

DOCKETED

Docket Number:	22-BSTD-02
Project Title:	2022 Energy Code Compliance Software && Supporting Documents
TN #:	242623
Document Title:	Integrated Environmental Solutions Limited Comments
Description:	Integrated Environmental Solution Limited Comments on (Draft) Nonresidential and Multifamily Alternative Calculation Method Reference Manual
Filer:	System
Organization:	Integrated Environmental Solutions Limited
Submitter Role:	Public
Submission Date:	4/11/2022 10:15:57 AM
Docketed Date:	4/11/2022

Comment Received From: Intergrated Environmental Solution Limited
Submitted On: 4/11/2022
Docket Number: 22-BSTD-02

**on (Draft) Nonresidential and Multifamily Alternative Calculation
Method Reference Manual**

Additional submitted attachment is included below.



By email to docket@energy.ca.gov.

11 April 2022

California Energy Commission, Building Standards Office
1516 Ninth Street
Sacramento, CA 95814

2022 Energy Code Compliance Software and Supporting Documents
Docket: 22-BSTD-02

Building Standards Office,

We, Integrated Environmental Solutions Limited, would like to thank you for working with us during the Title 24-2013, Title 24-2016, Title 24-2019 and now the Title 24-2022 code cycles. We are grateful for our partnership and the support the CEC's Building Standards Office team has provided to us.

I am writing today to make public comments regarding the “**(Draft) Nonresidential And Multifamily Alternative Calculation Method Reference Manual**” (NMACM) for the Title 24-2022 Part 6 and inform you of a number of significant policy issues with the compliance software process that with some enhancement would greatly streamline not only IES's but any future compliance software development team. These issues are outlined with suggested changes as an appendix to this letter.

It is IES's intention to continue working with the CEC on *all* future Title 24 code-cycles and we are appreciative of the CEC's willingness to accommodate feedback and for the ongoing dialogue in seeking to streamline certification of compliance software.

Please contact me directly if you have any questions.

Sincerely,

A handwritten signature in black ink, appearing to be "Dr. Craig Wheatley", is written over a horizontal line.

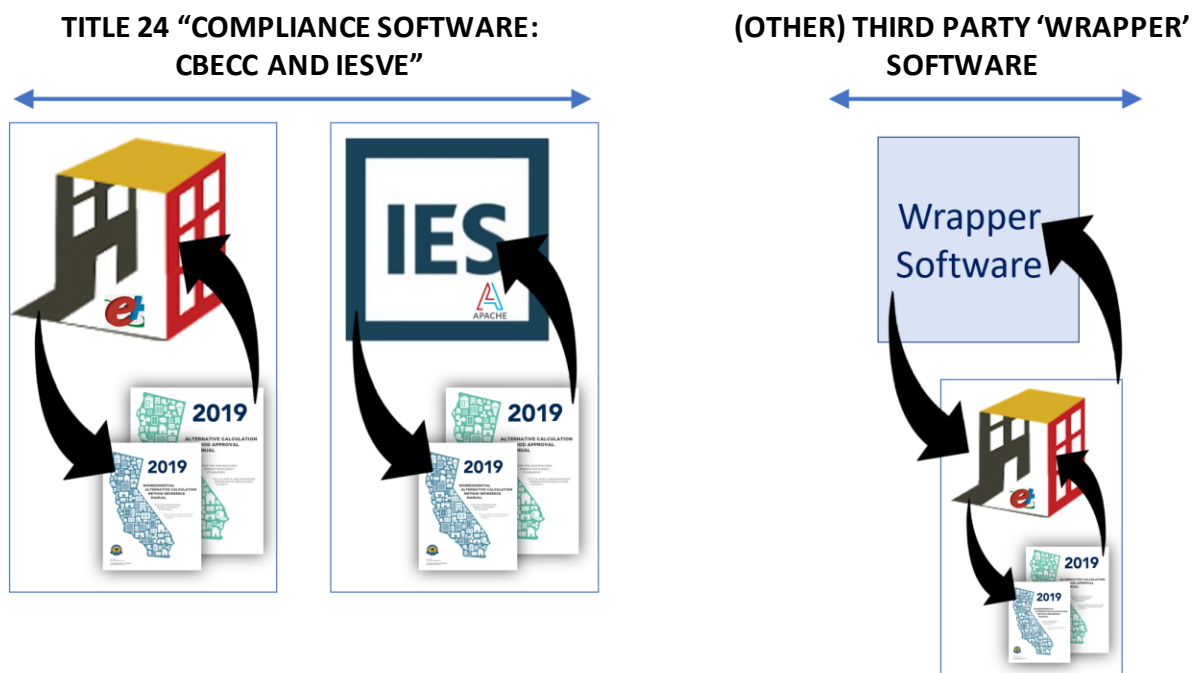
Dr. Craig Wheatley
Chief Technology Officer, IES Ltd.

