

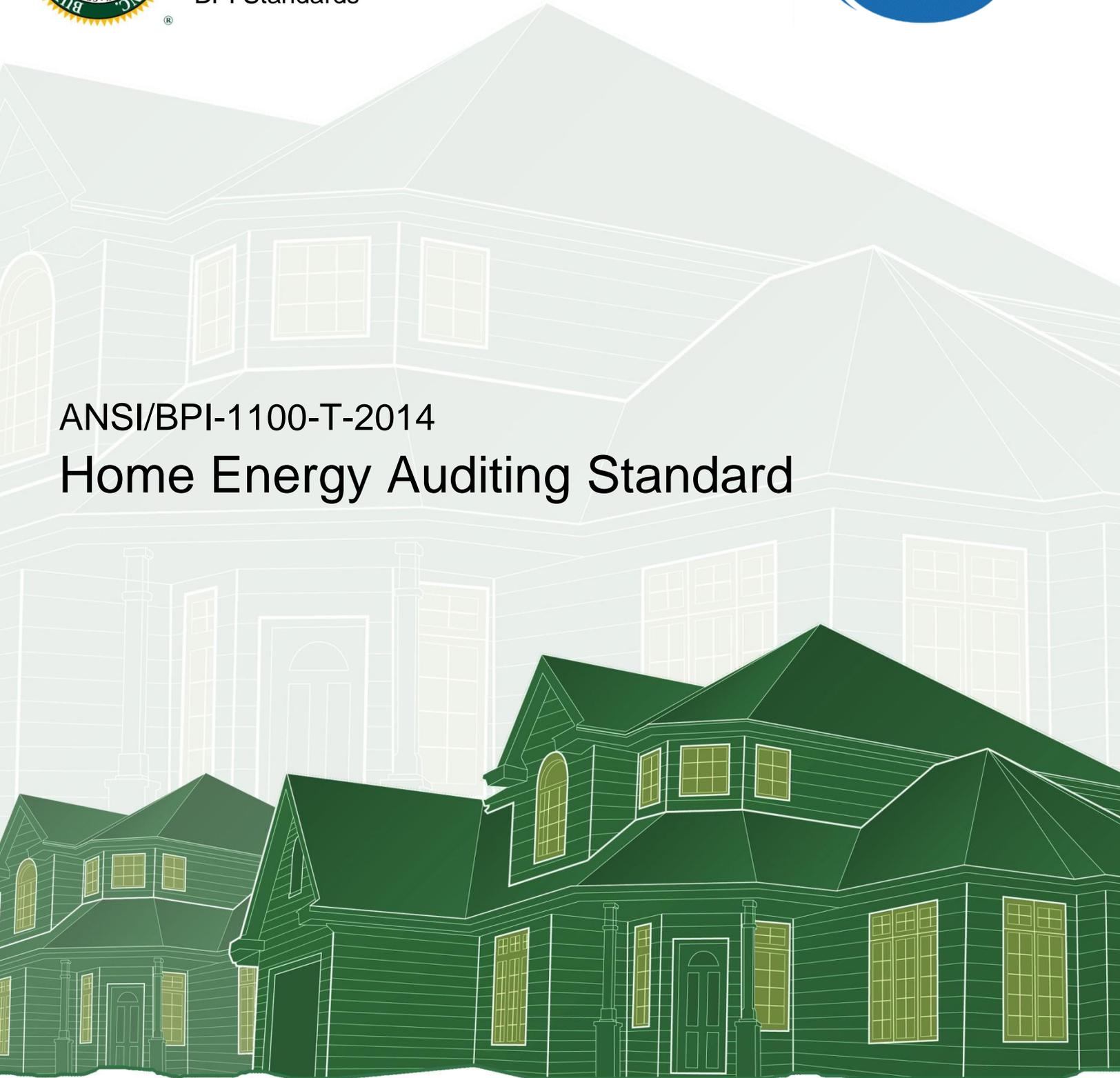


Building Performance Institute, Inc.
BPI Standards



ANSI/BPI-1100-T-2014

Home Energy Auditing Standard



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Notice

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This standard does not purport to address all safety problems associated with its use or all applicable regulatory requirements. It is the responsibility of the user of this standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations before its use.

This standard was formulated under the cognizance of the BPI Standards Technical Committee.

Introduction (Informative)

The Building Performance Institute, Inc. (BPI) publishes standards related to the energy efficiency and performance of residential buildings. This *Home Energy Auditing Standard* is the basis for BPI's Energy Auditor Certification and provides requirements for the energy-auditing profession. The goal of this standard is to direct the energy auditor to develop a comprehensive list of measures which lead to whole-house, building science-based home performance upgrades to existing detached single-family dwellings and townhouses.

