM approval. If any interested party believes that a compliance program, an algorithm or method of calculation used in a compliance program, a particular capability or other aspect of a program provides inaccurate results or results which do not conform to the criteria described in Section 5.1.4 the party may initiate the challenge of the program. (Please see Section 1.5 Decertification of Alternative Calculation Methods (ACMs) for a description of the process for a challenge.)

1.4 Alternative ACM Tests

Chapter 5 of this Manual contains a series of tests to verify that Alternative Calculation Methods (ACMs) accurately demonstrate compliance. An ACM vendor may propose alternate tests when the vendor believes that one or more of the standard tests are not appropriate for the ACM. The Commission will evaluate the alternate tests and will accept them if they are found to reflect acceptable engineering techniques.

If alternate tests are accepted by the Commission, the tests will be available for use by all Alternative Calculation Methods (ACMs). An alternate test will coexist with the standard test presented in this Manual until the Manual is revised. When a new version of this Manual is produced, the alternative test may be substituted for the current test or may continue to coexist with the original test.

1.5 Decertification of Alternative Calculation Methods (ACMs)

The Commission may *decertify* (rescind approval of) an alternative calculation method through the following means:

- All ACMs are decertified when the Standards undergo substantial changes which usually occur every three years.

- Any ACM can be decertified by a letter from the ACM vendor requesting that a particular version (or versions) of the ACM 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 an ACM according to the steps outlined below. The intent is to include a means whereby unfavorable comparisons with the reference method, 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 ACM version discontinued. In this process, there is ample opportunity for the Commission, the ACM vendor and all interested parties to evaluate any alleged problems with the ACM program.

NOTE 1: The primary rationale for a challenge is unfavorable comparison with the reference method which means that for some particular building design with its set of energy efficiency measures, the ACM fails to meet the criteria used for testing ACMs described in Section 5.1.4.

NOTE 2: Flawed numeric results where the ACM meets the test criteria used in Section 5.1.4. In particular when an ACM indicates the failure of a building to comply by a significant margin even though the reference method indicates that the building complies, i.e., the reference method has a proposed design building energy budget less than or equal to the standard design building energy budget.

An ACM is allowed to have inputs for energy efficiency measures that it cannot model. The proper method for an ACM to accommodate such inputs and features is for the ACM to automatically ensure compliance failure by a significant margin whenever that feature's inputs are entered by the user. In such cases numeric results are not directly relevant as long as the building fails to comply by an adequate margin. Lighting and receptacle/process loads however shall be within the numerically acceptable ranges.

Following is a description of the process for challenging an ACM or initiating a decertification procedure:

1. Any party may initiate a review of an ACM'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 ACM and the program version number(s) which contain the alleged errors;
 - b) Identify concisely the nature of the alleged errors in the ACM 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 on IBM PC compatible floppy diskettes 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 ACM vendor and interested parties within 30 days.
 3. Within 75 days of receipt of the written communication, the Executive Director may request any additional information needed to evaluate the alleged ACM 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 ACM 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 ACM need not be decertified; or,

- b) Submit to the Commission a written recommendation that the ACM be decertified.
- 6. The initial written communication, all other relevant written materials, and the Executive Director's recommendation shall be placed on the consent calendar and considered at the next business meeting after submission of the recommendation. The matter may be removed from the consent calendar at the request of one of the Commissioners.
- 7. If the Commission approves the ACM 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 ACM 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.

As a practical matter, the ACM vendor may use the 180- to 210-day period outlined here to update the ACM 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. Sometimes the ACM vendor may wish to be the initiating party to ensure that a faulty program version is taken off the market.