During the 2019 code cycle, IES became the first developer of Compliance Software to “use *alternative energy simulation engines for nonresidential modeling*”, as per **Section 1.1.5** of the NACM Approval Manual, rather than develop a wrapper to CBECC, for Title 24 performance-based compliance. During this process, IES have noted issues and subsequently recorded updates that would benefit all compliance software for the 2022 code cycle and all future code cycles.

Consideration of IES's position as developers of Compliance Software (IESVE) is central to any of the proposed solutions, be they updates to the ACM or implementation strategies around the ACM, namely software updates and accreditation procedures.

1 Request a Definition of “Compliance Software” in the ACM

There is ambiguity in the ACM between Compliance Software versus Software Wrappers. As such, the ACM requires a clear definition of “Compliance Software”.



Solution 1.1:

IES suggest that the following sentence is added to **Section 1.1.4** (Compliance Software) of the ACM Approval Manual:

“Compliance Software is defined as a software that complies with Section 1.1.4 of the ACM Approval Manual.”

This definition could also be echoed in the NACM too, along with a clear definition of a “Software Wrapper to Compliance Software”.

Solution 1.2:

Use the term “Compliance Software” throughout the Nonresidential and Multifamily Alternative Calculation Method Reference Manual (NMACM) with an appropriate definition. The NMACM should “*explain how the proposed and standard designs are determined*”; and not act as a user-guide to any specific Compliance Software tool. Any specific reference to any single Compliance Software should be removed.

For example:

- Section 6.9.2.7 (Evaporative Cooling) names the “**CSE Engine**”. Please remove this or indicate that there is more than one Compliance Software.
- Section 6.10.6.6 (Fenestration) names the “**California Simulation Engine (CSE)**”. Please remove this or indicate that there is more than one Compliance Software.
- Section 1.3 (Scope) names “**CBECC**”. Please replace with “Compliance Software”.
- Section 5.4.2 (Infiltration Data) names “**CBECC**”. Please replace with “Compliance Software”.
- Section 6.5.1 (Photovoltaics), 6.5.2 names “**PVWatts**”. Please replace with “Compliance Software” and remove reference of “See Appendix F. for more information”.
- Various sections: “software” should be replaced with “Compliance Software”. For example, “*The software simulates the dwelling unit being precooled ...*”. It should state “The Compliance Software is to simulate the dwelling unit *being precooled ...*”.

2 Involve “Compliance Software” Stakeholders earlier in all future NMACM Code-Cycles and mid-cycle Updates

By the Energy Commission’s own admission, Compliance Software requires a close unique connection to the ACM, so that the Compliance Software has time to be ready for day one of the associated code cycle. However not all Compliance Software are given the same opportunity to be ready for day one of the associated code cycle.

Compliance Software vendors like IES will need to develop features from first principles and work through the entire development cycle for all updates. This is vastly different to that of a Compliance Software ‘Wrapper’. This development cycle is required for all updates, and includes the following tasks, **highlighted** are the tasks not required by Software Wrappers, further **highlighted** are the areas of significant additional effort:

1. Research
2. Specification
3. Software Development (Algorithmic)
4. Software Development (Rules Interpretation)
5. Software Development (Interface)
6. Product Testing

7. QA & Rule Evaluation
8. User-guide creation
9. Create +200 CEC models for Ruleset and Sensitivity tests
10. Document 200+ model set results in CEC Spreadsheets
11. Submit software for Certification
12. Public beta-testing
13. Software Release

As of 28 March 2022, we as developers of Compliance Software are **only** permitted to begin this process and **then** be complete in ~6 months in order to submit software on time for the 3-month Compliance Software validation period. However, CBECC are given the opportunity to be almost complete with this process by the same date, due to selective access to the draft NACM while it is being drafted. There should be equivalence between all Compliance Software providers.

The current approach taken by the CEC results in the ACM remaining unpublished for all vendors of Compliance Software, finalized or in draft form, until a certified copy of the other Compliance Software, CBECC, is released to the public. This is hugely problematic for other developers of Compliance Software, like IES, as we cannot start work anywhere near as early as required.

