IBPSA-USA CERTIFICATION COMMITTEE - MODELER WORKING GROUP

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MODELER QUALIFICATION FRAMEWORK SEED DOCUMENTATION

1 Purpose and Scope

1.1 Purpose

To establish the minimum energy modeler qualification requirements of performing whole building energy models for

a. Energy code compliance
b. Other compliance programs

1.2 Scope

This document applies to certifying energy modelers who perform

a. Whole building energy modeling

This document does not apply to certifying energy modelers who perform

a. Daylight modeling
b. Computational fluid dynamics modeling
c. Any other simulation analytics not required by energy standards and codes or other compliance programs

Recommendation to the Certifying Body: The language should be flexible, allowing potential adopters to adjust the framework for certifying modelers, not just for code compliance. For example, if GBCI wants to certify daylight modelers for their LEED Daylight credit.

2 Definitions. Abbreviations, and Acronyms

2.1 Definitions

Computational Fluid Dynamics: the simulation and analysis of fluid flow and heat transfer using computer-based numerical algorithms and models.

Daylight Modeling: the simulation and analysis of natural daylight within a building or architectural space. It involves using computer software and mathematical models to predict how natural daylight will enter and interact with a building's interior spaces over the course of a day, season, or year.

Energy Code/Standard: an energy code or standard is a set of regulations, guidelines, or requirements established by governmental authorities or relevant industry organizations to govern and regulate the energy efficiency of buildings and structures. These codes and standards aim to set minimum benchmarks for the design, construction, and operation of buildings to reduce energy consumption, promote sustainability, and mitigate the environmental impact of energy use. Energy codes and standards typically include specifications related to various aspects of building design and construction, such as insulation, glazing, lighting, heating, ventilation, air conditioning (HVAC) systems, and the use of renewable energy sources. Compliance with these codes and standards is often mandatory and may be enforced through building permits, inspections, and certifications.

Energy Modeler: an individual who performs building energy modeling.

Whole Building Energy Modeling: physics-based software simulation of building energy use. A building energy modeling program takes as input a description of a building including geometry, construction materials, and

lighting, HVAC, refrigeration, water heating, and renewable generation system configurations, component efficiencies, and control strategies. It also takes descriptions of the building's use and operation including schedules for occupancy, lighting, plug-loads, and thermostat settings. A building energy modeling program combines these inputs with information about local weather and uses physics equations to calculate thermal loads, system response to those loads, and resulting energy use, along with related metrics like occupant comfort and energy costs. Building energy modeling programs perform a full year of calculations on an hourly or shorter basis. They also account for system interactions like the ones between lighting and heating/cooling.[1]

Shoebox Modeling: a simplified method used to represent a building's thermal and energy performance. It involves representing a building as a rectangular "shoebox" shape with simplified geometry and assumptions.

2.2 Abbreviations and Acronyms

AEE: Association of Energy Engineers

ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers

AIA: American Institute of Architects

AHJ: Authorities Having Jurisdiction

BEMP: Building Energy Modeling Professional

ECB: Energy Cost Budget

EUI: Energy Use Intensity

GBCI: Green Business Certification Inc.

IBPSA-USA: International Building Performance Simulation Association - United States of America Chapter

IECC: International Energy Conservation Code

[1] About Building Energy Modeling https://www.energy.gov/eere/buildings/about-building-energy-modeling

ILFI: International Living Future Institute
ICC: International Code Council
IRS: Internal Revenue Service
LEED: Leadership in Energy and Environmental Design
P.E.: Professional Engineer
PHIUS: Passive House Institute US, Inc.
PRM: Performance Rating Method
R.A.: Registered Architect

3 Adoption and Enforcement

3.1 General

The framework ought to be designed with flexibility to accommodate adoption by diverse AHJs or programs. In the event that an AHJ expresses interest in adopting this framework, the Certifying Body should collaborate with them to tailor the framework to meet the AHJ's specific requirements. Furthermore, the Certifying Body should maintain its role as the certifying authority in accordance with the AHJ's specified criteria and requirements.

