Energy Auditor Job Task Analysis

Jal Desai and Cory Chovanec

National Renewable Energy Laboratory

NREL is a national laboratory of the U.S. Department of Energy
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EA-QCI Scheme Committee Members (2022–2026):

- Amy Vieira
- Thomas McIvor
- Peter Martin
- Fain Perrin
- Pamela Palmer
- Lance Gast
- Aubrey Myers
- Michael Swafford
- Chris Clay
- Kevin Grothe
- Charles Childers
- Andrew Woodruff
- Lara O'Brady
- Matt Turner
- Robert Parkhurst
- Bill Nickerson.

List of Acronyms

CAZ	combustion appliance zone
DOE	U.S. Department of Energy
EA	Energy Auditor
GHEP	Guidelines for Home Energy Professionals
HEP	home energy professional
HVAC	heating, ventilation, and air conditioning
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
JTA	job task analysis
NFPA	National Fire Prevention Association
NREL	National Renewable Energy Laboratory
OSHA	Occupational Safety and Health Administration
QCI	Quality Control Inspector
WAP	Weatherization Assistance Program

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1 Introduction

The National Renewable Energy Laboratory (NREL), under contract to the U.S. Department of Energy's (DOE) Weatherization Assistance Program (WAP), develops and maintains the resources under the Guidelines for Home Energy Professionals (GHEP) project. The purpose of the GHEP project is to increase the work quality of residential energy retrofits performed by the WAP network and other residential retrofit programs in the United States. To meet the goal of "Establishing National Workforce Certifications and Training Standards," DOE tasked NREL with developing GHEP resources, including a set of advanced, competency-based home energy professionals (HEP) personnel certifications. Since 2010, NREL has recruited volunteer subject matter experts from the WAP network and the home performance industry to serve on committees to develop and update certification schemes and their requisite job task analyses (JTA) as the foundation of standardized certification and training programs.

The HEP certifications support WAP and the broader residential home performance industry through the credentialing process and development of defined JTAs for Energy Auditors (EA) and Quality Control Inspectors (QCI). This report outlines the most recent updates (2022) to the EA JTA.

2 Background

In 2013, NREL completed the development of four single-family, full-scope, International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC)-accredited HEP certifications[1] for QCI, EA, Crew Leader, and Retrofit Installer Technician.

Since the inception of the HEP certifications, significant changes to the structure of the certification programs have been made to better reflect the needs of the industry and reduce redundancy among job roles. The first major change occurred in Fiscal Year 2018 when DOE, along with the relevant scheme committee, determined the Retrofit Installer Technician JTA could be eliminated and its tasks inserted into the Crew Leader JTA. The Retrofit Installer Technician tasks became the basis of the Retrofit Installer Badges,[2] which provide a flexible, customizable, and voluntary approach to training and skills recognition for industry professionals. The second major change was the transition of the full-scope QCI certification to a microcredential, for which the EA certification is the single prerequisite. The rationale behind this change is that a QCI must possess the knowledge, skills, and abilities of an EA, and a smaller subset of skills is needed for QCIs. Since 2019, the EA remains a full-scope certification accredited by the ANSI National Accreditation Board to ISO/IEC 17024.

As the owner of the certification scheme for the HEP EA, NREL facilitates the development, maintenance, and validation of the certification schemes for use by certifying organizations compliant with the ISO/IEC 17024 standard.

On an ongoing basis, NREL brings industry practitioners and subject matter experts together to develop, review, and revise the certification schemes in accordance with the ISO/IEC 17024 standard. DOE chose this standard for the quality and rigor of personnel certifications that it offers to the home performance industry. These schemes define the general requirements of each certification (e.g., prerequisites, exam structure, recertification requirements, etc.) and are based on JTAs developed by NREL in accordance with industry-recognized practices of workforce psychometrics.

NREL is not directly engaged in the certification of any individual and only licenses the scheme to qualified certifying bodies. JTAs must be reviewed and revised as necessary approximately every 5 years to ensure that they align with current competencies needed on the job. The following section describes the process of revising the 2018 EA certification scheme and developing an improved 2022 EA certification program. Sections 5 and 6 provide the content of the revised 2022 EA certification JTA.

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[1] The ISO/IEC 17024:2012 standard contains the general requirements for bodies operating certification of persons. The standard includes requirements for the development and maintenance of the certification scheme for persons upon which the certification is based: https://anab.ansi.org/accreds/personnel-certification-programs/.
[2] https://sws.nrel.gov/installerbadges.