In California, we appreciate that a consultation process exists where the public and Compliance Software vendors are kept abreast of updates. At IES, we work with governments worldwide and some of the best rollouts we see include a private FTP site, available to all Compliance Software vendors where all updated information is made available on an ongoing basis. This should be achieved by publishing draft updates as a bundle, which includes the government funded software and all associated documentation including the ACM equivalent to all relevant parties.

The [Warren Alquist Act, updated 2021](#) has stated that the Energy Commission's duties include to ***“Establish a formal process for certification of compliance options for new products, materials, and calculation methods which provides for adequate technical and public review to ensure accurate, equitable, and timely evaluation of certification applications.”*** With respect, we do not feel that the Energy Commission is fulfilling this duty of equity to all Compliance Software vendors who submit certification applications and our suggestions in this document outline the requirements.

Obviously before the Compliance Software is certified, the associated documentation is in draft form and it is understood by all parties that changes are likely to take place before the final documents are published. Any areas to be updated are highlighted in the draft. However, these draft documents are invaluable to IES to start the development process in good time. IES suggests the following:

Solution 2.1:

- All documentation pertaining to the development of compliant software, including the ACM, is published in draft form as soon as its available.

- To maintain equivalence between Compliance Software developers, public, private or otherwise, all should be given the same opportunities to have Compliance Software ready for the same date e.g. access to all associated draft information, meetings with the CEC etc.
- As the NMACM Reference Manual for the 2022 code cycle only became available to third party vendors nine months before fully compliant software is meant to be available, we request that certified Title 24-2019 software remain as fully certified three months into the 2022 code-cycle.
 - Developers of Compliance Software should not be penalized for delays outside of their control.

3 Mid Cycle Development

From time to time mid cycle updates require changes to the software. The same issues apply here as outlined in Section (2), although they tend not to be as acute as with a full code cycle update.

Solution 3.1:

- All documentation pertaining to the development of compliant software, including the ACM, is published in draft form as soon as its available.
- To maintain equivalence between Compliance Software developers, public, private or otherwise, all should be given the same opportunities to have Compliance Software ready for the same date e.g. access to all associated draft information, meetings with the CEC etc.
- As the NMACM Reference Manual for the 2022 code cycle only became available to third party vendors nine months before fully compliant software is meant to be available, we request that certified Title 24-2019 software remain as fully certified three months into the 2022 code-cycle.
 - Developers of Compliance Software should not be penalized for delays outside of their control.

4 Accreditation

The accreditation procedure is fundamental to the production of compliant software and plays a major part in the development process for Compliance Software developers, like IES. During the 2019 code cycle, IES went through two rounds of accreditation, both full and streamlined, and have the following comments on how this could be improved.

4.1 Timing

Currently for mid cycle streamlined accreditation there is a 45-day turnaround from publication to be fully recertified. As certified Compliance Software vendors that are compliant with Section 1.1.5 (Alternative Nonresidential Energy Simulation Engines) of the ACM Approval Manual, IES is completely independent of CBECC, this means that the full development cycle process as outlined previously has to take place in the space of 45 days. However, other Compliance Software developers (e.g. of CBECC) likely received a 12-month notification of this required ACM update. Even for the smallest update to the ACM, a 45-day turnaround is a hugely challenging time frame and needs to be revised in the context for all Compliance Software developers.

Solution 4.1:

- Compliance Software developers (e.g. IES, NORESKO, etc.) are made aware of any updates as soon as they become relevant and all details are passed to **ALL** Compliance Software developers in good time
- Compliance Software developers (e.g. IES, NORESKO, etc.) are continuously kept abreast of any progress so that they can start to add any new features into the Compliance Software.
- Replace the 45-day period with a 120-day period.

4.2 Technical

The underlying neutralization principle of the sensitivity tests is fair, in that the Compliance Software vendor is comparing a variation to their own baseline and it's this variation that is compared to CBECC, within a tolerance. The problem is the part of this test that senses the direction of movement from the baseline, most specifically when you have very small variations. We have seen in multiple situations where CBECC is less than 0.1% above the baseline and IESVE is less than 0.1% below and because the variation is moving in the opposite direction, it fails, even though the margin is extremely small and negligible.

Solution 4.2:

- Expand the variation tolerance to be in line with the standard tolerance of 0.5% used elsewhere in the TDV calculation
- Allow the tolerance to be irrespective of the 'direction' of variation

As described previously the underlying neutralization principle (compliance software being compared to its own baseline) levels the playing field and makes the tests fair. However, this is not the case with the unmet load hour (UMLH) part of these tests. In this case the compliance software is being compared directly to CBECC and this nullifies the fairness of the tests overall.