3.2 Adoption

In the event that an AHJ or program chooses to adopt this framework, any revenue generated by applicants for work within the specific AHJ or program may be subject to revenue-sharing agreements. These agreements are intended to support the AHJ's or program's technical development and training initiatives. This initiative aims to encourage the widespread adoption of this qualification framework.

3.3 Compliance

The energy modeler's responsibilities and obligations within this framework are detailed in Sections 4 and 6. These sections outline the specific qualifications, project experience, acceptable tools, and the qualification score system that the energy modeler must adhere to in order to meet the minimum standards for whole building energy modeling. This includes criteria related to professional licenses, project experience, and maintaining the qualifications over time.

The application process shall comply with Section 7, which provides a comprehensive overview of the application and appeal process that energy modelers must follow. It outlines the roles and responsibilities of the Certifying Body, the Certification Board, and the Appeal Board. Additionally, it defines the application requirements, review procedures, and the criteria for approval and appeals, ensuring that the certification process is fair, transparent, and in accordance with the established standards. Compliance with these sections is essential for energy modelers to qualify and maintain their certification status.

The AHJ or program is responsible for enforcing this framework if they choose to adopt it. Energy modelers should also ensure compliance with any other applicable requirements enforced by the AHJ or program.

4 Energy Modeler Responsibility

4.1 General

Energy modelers play a critical role in compliance energy modeling submissions. Their responsibilities involve creating whole building energy models, performing simulations, and ensuring that buildings and systems

meet the energy efficiency requirements specified in energy codes and standards or other regulations.

4.2 Scope of Work

The energy modeler shall

a. Be familiar with energy codes, standards, or any amendments the jurisdiction adopts and enforces.
b. Gather relevant data about the building's architectural design, construction materials, HVAC systems, lighting, and other energy-related components.
c. Use energy modeling software to create a digital representation of the building and designs. Ensure accurate input of the gathered data into the software tool.
d. Run simulations using the energy modeling software to calculate the building's performance, including but not limited to energy consumption, energy cost, and carbon emissions.
e. Compare the results of the energy simulations with the requirements outlined in the relevant energy code or standard.
f. Compile and prepare all requisite documentation in accordance with the requirements specified by the AHJ or other programs.
g. Responsively address and incorporate any comments or feedback provided by the AHJ or other programs.
h. As necessary, update the energy model and accompanying documentation to reflect any modifications or changes.
i. Maintain the energy model file and its associated documentation in an organized and accessible manner, ensuring they are readily available in the event of an audit or as required.

4.3 Ethics of Energy Modelers

Energy modelers shall adhere to the following ethical principles:

a. Accuracy and Honesty: Energy modelers should strive to uphold high standards of accuracy and honesty in their professional work. They must provide reliable assessments and results, avoiding any undue manipulation or exaggeration of data, while recognizing the need for reasonable assumptions in energy modeling.
b. Integrity in Reporting: Energy modelers shall not engage in the fabrication of results, which encompasses the creation of false or misleading data. For instance, an energy model should not be manipulated to produce compliant energy simulation results for a non-compliant building design.
c. Transparency: Energy modelers are obligated to maintain transparency regarding the methodologies employed, assumptions made, and limitations inherent in the energy models they produce.
d. Professional Competence: Energy Modelers should not engage in fraudulent or dishonest practices and should accurately represent their qualifications, experience, and the capabilities of their work.
e. Conflict of Interest: Energy modelers should openly disclose their client or employer responsible for performing the model, such as the owner, design team, or project manager.

Any violation of the above principles is subject to immediate removal from the Directory of Qualified Individuals.

5 Certifying Body

5.1 General

The certifying body is responsible for evaluating, assessing, and verifying the qualifications, skills, competencies, or compliance of energy modeler individuals against established requirements in this framework.