3 EA Certification Scheme Revision Process

The certification committee is a voluntary group comprised of subject matter experts with regional and industry diversity. A new combined EA and QCI scheme committee was selected for a 5-year term and in 2022, NREL held 21 virtual meetings with the QCI and EA scheme committee to review and validate the QCI and EA JTAs. The scheme committee completed a detailed crosswalk of the QCI and EA domain tasks, ability, and knowledge statements to identify necessary changes and updates. Updates to the QCI JTA can be found in a separate publication.

3.1 JTA Revision Process

From March–October 2022, NREL assembled a panel of 16 subject matter experts. In addition to updating the QCI and EA JTAs, this committee was tasked with validating and updating the QCI and EA scheme components. Professional Testing, Inc., a full-service provider of assessment, evaluation, and certification services, facilitated each of the virtual scheme revision meetings.

The first step in developing the updated EA JTA was to evaluate the major responsibilities or duties (i.e., performance domains) characterizing the practice of an EA. As a group, committee members were asked to assess the current relevance of the existing domains and add, edit, or remove content as needed. Additionally, the panel was instructed to remove any content that was the responsibility of a QCI. Next, the panel reviewed and revised the task, ability, and knowledge statements from the previous EA JTA. For its final major undertaking, the panel identified knowledge and ability statements for each task. During the review process, the committee noticed that manufactured housing knowledge and abilities were implied but not explicitly specified in the current JTA. The committee added several ability and knowledge statements to clarify the inclusion of manufactured housing.

3.2 JTA Phase II: Validation Study

Professional Testing, Inc. designed an online JTA validation questionnaire and sent it to industry stakeholders to corroborate the work of the committee, many of whom held current EA certifications in 2022. The first section asked respondents to rate each of the tasks on two rating scales: task importance[3] and task frequency.[4] The second section asked respondents to provide demographic information used to evaluate the representativeness of the respondents. The final task weighting from the validation process can be found in the exam blueprint in Section 6 of this report.

3.3 Results

During the QCI and EA scheme committee meetings, the committee members worked on the necessary updates to the certification scheme components. These included the prerequisite and recertification requirements, minimal competencies, job scope and descriptions, and other relevant aspects of the QCI and EA certification schemes.

[3] Task importance is defined as the potential for public harm if the task is performed incorrectly or not at all.
[4] Task frequency is defined as how frequently each task is performed.

The committee reviewed each item of the 2018 EA JTA, adding details where necessary. Manufactured housing details were added to make it clearer that the single-family EA possesses the knowledge, skills, and abilities to perform energy audits on both single-family and manufactured homes.

The following sections of this report are the results of the scheme committees' updates of the 2018 EA JTA, the foundation of the certification program. The following sections include the scope of certification; the EA JTA content outline; performance domains, tasks, ability, and knowledge statements; and the exam blueprint, which provides the ideal percentage of exam questions that should be asked about each domain.

4 EA Job Scope and Description

The EA is an experienced professional who evaluates the potential health and safety issues, durability, comfort, and energy use of a residential building. The EA conducts advanced diagnostic tests, gathers and analyzes data, and creates energy models to draw conclusions and make recommendations for improvements.

5 EA JTA

A JTA is the foundation for a valid credentialing program and identifies the core knowledge areas, critical work functions, and/or skills typically found across a representative sampling of current practitioners. Empirical results from a JTA provide examinees and the public with a valid, reliable, fair, and realistic assessment that reflects the knowledge, skills, and abilities required to competently perform a job.

5.1 DOMAIN I: Collection of Visual, Material, Dimensional, and Appliance Information About the Building for an Energy Audit

5.1.1 D1-Task 1: Document energy consumption

Ability to:

- Obtain 12 months of metered building utility bills
- Obtain unmetered annual fuel use information (e.g., oil, propane, solid fuel, etc.).

Knowledge of:

- How to access utility information
- Utility bill and client-stated usage.

5.1.2 D1-Task 2: Document the building history

Ability to:

- Determine the age of the original structure
- Determine if the building has historical significance.

Knowledge of:

- Where to access property record
- Historical preservation requirements (e.g., State Historic Preservation Office)
- General construction practices associated with different eras of buildings
- Location of mobile/manufactured homes data plate and information contained therein.

5.1.3 D1-Task 3: Conduct a physical/visual inspection of the building exterior

Ability to:

- Determine orientation of the building
- Identify components or issues that affect the structural integrity, durability, and energy efficiency of the building (e.g., holes, vents, land grading, shading, crawl space access, etc.)
- Identify mechanical penetration locations and compare with interior mechanical systems (e.g., exhaust fan terminations, chimneys, flues, etc.)
- Identify the cladding materials (e.g., siding, foundation, roofing, etc.)
- Identify issues on adjacent and/or connected buildings that could impact or be impacted by the audited building
- Identify evidence of pest/vermin infestations

- Identify evidence of water and/or structural damage
- Identify combustion appliance venting terminations.