Solution 4.3:

- The UMLH check within the sensitivity tests follows the same rules as all other aspects of these tests i.e. the variant model is compared to its own baseline

5 Better support for queries addressed to CEC Contractors (*currently NORESKO + sub-contractors*)

During the development cycle issues and questions can arise that can only be answered by the CEC contractors or subcontractors. A quick response to these questions is essential to ensure that the development is not delayed and that software is released in a timely manner.

Solution 5.1:

- Agree response times to Vendor queries based on urgency / severity
 - i.e. within 24 hours if marked urgent
 - within 3 working days if otherwise
- List of contacts with their noted areas of expertise, so we can ask the right person.
- The 2022 NMACM seems to be referencing a new engine: CSE. Please include access to pre-recorded video material and associated documentation from the engine developers to help explain the underlying principles of how the 'Under the Hood' engine operates and include any unknown/unique nuances. Note in the CEC's "Notice of Public Comment Period" document, a reference is made to the "Link to introduction video". However, this text is not hyperlinked to a video and no link is provided.

6 PRF-01 Report

In order to ensure successful and timely development of the PRF-01 report it is critical that proper table documentation is provided.

Solution 6.1:

- Any release of CBECC, full or Beta, should be withheld until a full and complete set of table documentation accompanies the software.
- More care in documentation to make sure all tags are written out.
- Indicate which tags apply to which field.
- More detailed info in the Tables documentation. Keep the SDD in sync to make sure further information can be obtained from it
- Make sure each example CBECC model provided displays every table required. Some tables have not been present in any of the models provided
- Provide a fully documented list of all error messages and a full documented list of debug info/general feedback for the report generator when sharing with other Compliance Software
- Provide example XML files (without the requirement of Compliance Software developers needing to create XML in CBECC) with only the information required to generate the report
- Provide documentation that describes the report generation XML schema

7 NMACM Reference Manual

7.1 Unmet Load Hours

Section 5.6.3 of the NMACM Reference Manual and other sections of the Manual refers to a situation whereby an energy analyst and design team may need to increase the size of equipment so that unmet load hours (UMLHs) are less than 150. In some scenarios, increasing capacities, again and again, will not result in UMLHs less than 150. In some scenarios, the capacity is large enough but an UMLH occurs during an hour of building opening, if say the building is closed during a longer holiday weekend and a 3-hour start-up doesn't quite achieve the target temperature on time.

IES have drafted extensive [technical content](#) related to UMLHs in various energy code compliance standards and are convinced that the 150 hour tolerance is too tight and it is fundamentally impractical, especially when an UMLH is mirrored on both Proposed & Standard Design buildings. IES suggest that Title 24 matches ASHRAE 90.1 in this regard:

Solution 7.1.1:

- Align the Title 24 UMLHs with ASHRAE Standard 90.1-2019, Section G3.1.2.3: *“Unmet load hours for the proposed design or baseline building design shall not exceed **300** (of the 8760 hours simulated). Alternatively, unmet load hours exceeding these limits shall be permitted to be accepted upon approval of the rating authority, provided that sufficient justification is given indicating that the accuracy of the simulation is not significantly compromised by these unmet loads...”*

Section 2.4 of the NMACM Reference Manual refers to a “centering” of a Throttling range for establishing unmet load hours. There is a problematic statement: *“The throttling range is fixed at 2°F for simulating both the standard design and proposed design”* which is too tight of a throttle range and is not aligned with ASHRAE's recommendation for throttling. IES suggest that Title 24 matches ASHRAE 90.1 in this regard:

Solution 7.1.2:

- Remove the sentence about a 2F throttling range and replace it with ASHRAE's recommendation; copied from ASHRAE Standard 90.1-2016 (Table G3.1) below: *“**Temperature and Humidity Schedules.** Temperature and humidity control set points and schedules as well as temperature control throttling range shall be the same for proposed design and baseline building design.”*

Section 2.2.1 defines “An HVAC zone is a physical space within the building that has a thermostat and zonal system for maintaining **thermal comfort**”. However, thermal comfort of a building occupant does not solely rely on maintenance of air temperature, which is implied in the Title 24 UMLH limit test of 150 hours. See “ASHRAE Standard 55 – 2017: Thermal Environmental Conditions for Human Occupancy” for more information. IES suggests that an approach similar to that taken in ASHRAE 90.1 is used i.e. “where set points and schedules for HVAC systems that automatically provide occupant thermal comfort via means other than directly controlling the air dry-bulb and wet-bulb temperature may be allowed to differ, provided that equivalent levels of occupant thermal comfort are demonstrated via the methodology in ASHRAE Standard 55.”