5.2 Authority

The certifying body shall have the following authorities:

a. Create, maintain, and modify this framework to establish clear and comprehensive standards or competency criteria that energy modelers need to meet in order to obtain certification.
b. Manage the certification process, including application, review, approval, appeal, audit and handling complaints as defined in Section 7.
c. Maintain a public directory of qualified energy modelers, allowing stakeholders and AHJs to verify an individual's certification status.
d. Develop and enforce a code of ethics and professional conduct for qualified energy modelers, outlining expectations for ethical behavior in their work.
e. Establish requirements for qualified energy modelers to engage in continuous learning and professional development to ensure continuous compliance with this framework.

5.3 Responsibility

The certifying body shall have the following responsibilities:

a. Seek adoptions from relevant industry bodies or government authorities, such as AHJs, GBCI LEED, ILFI, ICC, ASHRAE, utilities, and AIA.

b. Promote awareness of the certification program among stakeholders, including building owners, design teams, regulatory authorities, and the general public.
c. Implement mechanisms for ongoing quality assurance and monitoring of certified energy modelers' work to ensure they maintain the required standards and competence.
d. Establish a feedback mechanism for stakeholders to provide input on the certification program's effectiveness and relevance.

Recommendation to the Certifying Body: Consider developing a standardized whole-building energy modeling reporting template to facilitate the review of energy model submittals by AHJs or programs. This template can enhance consistency and clarity in the review process, making it more efficient and effective. It would also promote the adoption of this framework.

6 Qualifications

6.1 General

The modeler must meet the criteria outlined in Sections 6.1, 6.2, 6.3, and 6.4 to qualify for performing whole building energy modeling. An exception to Section 6.1 is possible if the modeler is exempted by the AHJ, in which case a written letter of exemption should be provided.

6.2 Project Experience (Mandatory)

The individual must provide evidence of a minimum of three projects completed within the last five years. This requisite project experience should encompass the practice of whole building energy modeling, specifically addressing areas such as Energy Code Compliance through the utilization of compliance rules like ASHRAE ECB, PRM, or IECC C407 Total Building

Performance. Additionally, whole building energy modeling experience in projects related to LEED, ILFI, utility incentive programs, 179D Commercial Buildings Energy-Efficiency Tax Deduction and analogous domains is acceptable.

Activities such as shoebox modeling, daylight modeling, Computational Fluid Dynamics modeling, and spreadsheet-based analyses of electrical or mechanical performance should not be considered as qualifying experience for this purpose.

6.2.1 Examples of Project Experience

a. Energy Code Compliance - Performance Path

These energy models are often used for building permit applications, as permitted by the energy code or standard as an alternative option to the prescriptive path.
This type of modeling involves the creation of two models: a proposed model based on the building's designs and a baseline model according to energy code or standard requirements as adopted by the AHJ. Generally, these types of models only allow credits to be taken from regulated components in the energy code or standard. Credits from unregulated components are not permitted unless approved by the AHJ through exceptional calculations. The energy modeler submits compliance documentation as per the reporting requirements outlined in the energy code or standard, along with any other documents required by the AHJ.

b. LEED Optimize Energy Performance Energy Modeling

These energy models are often used to meet the Minimum Energy Performance prerequisite and earn points in the Optimized Energy Performance Credit.
This type of modeling involves creating two models: a proposed model based on the building's designs and a baseline model following ASHRAE 90.1 as

adopted by GBCI. Generally, these models allow for credits to be earned from both regulated and unregulated components in ASHRAE 90.1. The energy modeler submits compliance documentation in accordance with the reporting requirements outlined by LEED, which includes a standardized report called the 'Minimum Energy Performance Calculator.

c. ILFI Predict Building Performance Modeling

These energy models are often employed to predict actual building performance, including energy use intensity, when the building is occupied and operational. It's a crucial step for energy modelers and designers in sizing offset renewable systems, and later, for ILFI to verify net-zero energy operations. This type of modeling typically only necessitates a proposed model. However, the process demands rigorous and accurate input of the building components and their sequence of operations.