This standard is intended and structured to be used in conjunction with ANSI BSR/BPI-1200-S-201X Standard Practice for Basic Analysis of Buildings, which outlines in detail how an energy auditor shall meet the requirements noted in this standard. However, the requirements included in BPI-1100 may also be met using procedures from other American National Standards related to residential building performance. It is understood that other standards or guidelines may be required by the Authority Having Jurisdiction (AHJ) and in such instances the energy auditor should comply with the AHJ's requirements.

This *Home Energy Auditing Standard* may be used in conjunction with the U.S. Department of Energy's Home Energy Score. An assessment performed in accordance with the *Home Energy Auditing Standard* will gather all necessary data required by a Home Energy Score Qualified Assessor to develop a Home Energy Score, complete the Appraisal Institute Green Addendum, and provide energy efficiency information into the Real Estate Transaction System for inclusion in the Multiple Listing Service. Home Energy Score is the only federal asset score designed for existing homes, used nationwide and backed by DOE.

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1 Scope

This standard practice defines the minimum criteria for conducting a building science-based residential energy audit.

The energy audit will address energy usage and limited aspects of building durability and occupant health and safety. The energy audit will provide a comprehensive report with a list of prioritized recommendations to improve the home and will include a cost-benefit analysis.

Residential building types covered are defined as: existing detached single-family dwellings and townhouses that:

- have independent mechanical systems for each dwelling unit (heating, cooling, water heating, and ventilation)
- have direct access to outdoors for each dwelling unit
- were designed to have continuous party walls with no penetrations to adjacent units, with such party walls extending from ground to roof where the dwelling unit is attached to one or more adjacent single-family dwelling units.

2 General Requirements

Energy audits shall be based on building science principles and include the use of appropriate equipment in diagnosing opportunities for improving energy efficiency and minimizing health and safety hazards.

2.1 All energy audits shall include the following:

- 2.1.1 A review with the homeowner/occupant(s), if available, about any concerns they may have related to the performance of their home.
- 2.1.2 Immediate disclosure to homeowner/occupant(s) when any suspected emergency or urgent health and safety hazard or situation is present in the home.
- 2.1.3 A report that meets the requirements laid out in this standard.

2.2 All energy audit reports shall include the following:

- 2.2.1 Results of diagnostic tests and visual/sensory inspections including a summary of the diagnostic testing and inspections and their purpose.
- 2.2.2 Information on energy programs, incentives, regulations and energy costs relevant to prioritized recommendations for improving the home.
- 2.2.3 A baseline energy use analysis [when energy-consumption records are available].
- 2.2.4 A comprehensive set of recommended health and safety measures, warranted by the site-specific circumstances.

2.2.5 A comprehensive set of recommended energy efficiency measures, warranted by the site-specific circumstances.

2.2.6 Advice to the homeowner/occupants on user-controlled energy reduction strategies.

3 Health and Safety Related Requirements

The health and safety requirements included in this standard are intended to ensure that home performance upgrade activities do not negatively affect indoor air quality or otherwise cause or exacerbate an unsafe condition in the home.

The energy audit shall include the following:

- 3.1 Evaluation of combustion air requirements and a test of combustion appliances in accordance with Section 7 of this standard.
- 3.2 Evaluation of ventilation needs in accordance with Section 8 of this standard.
- 3.3 Identification of existing and/or potential moisture issues in accordance with Section 9 of this standard.
- 3.4 Identification of areas containing known or suspected hazardous materials, including but not limited to, lead, asbestos, or mold.
- 3.5 Visual inspection for existence of an Environmental Protection Agency (EPA) guidelines-compliant radon mitigation system.
- 3.6 Visual inspection for existence of knob and tube wiring.
- 3.7 Identification of obvious electrical hazards.

4 Disclosure and Ethics

The energy auditor shall act in a professional and ethical manner during the course of conducting all energy audits, completing energy audit reports, and interacting with the homeowner/occupants. (See Annex B, Code of Ethics for the Energy Auditor for guidance.)

The energy audit report shall include the following:

- 4.1 Clear and accurate information on home performance upgrades and health and safety improvements.
- 4.2 The cost-effectiveness of the recommended home performance upgrades, based on energy modeling, utility-bill history or typical usage and energy cost for similar homes in the area.
- 4.3 Disclosure of any current or potential conflict of interest of the auditor.
- 4.4 Disclosure of any products and services that the auditor or his/her company provides in addition to energy auditing.