Knowledge of:

- General construction (e.g., techniques, terminology, materials)
- Applicable codes and standards (e.g., International Codes Council [ICC], National Fire Prevention Association [NFPA])
- Healthy homes principles
- Situations that pose a health and/or safety risk
- Sources of moisture
- Occupational Safety and Health Administration (OSHA) safe work practices
- Abnormalities identified through other senses (e.g., unusual odors, sounds)
- Building science principles
- Geographical orientations
- Flood plains
- Mobile/manufactured homes construction (e.g., techniques, terminology, materials).

5.1.4 D1-Task 4: Conduct a physical/visual inspection of the building interior

Ability to:

- Identify components or issues that affect the structural integrity, durability, and energy efficiency of the building and the indoor environment (e.g., soffits, drop ceilings, ceiling penetrations, exhaust fans, electrical, plumbing and venting, interior building materials, damaged surfaces, etc.)
- Identify evidence of structural damage, water damage or leaking, and pest/vermin infestations
- Identify hidden or inaccessible spaces (e.g., crawl spaces, attics, interstitial areas)
- Identify conditions that would interfere with or prevent tests (e.g., active solid fuel burning, large hole in pressure boundary, nonfunctional appliance, lack of fuel, indoor air contaminants, etc.)
- Identify potentially hazardous materials in the building (e.g., asbestos, mold, lead, etc.)
- Identify health and safety issues (e.g., clutter, volatile organic compounds, lack of handrails, electrical hazards, etc.)
- Identify combustion appliance zone(s) (CAZ).

Knowledge of:

- General construction (e.g., techniques, terminology, materials)
- Applicable codes and standards (e.g., ICC, NFPA)
- Healthy homes principles
- Situations that pose a health and/or safety risk
- Sources of moisture
- OSHA safe work practices
- Abnormalities that may be identified through other senses (e.g., unusual odors, sounds)

- Building science:
    - Heat transfer mechanisms (e.g., convection, conduction, radiation)
    - Moisture transfer mechanisms (e.g., water vapor, bulk moisture)
    - Air transfer mechanisms (e.g., stack effect, pressure differences, etc.).

5.1.5 D1-Task 5: Collect health and safety data

Ability to:

- Determine the presence and condition of smoke and carbon monoxide alarms
- Verify that clothes dryers are properly vented to the exterior
- Verify that all exhaust fans are properly vented to the exterior
- Document any existence of hazardous materials/conditions
- Document moisture issues (e.g., standing water, condensation, plumbing leaks, mold, etc.)
- Document potential electrical hazards (e.g., frayed wiring, open junction boxes, overloaded circuits, active knob-and-tube wiring, etc.)
- Document suspected asbestos-containing materials
- Document potential lead-based paint hazards
- Document vented and unvented combustion appliances
- Document conditions that promote radon infiltration
- Document other potential indoor air quality hazards (e.g., volatile organic compounds, indoor smoking, etc.).

Knowledge of:

- Applicable codes, standards, and program requirements (e.g., ICC, NFPA, Asbestos Hazard Emergency Response Act, etc.)
- Healthy homes principles
- Domestic water heater safety
- Electrical hazards
- Hazardous materials
- Heating system safety
- Knob-and-tube wiring
- Issues and hazards associated with asbestos-containing materials
- Issues and hazards associated with lead-based paint
- Mobile/ manufactured homes combustion appliance regulations (see U.S. Department of Housing and Urban Development standard)
- Use of building cavities as supply or return air pathways
- Operation of smoke/carbon monoxide alarms
- Issues and hazards associated with radon
- Radon zones.

5.1.6 D1-Task 6: Collect appliance and base load information

Ability to:

- Collect household appliance tag data (e.g., refrigerator, dishwasher, dehumidifier, etc.)
- Collect heating, ventilation, and air conditioning (HVAC) and water-heating appliance tag data and documentation
- Document appliance energy source(s)
- Document water fixture flow rates
- Document type, location, and use of thermostats
- Document other components related to the HVAC appliances (e.g., expansion tanks, fill valves, remote compressors, etc.)
- Document other components related to the domestic water-heating appliances (e.g., storage tanks, mixing valves, etc.)
- Identify safety features related to the HVAC and water-heating appliances
- Collect lighting data (e.g., type, fixtures, wattage, usage)
- Document the number of occupants
- Identify appliances that use energy (e.g., Audio Visual, freezers, pool equipment, etc.)
- Document client energy-use habits
- Collect electrical service information (e.g., size, brand, amperage, etc.).