d. Utility Incentive Application

Many utilities in the U.S. offer incentives for new constructions and existing building retrofit projects. Some utilities permit the use of whole-building energy modeling to demonstrate savings compared to an established baseline as defined by the utility. This type of modeling often involves creating two models: a proposed model based on the building's designs and a baseline model defined by the utility, which in most cases align with the local energy code baselines. Some utilities define a baseline target, such as EUI; in such cases, the modeling process typically does not require a baseline model. The energy modeler submits the necessary documentation as required by the utilities.

e. 179D Commercial Buildings Energy-Efficiency Tax Deduction

The 179D commercial buildings energy efficiency tax deduction primarily enables building owners to claim a tax deduction for installing qualifying systems in buildings[3]. Energy models are often used to demonstrate energy

and cost savings compared to an ASHRAE 90.1 PRM baseline as adopted by the IRS. This type of modeling involves creating two models: a proposed model based on the building's designs and a baseline model according to energy code or standard requirements. Credits from unregulated components are not permitted. The energy modeler keeps all energy modeling related documents on file in case of an audit. Additionally, a licensed P.E. goes onsite to verify the installation of claimed building systems and signs off on a statement.

f. Whole Building Energy Conservation Measures (ECM) Study

In the design and planning phases, energy modelers frequently utilize whole-building energy modeling to study ECMs, assess feasibility, or conduct life cycle cost analyses. This modeling approach entails creating a detailed proposed model and integrating various design options to compare their performance. The process requires meticulous and precise input of building components and their sequences of operations. Note: Simplified 'shoebox' modeling does not fall under this category.

6.3 Acceptable Tools (Mandatory)

Project experience is considered valid only when completed using qualifying tools, which align with the DOE's 'Qualified Software for Calculating Commercial Building Tax Deductions'[2] and include: DesignBuilder, DeST, DOE-2.2, EnergyGauge, EnergyPlus, eQUEST, Hourly Analysis Program (HAP), IES Virtual Environment, OpenStudio with EnergyPlus, TAS, TRACE 3D Plus, TRACE 700, and TRNSYS.

Project experience completed with any other tools is not deemed acceptable.

[2] Qualified Software for Calculating Commercial Building Tax Deductions
https://www.energy.gov/eere/buildings/qualified-software-calculating-commercial-building-tax-deductions

The Certifying Body retains the authority to append or remove any tools from this list.

6.3.1 Removal of a Tool

In the event that a tool is removed from the list because the software vendor has stopped developing the tool, a qualifying energy modeler who used that specific tool could maintain their qualifying status. However, the energy modeler should provide qualifying experience with acceptable tools in the renewal application.

If a tool is removed from the list due to its disqualification for performing whole building energy models, a qualifying energy modeler who used that specific tool could lose their qualifying status.

Recommendation to the Certifying Body: Align 'Acceptable Tools' in the modeler qualification framework with the software qualification framework.

6.4 Qualification Score System (Mandatory)

The modeler must achieve a minimum of ten points based on the scores awarded for the following credentials and project experience:

a. P.E. Mechanical - HVAC&R: three points
b. P.E. Electrical or Thermal: two points
c. P.E. Other: one point
d. R.A.: two points
e. BEMP: five points
f. Five applicable project experiences: five points
g. Ten applicable project experiences: seven points
h. Eleven to twenty applicable project experiences: nine points
i. More than twenty applicable project experiences: eleven points

Professional licenses and credentials must maintain validity for a minimum of six months at the time of application, and project experience should have been completed within the preceding five years.

The following table provides examples of various combinations by which modelers can achieve a minimum of ten points.