Note: The energy audit report shall not include recommendations for measures based primarily on a specific product line, services of a contractor, or convenience.

5 Cost-Benefit Analysis

A cost-benefit analysis includes a projected site energy savings associated with the recommended home performance upgrade package(s). This may be presented in terms of reduced fuel consumption, reduced costs, a fractional performance improvement over existing performance, or an improvement on a relative scale or benchmark such as a Home Energy Score, Home Energy Rating, or Energy Performance Score. (Note: Energy simulation software is an option, but not a requirement.) Savings estimates shall clearly indicate whether savings are projected for baseload, heating, cooling, or total household energy consumption.

- 5.1 The energy audit shall include a customized cost-benefit analysis of a comprehensive package of home performance upgrades.
- 5.2 The energy audit shall include an analysis of energy consumption records to validate estimates of energy savings from the installed home performance upgrades [when energy-consumption records are available].

6 Prioritizing Recommendations

The objective of the prioritized recommendations is to optimize home performance cost-effectively, while maintaining or improving health and safety and satisfying homeowner/occupant objectives.

- 6.1 The energy audit shall include an interview with the homeowner/occupants to understand their goals, priorities, and any potential limitations or barriers for implementing home performance upgrades.
- 6.2 The energy audit report shall include the following:
 - 6.2.1 A list of applicable health and safety improvements.
 - 6.2.2 A list of home performance upgrades, building repairs and renovation work based on an evaluation of the whole house according to the requirements of this standard and prioritized according to homeowner/occupant objectives and cost-effectiveness.

7 Combustion Appliance and Fuel Distribution System Inspection

The energy audit shall include inspection of combustion appliances and fuel distribution systems for safety.

The energy audit shall include the following:

- 7.1 Identification of building-related conditions that may require immediate health and safety remediation.
- 7.2 Inspection of the ambient air for carbon monoxide (CO) and combustible gas prior to undertaking inspections of fuel distribution systems and combustion appliances.
- 7.3 Testing for gas leakage at connections of natural gas and propane piping systems.
- 7.4 Inspection of oil-fired appliance fuel supply system (tank, supply line, burner) for leaks.
- 7.5 Inspection of combustion venting systems for damage, leaks, disconnections, inadequate slope and other safety hazards.

- 7.6 Verification that sufficient combustion air is available.
- 7.7 With the combustion appliance zone (CAZ) in a depressurized state, CO tests and spillage assessment on all combustion appliances venting into atmospheric chimneys or flues, including fan-assisted gas appliances.
- 7.8 If the outlet of the exhaust is safely accessible, a CO test on all direct vent and power-vented appliances (without atmospheric chimneys or flues).
- 7.9 Testing of gas ovens and unvented appliances for CO.
- 7.10 Inspection of solid fuel burning appliances for safe operation.

8 Indoor Air Quality and Ventilation

The energy audit shall include inspection of air infiltration sources, air barriers and ventilation. Consider the house ventilation as a system, including both whole-building ventilation and local exhaust ventilation.

The energy audit shall include the following:

- 8.1 Identification of sources of indoor air pollutants.
- 8.2 For houses with an attached or “tuck under” garage, identification of joints, seams, penetrations, openings between door assemblies and their respective jambs and framing, and other sources of air leakage through walls and ceilings separating the garage from the residence and its attic area.
- 8.3 Evaluation of terminations of all exhaust fans and clothes dryer vents.
- 8.4 Evaluation of existing ventilation systems in the dwelling.
- 8.5 Determination of the ventilation needs.

9 Moisture Control

The energy audit shall include a visual/sensory inspection of each home for moisture issues.

The energy audit shall include the following:

- 9.1 Inspection for evidence of exterior water intrusion, such as roof leaks, foundation leaks, fenestration assembly leaks and ground-water intrusion.
- 9.2 Inspection for evidence of damage caused by interior water sources, such as plumbing leaks or condensation on piping, ductwork or interior surfaces.
- 9.3 Inspection for effects of water damage on buildings, such as structural damage, mold, mildew, efflorescence, and stains.
- 9.4 Identification of existing vapor retarders, flashing, gutters or other moisture-control strategies.

10 Building Enclosure

The energy audit shall include an evaluation of the performance of the building enclosure, to include both the pressure and thermal boundaries and their combined effectiveness and alignment.

The energy audit shall include the following:

- 10.1 Evaluation of the envelope insulation level and performance.
- 10.2 Evaluation of the air-leakage of the building, as determined by blower door diagnostic testing.
- 10.3 Evaluation of fenestration performance and fit.
- 10.4 Evaluation of the potential for energy savings of shading and solar-reflectance upgrades for the roof and/or wall.