Solution 7.1.3:

- If UMLHs are exceeded, that does not imply a measure of human discomfort. A ‘pass’ scenario should be permitted assuming an associated ASHRAE Standard 55 analysis has been carried out.
 - Solutions could include:
 - 1 Dynamic clothing (CLO) – if too warm, occupant removes a sweater!
 - 2 Elevated Air Speed – if too warm, increase the air speed by way of local fans (ceiling or desk), or open windows.
 - 3 Apply a ‘mitigation’ control if the occupant is receiving direct short-wave radiation. The control would be a lowering of a window blind.

7.2 Air Leakage, Infiltration and Natural Ventilation

Section 6.7.1 is recommending an Infiltration rate of 7 ACH for multi-family buildings. This appears to be approximately 25 times larger than we would expect in any commercial/MF/residential building when compared to a similar analysis using ASHRAE Standard 90.1.

Solution 7.2.1:

- Align the NMACM infiltration rates with current construction practices.

Section 6.7.2 states that “Multifamily buildings that have floors between dwelling units must define each floor as a separate zone, or each dwelling unit as a separate zone.”. We agree with the premise of this but this creates a conflict with Section 2.3.1 (Required Zone Modeling Capabilities), which states that “Compliance software may use zone multipliers for identical zones”. As previously documented during Title-24 2019 accreditation submissions, the use of ‘Floor Multipliers’ should not be used in any compliance modeling software due to non-alignment with ASHRAE 140. No two zones are **ever** truly “identical”.

Solution 7.2.2:

- Remove the reference to use of zone multipliers in Section 2.3.1

Section 6.10.3.7 on “Natural Ventilation” seems to imply that this building design strategy is only a cooling-energy design strategy and should be controlled as such, by cooling setpoints. However, this is also a “Ventilation” design strategy and can help to reduce fan energy. It is also a healthy-building design-strategy for building occupants and can be controlled by CO2 when spaces become densely occupied.

Solution 7.2.1:

- Review or remove the narrative for Natural Ventilation and the associated restrictive “cooling mode” control.

7.3 Evaporative Cooling

Section 6.9.2.7 provides a lot of details regarding limited capability of modeling evaporative cooling technology in the public-domain software and suggests a workaround to assigning high efficiency “split-system cooling” instead. This suggested workaround should really only be detailed in that particular software tool’s user guide, and not in the NMACM, which is supposed to be for all Compliance Software.

Solution 7.3:

- Rewrite the “Proposed Design” section so that evaporative cooling is to be modeled as evaporative cooling.

7.4 Thermal Mass

Sections 6.10.6.4 and 6.10.6.10 states that the Proposed Design “*may be modeled with the default 20 percent exposed mass/80 percent covered mass or with actual mass areas modeled as separate covered and exposed mass surfaces.*” However, the Standard Design “*is assumed to be 20 percent exposed slab and 80 percent slab covered by carpet or casework*” with no option to copy a like-for-like of thermal mass from the Proposed Design to the Standard Design, thus unfairly capturing the effects of thermal mass.

Solution 7.4:

- Allow the Standard Design building to copy the slab-to-carpet/casework ratio from the Proposed Design building to the Standard Design building in any 80/20, 50/50, 20/80, 100/0 ratio as created by the user on a room-by-room basis.

7.5 Exterior Shading

Sections 6.10.6.9 and 6.13.4.6 states that “*Exterior shading is modeled as an additional glazing system layer using the ASHRAE Window Attachment (ASHWAT) calculation.*”

Solution 7.4:

- Remove the sentence “*Exterior shading is modeled as an additional glazing system layer using the ASHRAE Window Attachment (ASHWAT) calculation.*”. This sentence is better-suited to the associated user-guide of the public-domain software tool that it refers to.
- Replace the sentence with “Exterior shading is to be modeled as per the architectural design – please refer to software documentation for capabilities and limitations”; thus allowing credit for good architectural design.

7.6 Solar Thermal Water Heating Credit

Sections 6.12.4 states that the “*solar fraction (SF) is determined using the CEC Solar Water Heating Calculator*”. It is unclear if this input is for 3-D model geometry-based Compliance Software.

Solution 7.6:

- Please clarify if this is an input requirement for ‘Simplified Geometry’ Compliance Software or for all Compliance Software.