Table 1: Qualification Score System and Example Combinations

Credentials	Points	1	2	3	4	5	6	7	8	9	10
P.E. HVAC&R	3	3	3								
P.E. Electrical or Thermal	2			2	2						
P.E. Other	1					1	1				
R.A.	2							2	2		
BEMP	5	5		5		5		5		5	
Total of 5 Project Experience	5	5		5		5		5		5	
Total of 10 Project Experience	7		7								
Total of 11-20 Project Experience	9				9		9		9		
Total >20 Project Experience	11										11
Total points		13	10	12	11	11	10	12	11	10	11

7 Application and Appeal

7.1 Certifying Body

The Certifying Body is responsible for receiving, reviewing, approving, removing, and addressing appeals related to applications. Furthermore, the Certifying Body should maintain a directory of qualified individuals and make it accessible to AHJs or programs that adopt and enforce this qualification framework.

7.2 Certification Board

The Certifying Body shall institute a Certification Board comprising members who are qualified by experience and training to pass on matters pertaining whole building energy modeling. Their credentials shall be made publicly accessible. This Board shall offer technical guidance and support to the certification process as and when required.

7.3 Appeal Board

The Certifying Body shall appoint an Appeal Board comprising members who are qualified by experience and training to pass on matters pertaining whole building energy modeling. Their credentials shall be made publicly accessible. This Board shall offer technical guidance and support in the event of appeal.

It is stipulated that no individual shall concurrently serve on both the Certification Board and the Appeal Board. The board shall not have authority to waive requirements of this framework.

7.4 Application

The Certifying Body shall establish a streamlined application form accompanied by an associated checklist of requisites. The checklist shall align with the 'Qualification Score System.' The application form shall prioritize the submission of project references, while the initial submission of actual modeling work shall not be obligatory unless subject to an audit. Applicants shall be obligated to furnish all supporting documentation as stipulated by the application form.

The Certifying Body expressly reserves the authority to expunge and disqualify any applicants discovered to have provided false information during the application process.

Recommendation to the Certifying Body: Consider implementing mandatory energy code and fundamental whole building energy modeling training and/or an exam for candidates before they submit their applications. This practice is similar to the accreditation processes of organizations like AEE and PHIUS for their credentialing.

7.5 Review

The Certifying Body shall evaluate every application in accordance with this qualification framework and shall furnish prompt notifications to the respective applicants. Given that the initial submission does not necessitate the submission of actual modeling work, these applications shall be eligible for review by the administrative staff of the Certifying Body. However, should any applications necessitate professional review, a member of the Certification Board shall undertake the evaluation process.

7.6 Approval

When an application is granted approval, the applicant shall receive written notification and shall be duly included in the directory of qualified individuals. In cases where an application is not approved, a written explanation detailing the decision shall be provided.

7.7 Appeal

In case of an appeal, the application shall undergo a comprehensive review by the Appeal Board, and the applicant shall receive timely notification of the decision. A written explanation shall be furnished, whether the outcome is approval or disapproval.

7.8 Directory of Qualified Individuals

The Certifying Body shall be the designated entity responsible for establishing and maintaining a directory of qualified individuals. This directory shall be accessible to the general public. Furthermore, the directory shall incorporate a multi-tiered filtering system designed to categorize locations and emphasize various areas of expertise.

7.9 Audit

The Certifying Body should periodically conduct audits of qualified modelers' work to ensure ongoing compliance with qualification requirements.

7.10 Complaint

The Certifying Body should establish a procedure for handling complaints and disputes related to the certification process or the conduct of qualifying energy modelers, including a fair and transparent appeals process.

8 Maintenance of the Qualification

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Informative Appendix A: ASHRAE 90.1 and IECC Provisions

A1 ASHRAE 90.1 2007, 2010, 2013, 2016, and 2019

a. Chapter 11 Energy Cost Budget Method

This chapter outlines specific requirements for compliance documentation and simulation programs. It notably omits any stipulations concerning qualifications for energy modelers.

b. Appendix G Performance Rating Method

This chapter outlines specific requirements for compliance documentation and simulation programs. It omits any stipulations concerning qualifications for energy modelers.