11 Heating, Cooling, and Domestic Water Heating Systems

The energy audit shall include an evaluation of the heating, cooling, and domestic water heating systems in the home.

The energy audit shall include the following:

- 11.1 Evaluation of heating appliance/s operation, condition, and efficiency.
- 11.2 Evaluation of cooling appliance/s operation, condition, and efficiency.
- 11.3 Evaluation of heating and cooling distribution system/s operation, condition, and efficiency.
- 11.4 Evaluation of domestic water heating appliance/s operation, condition, and efficiency.
- 11.5 Evaluation of domestic water heating distribution system/s operation, condition, and efficiency.

12 Baseload Energy Efficiency

The energy audit shall include an estimate of present baseload energy use and cost and a description of the current major appliances and plug loads.

The energy audit shall include the following:

- 12.1 Evaluation of refrigerator and freezer energy consumption.
- 12.2 Evaluation of lighting efficiency, controls and efficient alternatives.
- 12.3 Inspection of clothes dryer vents for restrictions, lint build-up appropriate venting configuration and materials.
- 12.4 Evaluation of pool and spa energy consumption and conservation strategies.
- 12.5 Evaluation of the efficiency of other major baseload energy-consuming devices.
- 12.6 Collection of information regarding the type and input rate of installed renewable energy systems or other on-site electricity generation.
- 12.7 Advice to the homeowner/occupant about user-controlled changes that may reduce energy consumption including:
 - 12.7.1 Plug loads and associated electricity costs.
 - 12.7.2 Calculated baseload energy consumption with space conditioning energy usage disaggregated from baseload energy usage [when energy-consumption records are available].

12.7.3 A comparison of the home's energy use with similar homes in the region [when data is available].

12.7.4 Value of energy saving behaviors and measures.

13 Water Conservation

The energy audit shall include an assessment of potential water conservation measures.

The energy audit shall include the following:

13.1 Evaluation of water usage of toilets, shower heads, faucets, and clothes washers.

13.2 Advice to the homeowner/occupant about the value of water efficiency and conservation strategies and user-controlled changes that may reduce water consumption.

Annex A | Terms and Definitions (Normative)

Term	Definition
<p>Authority Having Jurisdiction (AHJ)</p>	<p>The Authority Having Jurisdiction [AHJ] is the organization, office, or individual with final and ultimate authority for approving equipment, materials, an installation, or a procedure, where jurisdiction includes the governmental or administrative territory within which authority may be exercised, and also the scope of what trades, professions, devices or systems they regulate.</p> <p>Where public safety is the primary concern, the AHJ may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. Within federal, state, local, or other regional programs, the program administrator, utility commission, or others having regulatory authority or responsibility for the program may be the AHJ.</p> <p>In many cases, there may be more than one organization, agency, or department that has “jurisdiction” over particular work, but regulations and statutes establish and define relationships and levels of authority, so that only one entity has “authority.” A good example of this overlap is the one between an energy program funding source and code officials. If the project in question is a solar/PV project operating under program rules but also subject to State electrical codes, the funding source can require construction practices only to the extent that the required work does not violate the applicable electrical code, and so the code inspection office (or official) empowered under the state electrical code is the Authority Having Jurisdiction. If there is also a county or city electrical inspection office, state law identifies the Authority Having Jurisdiction, as it defines which entity has the highest level of authority and responsibility.</p>
<p>Building Enclosure</p>	<p>The system or assembly of components that provides environmental separation between the conditioned space and the exterior environment.</p> <p> © Building Science Corporation. Reprinted with permission.</p>
<p>Chimney</p>	<p>One or more passageways, vertical or nearly so, for conveying flue or vent gases to the outdoors.</p>
<p>Direct Vent Furnace</p>	<p>A system consisting of an appliance, combustion air, and flue gas connections between the appliance and the outdoor atmosphere, and constructed so that all air for combustion is obtained from the outdoor atmosphere and all flue gases are discharged to the outdoor atmosphere.</p>
<p>Fan-Assisted Combustion Appliances</p>	<p>An appliance equipped with an integral mechanical means to either draw or force products of combustion through the combustion chamber or heat exchanger.</p>
<p>Flue</p>	<p>A passage through which combustion gases are conveyed from the combustion chamber to the outside atmosphere.</p>

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Annex A – Terms and Definitions**