Knowledge of:

- Appliance types and energy sources
- Applicable codes, standards, and program requirements
- Domestic water heating types, components, and operation
- Heating/cooling system types, components, and operation
- Safety issues associated with domestic water-heating systems
- Thermostat set points, backup set points for heat pumps
- Water fixture operations and flow rates
- Mobile/ manufactured homes appliance types
- Alternative domestic water-heating technologies (e.g., heat pump water heater, solar thermal, indirect, etc.)
- Definition of base load
- Utility bill analysis, including base load calculation
- Electrical system components (e.g., breaker box, fuse box, etc.).

5.1.7 D1-Task 7: Collect conditioned building enclosure data

Ability to:

- Document pertinent building dimensional data (e.g., footprint, height, elevations, volume, etc.)
- Determine conditioned, unconditioned, and unintentionally conditioned spaces
- Assess alignment of thermal and pressure boundaries.

Knowledge of:

- Pressure boundary identification
- Thermal boundary identification
- Proper pressure and thermal boundary alignment.

5.1.8 D1-Task 8: Collect mechanical ventilation data

Ability to:

- Collect nameplate data for ventilation systems/equipment
- Determine the type of control (e.g., continuous, intermittent, or on-demand)
- Determine the condition of the ventilation ductwork/piping (e.g., pitch, insulation, size, material, elbows, length of run, terminations, etc.).

Knowledge of:

- Controls and motors
- Types of ventilation
- Ventilation ductwork
- Applicable codes, standards, and program requirements (e.g., ASHRAE 62.2).

5.1.9 D1-Task 9: Collect building insulation data (roof, attic, walls, and foundation/subspaces)

Ability to:

- Document insulation type(s)
- Measure insulation (e.g., thickness, depth)
- Document insulation condition
- Document insulation coverage
- Document presence and placement of vapor retarders
- Document roof insulation (e.g., flat roofs with rigid insulation board, etc.)
- Document and evaluate the mobile/ manufactured homes road barrier/belly.

Knowledge of:

- Insulation types
- Insulation effectiveness
- Insulation R-values
- Effective R-values
- Insulation installation best practices
- OSHA safety requirements
- How to interpret infrared imaging
- Mobile/manufactured homes insulation installation best practices
- Vapor retarders.

5.1.10 D1-Task 10: Collect attic data

Ability to:

- Document attic details (e.g., drop soffit, rafters, joists, inaccessible areas, floored areas, bowstring truss, half truss roof, marriage wall, etc.)
- Document attic type (e.g., finished, unfinished, knee-wall, cathedral, etc.)

- Document existing attic ventilation type and size (e.g., soffit vents [baffles], ridge, power roof vent, etc.)
- Document potential fire hazards (e.g., non-insulation contact (IC) rated recessed lights, heat lamps, chimneys, flues, furnaces, electrical devices, etc.)
- Document sources/evidence of water damage
- Document air leakage in the pressure boundary (e.g., penetrations, chases, balloon framing, top plate, knee wall, etc.)
- Document bypasses, misalignments, or missing insulation in the thermal boundary
- Document types, locations, and conditions of access
- Document potential electrical hazards
- Document evidence of pest/vermin infestations
- Document potential structural integrity issues
- Document presence and condition of whole-house fans
- Determine attic uses (e.g., storage, finished, unfinished, etc.)
- Document the presence and condition of any radiant barriers.

Knowledge of:

- Attic components
- General construction (e.g., techniques, terminology, materials)
- Air leakage points
- Required clearance to combustibles
- Potential safety hazards (e.g., electrical hazards, nails, rafters, heat exposure, etc.)
- Signs of water damage
- Sings of pest/vermin infestations
- How to interpret infrared imaging
- Ventilation requirements
- OHSA safety requirements (e.g., ladder usage, confined spaces, personal protective equipment, etc.)
- Attic components for mobile/manufactured homes.

5.1.11 D1-Task 11: Collect wall data

Ability to:

- Document wall thickness and/or cavity depths
- Document wall types (e.g., masonry, adobe, balloon frame, platform frame, etc.)
- Document wall finishes (e.g., stucco, brick, vinyl, metal, wood, drywall, plaster, paneling, etc.)
- Document wall components (e.g., back plastering, tar paper, fire blocking, etc.)
- Document presence and type of wall insulation
- Document wall orientation
- Document sources and evidence of water damage
- Document air leakage locations
- Document evidence of pest/vermin infestation
- Document wall exposure (e.g., above grade, below grade, buffered, etc.).

Knowledge of:

- General construction (e.g., techniques, terminology, materials)
- Mobile/manufactured homes construction (e.g., techniques, terminology, materials)
- Air leakage points
- Typical wall framing and components (e.g., platform, balloon, post and beam, etc.)
- Unique characteristics of framing methods (e.g., use of upper-story band joists, angle bracing in post and beam framing, etc.)
- How to interpret infrared imaging.