A2 ASHRAE 90.1 2022

a. Chapter 12 Energy Cost Budget Method

This chapter outlines specific requirements for compliance documentation and simulation programs. It notably omits any stipulations concerning qualifications for energy modelers.

b. Appendix G Performance Rating Method

This chapter outlines specific requirements for compliance documentation and simulation programs. It omits any stipulations concerning qualifications for energy modelers.

A3 IECC 2009

a. Section C506 Total Building Performance

This section outlines specific requirements for compliance documentation and simulation programs. It notably omits any stipulations concerning

qualifications for energy modelers. It solely necessitates the inclusion of the individual's name who completed the compliance report.

A4 IECC 2012, 2015, 2018, 2021

a. Section C407 Total Building Performance

This section outlines specific requirements for compliance documentation and simulation programs.It notably omits any stipulations concerning qualifications for energy modelers. It solely necessitates the inclusion of the individual's name who completed the compliance report.

Informative Appendix B: AHJ Adoptions

B1 Denver

Section C407.2 of the 2022 Denver Energy Code states:

"Performance modeling utilized to meet the requirements of this section shall be conducted under the supervision of an individual who holds an ASHRAE Building Energy Modeling Professional Certification or approved equivalent certification. The name, affiliation and contact information of the modeler who supervised the performance modeling shall be included in the documentation required by section G1.3.2."[3]

B2 Washington

Section C407.3.8 of the 2021 Washington State Energy Code states:

"8. Energy modeler qualifications. The energy analyst in responsible charge of the Section C407 submittal shall meet at least one of the following:
8.1. ASHRAE Building Energy Modeling Professional (BEMP) certification.
8.2. Association of Energy Engineer's Building Energy Simulation Analyst (BESA) certification.
8.3. Successful completion of at least five projects modeled following any version of
ANSI/ASHRAE/IESNA 90.1 Appendix G within the last three years that were reviewed and approved by a code official or rating authority."[4]

[3] 2022 Denver Energy Code
https://www.denvergov.org/files/assets/public/v/5/community-planning-and-development/documents/ds/building-codes/2022-denver-building-and-fire-code.pdf

[4] 2021 Washington State Energy Code
https://sbcc.wa.gov/sites/default/files/2023-05/2021_WSEC_C_2ndPrint_0518023.pdf

Informative Appendix C: Value Proposition from the Working Group

C1 Quality Assurance

It ensures that individuals conducting energy modeling for buildings have a baseline level of competence, enhancing the quality and accuracy of energy modeling work.

C2 Energy Efficiency

Qualified energy modelers are more likely to produce more accurate models, leading to better-informed decisions and potentially greater energy efficiency in building design and operation.

C3 Compliance

It helps ensure that energy modeling efforts align with relevant codes, standards, and regulations, facilitating compliance with energy efficiency requirements

C4 Credibility

A qualification framework enhances the credibility of energy modeling results, making them more reliable for building owners, architects, engineers, and regulatory authorities.

C5 Consistency

It promotes consistency in modeling practices, reducing variability in results and ensuring that different energy modelers produce comparable outcomes.

C6 Professional Development

Encourages ongoing professional development among energy modelers, ensuring that they stay updated on best practices and emerging technologies.

C7 Transparency

By specifying qualification criteria and procedures, it provides transparency in the selection and evaluation of energy modelers, enhancing trust in the process.

C8 Education and Training

The framework can promote education and training in energy modeling, fostering a community of knowledgeable professionals in the field.

C9 Support for Decision-Making

Building owners and project stakeholders can make more informed decisions about energy efficiency measures based on the expertise and qualifications of the energy modeler.

C10 Risk Mitigation

Reduces the risk of inaccurate modeling, which can lead to costly design changes or operational inefficiencies.

Informative Appendix D: Sample Application And Renewal Form