Flue Gases	Products of combustion plus excess air in appliance flues or heat exchangers. This does not include dilution air from a draft diverter.
Home	A place of residence.
Pressure Boundary	The barrier that prevents infiltration of outdoor air into the conditioned space and exfiltration of indoor air to the outside. It should be continuous and aligned with the thermal boundary. The pressure boundary is effective if it stops most air leakage
Spillage	Entry of combustion products into a building from dilution air inlets, vent connector joints, induced draft fan case opening, combustion air inlets, or other locations in the combustion or venting system of a vented combustion appliance (boiler, fireplace, furnace, or water heater), caused by backdrafting, vent blockage, or leaks in the venting system.
Thermal Boundary	The insulation boundary that separates conditioned from non-conditioned spaces in a building. It should be continuous and aligned with the pressure boundary.
Unvented Room Heater	Category of unvented, self-contained, free standing, non recessed (except as noted) fuel gas burning appliance for furnishing warm air by gravity or fan without duct connection. Gas hearth appliances listed to ANSI Standard Z21.11.2 include Gas Fireplaces and Fireplace Inserts.
Vent	A passageway used to convey flue gases from appliances or their vent connectors to the outdoors. Or: An opening that allows air, gas, or liquid to pass out of or into a confined space.
Vent Connector	The pipe or duct that connects a fuel gas-burning appliance to a vent or chimney.
Vent Gases	Products of combustion from appliance plus excess air, plus dilution air in the venting system above the draft hood or draft regulator.
Venting	The conveyance of combustion products to the outdoors.

Annex B | Code of Ethics for the Energy Auditor (Informative)

(This appendix is not part of the standard. It is informative and does not contain requirements necessary for conformance to the standard.)

The Building Performance Institute, Inc. (BPI) is committed to promoting the highest level of professionalism, integrity, and ability available in the residential contracting industry.

This Code of Ethics for Energy Auditors is designed to foster trust and mutual respect among individuals working in the industry as well as the public at large; it is intended to increase the esteem of the credentials and of the individuals who have earned them. This Code does not discourage healthy competition within the industry. BPI considers industry relationships critical to the industry's success. This Code is also not intended to limit the ability of energy auditors to earn fair compensation for their services. BPI's goal is to promote the professionalism of energy auditors' work products and thereby to enhance their quality.

I. Avoiding Conflicts of Interest

- A. Energy auditors shall not be inappropriately motivated by any financial, personal, or professional purpose other than performing residential energy audits in compliance with this standard.
- B. Energy auditors shall avoid, whenever possible, even the appearance of a conflict of interest and shall disclose all potentially questionable associations and relationships in advance to any stakeholder with a legitimate right to be informed of them.

II. Professionalism and Integrity

- A. Energy auditors shall comply with all safety-related regulations, warnings, and instructions set forth by local, state, or federal organizations and other recognized safety organizations.
- B. Energy auditors shall report any identified safety concerns to the homeowner/occupant.
- C. Energy auditors shall make recommendations based on best practices and standards in the field, using diagnostics, testing, and visual inspection within their areas of education, training, and expertise.
- D. Energy auditors shall provide professional services that effectively guide the homeowner/occupant to reduce energy consumption, improve health and safety, and increase the lifespan of the building while also improving the comfort for building occupants.
- E. Energy auditors shall help the homeowner/occupant to evaluate the costs and benefits of available energy efficiency options in a way that promotes the homeowner/occupant's best interests.

III. Representation of the Energy Auditor Profession and Self-Representation

- A. Energy auditors shall neither misrepresent nor knowingly deceive others concerning their experience and capabilities.
- B. Energy auditors shall act professionally at all times and in the best interests of the homeowner/occupant. Energy auditors shall not act in any way that denies or impedes competent, timely, and professional service to the homeowner/occupant.

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- C. Energy auditors shall not willfully damage, or by negligence or indifference allow to be damaged, any property belonging to the homeowner/occupants. Energy auditors shall take reasonable means to protect the homeowner/occupant's health, safety, property, and possessions and also to prevent the undue loss, theft, waste, and dissipation of the homeowner/occupant's funds, resources, and supplies.
- D. Energy auditors shall not betray the trust that homeowner/occupants have placed in them by inviting them to work in their homes.
- E. Energy auditors shall ensure that any individuals working under their supervision will act in a professional manner, in compliance with all applicable laws, regulations, and standards, and in compliance with all articles specified by this Code of Ethics.

IV. Maintaining Confidentiality

Energy auditors shall not, without permission, disclose private, confidential information about any client for the use or interests of any third parties whose services and opinions have not been explicitly requested by the homeowner/occupant. The energy auditor may discreetly discuss their own work and working conditions with their family and associates, but not in any way that violates the privacy of the homeowner/occupants.