5.1.12 D1-Task 12: Collect window and door data

Ability to:

- Document window and door dimensions
- Document window and door locations and orientations
- Document window types (e.g., jalousie, awning, single-hung, double-hung, storm, etc.)
- Document window frame materials (e.g., wood, metal, vinyl, fiberglass, etc.)
- Document window glazing types (e.g., single pane, double pane, triple pane, reflective, low-E, etc.)
- Document presence and coverage of interior and exterior shading
- Document condition of windows, including hardware, seals, and operation (e.g., air leaks, water leaks, locks, cracks, missing glazing, rotted sashes, lead paint, etc.)
- Document door type and materials (e.g., french doors, dutch doors, in or out swing, insulated, metal, wood, solid core, hollow core, etc.)
- Document condition of doors, including hardware, door sweep, seals, and operation (e.g., air leaks, water leaks, locks, cracks, missing glazing, rotted sashes, lead paint, etc.).
- Determine thermal characteristics of windows and doors (e.g., R-value, glazing, etc.).

Knowledge of:

- Mobile/manufactured homes window and door construction, components, hardware, and terminology/nomenclature
- Presence of lead paint
- Window and door construction, components, hardware, and nomenclature
- R- and U-values
- Emissivity of glass.

5.1.13 D1-Task 13: Collect foundation/subspace data

Ability to:

- Document foundation/subspace types (e.g., crawl space, basement, slab on grade, etc.)
- Document foundation materials (e.g., post and beam, piers, skirting, poured concrete, masonry blocks, etc.)
- Document air leakage in the pressure boundary (e.g., penetrations, chases, balloon framing, sill plate, rim joist, etc.)
- Document bypasses, misalignments, or missing insulation in the thermal boundary

- Document foundation/subspace existing ventilation type and size (e.g., crawl space vents, etc.)
- Document potential sources and evidence of moisture issues (e.g., presence or condition of ground vapor retarder, standing water, leaks, mold, ground cover-dirt, etc.)
- Document type, locations, and conditions of access
- Document potential electrical hazards
- Document evidence of pest/vermin infestations
- Document potential structural integrity issues
- Document special equipment (e.g., sump pumps, dehumidifiers, heat tape, etc.)
- Document and evaluate the mobile/ manufactured homes road barrier/belly.

Knowledge of:

- Applicable codes, standards, and program requirements
- Crawl space ventilation requirements
- Foundation construction materials and methods
- OHSA safety requirements (e.g., ladder usage, confined spaces, personal protective equipment, etc.)
- Signs of structural hazards on foundations
- How to interpret infrared imaging
- Signs of pest/vermin infestations
- Mobile/manufactured homes belly and skirting construction materials and methods.

5.1.14 D1-Task 14: Collect roof data

- Document roof types (e.g., parapet, mansard, gambrel, gable, etc.)
- Document roof condition(s) (e.g., debris, age, deterioration, damage, etc.)
- Document roof color(s)
- Document roofing materials (e.g., membrane, shingle, metal, etc.)
- Document roof penetrations (e.g., skylights, chimneys, vents, etc.)
- Document the presence and condition of roof drainage (e.g., slopes, gutters, downspouts, etc.)
- Document the flashing condition (e.g., missing, damaged, deteriorated etc.)
- Document roof shading and orientation
- Document roof pitch.

Knowledge of:

  - Insulation materials and methods
  - OSHA requirements (e.g., ladder usage, confined spaces, personal protective equipment, etc.)
  - Roofing construction methods
  - Roofing materials
  - Mobile/ manufactured homes roofing construction methods and materials.

5.2 DOMAIN II: Diagnostic Testing of the Dwelling Unit for an Energy Audit

5.2.1 D2-Task 1: Prepare the dwelling unit for the test(s)

Ability to:

- Determine the test(s) to be performed (e.g., blower door test, duct leakage test, combustion safety testing, etc.)
- Prepare the building and equipment for testing based upon industry protocols.

Knowledge of:

- Building diagnostic testing (e.g., set building for wintertime conditions, zero out equipment, etc.)
- Test protocols.

5.2.2 D2-Task 2: Test the electric appliances

Ability to:

- Inspect appliances for test accessibility
- Determine the appliance(s) energy usage (e.g., using a watt-hour meter, using data from an industry-accepted resource, etc.).

Knowledge of:

- Electric appliance metering
- Manufacturer's instructions/guidelines
- Electric appliance safety.

5.2.3 D2-Task 3: Test indoor air quality

Ability to:

- Measure levels of targeted indoor air pollutants (e.g., carbon monoxide, combustible gases, etc.)
- Determine if the pollutants exceed any applicable action levels
- Determine need for further testing.

Knowledge of:

- Indoor air pollutant exposure systems
- Indoor air pollutant action levels
- Applicable codes, standards, and program requirements (e.g., ASHRAE 62.2, U.S. Environmental Protection Agency, National Institute for Occupational Safety & Health, OSHA, etc.)
- How to measure relative humidity
- Source of pollutants
- Safe entry procedures.

5.2.4 D2-Task 4: Determine the safety and efficiency of combustion appliances

Ability to:

- Inspect the fuel supply lines for issues (e.g., leaks, kinks, corrosion, etc.)
- Perform combustion safety tests (e.g., CAZ depressurization and spillage, carbon monoxide, etc.)
- Perform combustion analysis (e.g., oxygen, stack temperature, steady-state efficiency, carbon monoxide, oil burner smoke test, etc.)
- Perform inspection of combustion appliance venting (e.g., sizing, condition, configuration, etc.)
- Determine the presence and condition of associated equipment (e.g., backdraft dampers, power vents, barometric damper, sight glass, water level controls, direct vent appliance intakes, etc.)
- Measure CAZ volume
- Measure ambient carbon monoxide levels during testing.

Knowledge of:

- Mobile/manufactured homes combustion appliance regulations (e.g., U.S. Department of Housing and Urban Development standard 24 CFR Part 3280)
- Applicable codes, standards, and program requirements (e.g., NFPA, etc.)
- Combustion efficiency test procedures (e.g., oxygen, stack temperature, steady-state efficiency, etc.)
- Fuel line leak testing techniques applicable to each fuel type
- Heating system type (e.g., forced air heater, hydronic heater, steam heater, unit heater, space heater, wood burning, etc.)
- Annual fuel utilization efficiency versus steady-state efficiency
- Combustion safety test procedures
- Venting types, materials, methods, and safety issues (e.g., venting categories)
- CAZ testing protocols
- Clearance to combustibles.

5.2.5 D2-Task 5: Determine air leakage of the building envelope

Ability to:

- Perform blower door tests to industry standards
- Perform single point zone pressure diagnostics (e.g., garages, crawl spaces, attics, etc.)
- Perform pressure pan tests
  Determine points of infiltration/exfiltration (e.g., infrared, smoke, sensory, etc.).

Knowledge of:

- Advanced blower door diagnostics (e.g., zone pressure diagnostics, pressure pans, manometer, etc.)
- Blower door testing procedures (e.g., when and how to pressurize or depressurize, etc.)
- Blower door assembly and operation

- How to interpret infrared imaging
- Industry-recognized blower door testing standards.

5.2.6 D2-Task 6: Determine the performance of HVAC distribution

Ability to:

- Perform a duct leakage test on a forced air system
- Measure room temperatures
- Determine if hydronic radiators are operating
- Measure the supply and return of water temperature in a hydronic distribution system
- Locate points of duct leakage
- Measure temperature rise across heat exchangers/cooling coils
- Measure static pressure
- Inspect hydronic distribution for leaks
- Determine the need for pressure balancing
- Measure mechanical ventilation flow rates (e.g., exhaust fans, supply fans, balanced ventilation, etc.).

Knowledge of:

- HVAC distribution testing protocols (e.g., total duct leakage, duct leakage to outside, use of a pressure pan, etc.)
- HVAC terminology (e.g., air handler, trunk line, supply/return, crossover duct, etc.)
- Manufacturer's specifications
- Distribution system design and materials (e.g., forced air, hydronic, etc.)
- Best practices for duct sealing
- Mobile/manufactured homes return duct modification techniques
- Mechanical ventilation systems (e.g., exhaust, supply, balanced, etc.)
- Applicable codes, standards, and program requirements (e.g., ASHRAE 62.2, Air Conditioning Contractors of America, etc.)
- Air flow testing protocols (e.g., exhaust fan flow meter, etc.)
- Pressure balancing testing and techniques (e.g., undercut door, return air pathway, jumper duct, etc.).

5.3 DOMAIN III: Evaluation of Collected Energy Audit Data to Determine the Scope of Work

5.3.1 D3-Task 1: Evaluate the health and safety data

Ability to:

- Determine potential health and safety concerns
- Determine if health and safety issues can be addressed through an energy efficiency measure
- Determine the repair options.

Knowledge of:

- Potential contaminants as related to work scope (e.g., mold, lead, asbestos-containing materials, radon, etc.)
- Repair/remediation methods (e.g., fix plumbing leak, lead-safe work practices, radon mitigation, etc.)
- The need for specialty licensure (e.g., asbestos remediation/encapsulation, knob and tube removal, etc.)
- Applicable codes, standards, and program requirements.

5.3.2 D3-Task 2: Evaluate the durability/structural integrity of the building

Ability to:

- Determine potential durability/structural integrity issues
- Determine the repair options
- Determine if further evaluation is recommended.

Knowledge of:

- Building science:
    - Heat transfer mechanisms (e.g., convection, conduction, radiation)
    - Moisture transfer mechanisms (e.g., water vapor, bulk moisture)
    - Air transfer mechanisms (e.g., stack effect, pressure differences, etc.).
- General construction (e.g., techniques, terminology, materials)
- General mobile/manufactured homes construction (e.g., techniques, terminology, materials)
- Applicable codes, standards, and program requirements.

5.3.3 D3-Task 3: Evaluate the HVAC system

Ability to:

- Determine if there are health and safety concerns (e.g., suspected asbestos-containing materials, etc.)
- Determine HVAC sizing for building
- Evaluate the need for distribution modification
- Evaluate fuel-switching options
- Determine the need to clean and tune, repair, or replace
- Evaluate the need for and supply of combustion air
- Evaluate the HVAC system for replacement or upgrades (e.g., condition, age, efficiency, sizing, etc.)
- Determine duct sealing/insulation and pipe insulation opportunities.

Knowledge of:

- HVAC load and sizing calculations (e.g., Air Conditioning Contractors of America manual D, J, S, T, etc.)
- General heating/cooling system function and operations
- Combustion air requirements

- HVAC system repair, replacement, or upgrade options
- Program requirements related to duct leakage
- Combustion vent sizing and installation requirements
- Applicable codes, standards, and program requirements (e.g., ASHRAE 62.2)
- Air-Conditioning, Heating, and Refrigeration Institute equipment certification
- Mobile/manufactured homes approved HVAC equipment
- Fuel delivery sizing and installation requirements (e.g., pipe sizing, electrical service, etc.).

5.3.4 D3-Task 4: Evaluate the mechanical ventilation

Ability to:

- Compare measured flow with ventilation requirements
- Determine the mechanical ventilation needs (e.g., repairs, replacements, additions, make-up air, etc.)
- Determine the type of ventilation controls needed
- Calculate the building ventilation requirements.

Knowledge of:

- Applicable codes, standards, and program requirements (e.g., ASHRAE 62.2)
- Mechanical ventilation systems and controls
- Optimal ventilation strategy based on client/program needs (e.g., optimize indoor air quality, avoid excessive CAZ depressurization, repair existing fans to reduce costs, etc.)
- Ventilation system sizing and installation.

5.3.5 D3-Task 5: Evaluate energy use

Ability to:

- Determine if replacements or upgrades will reduce energy consumption
- Analyze utility bills and fuel usage and calculate base loads.

Knowledge of:

- Base loads (e.g., lighting, electronics, domestic hot water, appliances, etc.)
- Base load calculation
- Seasonal loads (e.g., heating, cooling, etc.)
- Base load reduction strategies (e.g., reduce the number of appliances, client education, etc.)
- How occupant behavior affects energy consumption
- Unusual energy-use patterns.

5.3.6 D3-Task 6: Evaluate the foundation/subspace

Ability to:

- Determine if repairs are needed (e.g., plumbing, floors, etc.)
- Determine if insulation and/or air sealing is needed

- Determine the proper location for insulation and/or air sealing (e.g., floor, walls, sills, perimeter, cantilever floor, etc.)
- Determine the type of insulation materials to be added
- Calculate required ventilation and determine if the existing ventilation is appropriate
- Determine a moisture management strategy (e.g., site drainage, vapor barrier, etc.).

Knowledge of:

- Building science:
    - Heat transfer mechanisms (e.g., convection, conduction, radiation)
    - Moisture transfer mechanisms (e.g., water vapor, bulk moisture)
    - Air transfer mechanisms (e.g., stack effect, pressure differences, etc.).
- Foundation construction types (e.g., poured, block, rubble, limestone, etc.)
- Insulation density requirements and bag count calculations
- Foundation crawl space ventilation strategies (e.g., vented versus unvented, etc.)
- Foundation crawl space requirements
- Applicable codes, standards, and program requirements (e.g., International Residential Code, ICC, etc.)
- Foundation/subspace insulation (e.g., types, strategies, requirements)
- Foundation/subspace types (basements, crawl spaces, inaccessible crawl spaces, conditioned/unconditioned, slab, etc.)
- Vapor barriers (e.g., types, locations, purposes, etc.)
- Mobile/ manufactured homes floor and skirting construction/insulation (e.g., types-wings, joist directions, square belly, round belly, flat belly, etc.)
- OSHA safety requirements (e.g., ladder usage, confined spaces, personal protective equipment, etc.).

5.3.7 D3-Task 7: Evaluate the walls

Ability to:

- Determine if repairs are needed
- Determine if insulation opportunities exist
- Determine if air-sealing opportunities exist
- Determine the type of insulation materials to be added
- Determine the square footage of the area to be insulated
- Determine if the pressure boundary and thermal boundary align
- Determine if the vapor retarder is present and appropriately placed
- Determine if band joists insulation and/or air-sealing opportunities exist (e.g., upper stories)
- Determine the impact of potential health and safety issues (e.g., lead-based paint, asbestos-containing materials, electrical hazards, moisture, etc.)
- Determine a moisture management strategy (e.g., drainage, flashing, etc.).

Knowledge of:

- U.S. Environmental Protection Agency and DOE lead and asbestos standards

- Building science:
    - Heat transfer mechanisms (e.g., convection, conduction, radiation)
    - Moisture transfer mechanisms (e.g., water vapor, bulk moisture)
    - Air transfer mechanisms (e.g., stack effect, pressure differences, etc.).
- Applicable codes, standards, and program requirements
- Insulation types, techniques, and strategies
- Pressure and thermal boundaries
- Mobile/manufactured homes wall insulation types, techniques, and strategies (e.g., batt stuffing, blown fiberglass, etc.)
- Typical site-built wall structures (e.g., platform, balloon, post and beam, etc.)
- Vapor retarder placement in walls based on climate
- Moisture management strategies
- Typical R-values of insulation materials
- Gross versus net wall area calculation
- Insulation density requirements and bag count calculations
- Typical mobile/manufactured homes wall structures and materials (e.g., belt rails, cavity depth, cladding, etc.).

5.3.8 D3-Task 8: Evaluate the attic

Ability to:

- Determine if repairs are needed
- Determine if insulation opportunities exist
- Determine the type of insulation materials to be added
- Determine if air-sealing opportunities exist
- Determine if the pressure boundary and thermal boundary align
- Determine if the vapor barrier is present and appropriately placed
- Calculate required ventilation and determine if the existing ventilation is appropriate
- Determine if attic access must be created or changed
- Determine the impact of potential health and safety issues (e.g., heat sources, asbestos-containing materials, obvious electrical hazards, moisture, etc.)
  Determine needed attic preparation (e.g., baffles, rulers, boxing/damming, stored items, etc.).

Knowledge of:

- Attic construction and materials
- Attic fire hazards
- Mobile/manufactured homes insulation and air-sealing strategies
- Attic insulation and air-sealing strategies
- Attic ventilation standards
- Mobile/manufactured homes attic ventilation standards and best practices
- Mobile/manufactured homes roof/attic construction and materials
- Building science:

    - Heat transfer mechanisms (e.g., convection, conduction, radiation)
    - Moisture transfer mechanisms (e.g., water vapor, bulk moisture)
    - Air transfer mechanisms (e.g., stack effect, pressure differences, etc.).
- Applicable codes, standards, and program requirements
- Pressure and thermal boundaries
- Insulation density requirements and bag count calculations
- Repair techniques (e.g., ceiling, roof, and framing repair, etc.)
- Preparation needed for attic insulation and air sealing (e.g., moving stored materials, fixing roof leaks, electrical repair, etc.)
- Area-weighted average R-value (e.g., parallel path).

5.3.9 D3-Task 9: Evaluate the doors and windows

Ability to:

- Determine if door and window components must be repaired or replaced
- Evaluate the condition of and/or need for storm doors and windows
- Evaluate door and window components and performance
- Determine if insulation opportunities exist
- Determine if air-sealing opportunities exist
- Determine the impact of potential health and safety issues (e.g., lead-based paint, asbestos-containing materials, moisture, etc.)
- Determine if window film opportunities exist.

Knowledge of:

- Applicable codes, standards, and program requirements
- Building science:
    - Heat transfer mechanisms (e.g., convection, conduction, radiation)
    - Moisture transfer mechanisms (e.g., water vapor, bulk moisture)
    - Air transfer mechanisms (e.g., stack effect, pressure differences, etc.).
- Framing techniques
- Door and window installation techniques (e.g., flashing, drainage plane, etc.)
- Door and window types
- Door and window components
- Door and window glazing
- Mobile/manufactured homes window and door construction, components, hardware, and nomenclature
- U.S. Environmental Protection Agency, DOE, and OSHA requirements (e.g., asbestos, lead).

5.3.10 D3-Task 10: Conduct energy analysis

Ability to:

- Determine pertinent input data

- Analyze the output from the energy analysis (e.g., modeling software, spreadsheets, etc.)
- Produce an energy savings report
- Determine the economics of recommended measures (e.g., savings-to-investment ratio, return on investment, etc.).

Knowledge of:

- Basic construction terminology and components
- Building science:
    - Heat transfer mechanisms (e.g., convection, conduction, radiation)
    - Moisture transfer mechanisms (e.g., water vapor, bulk moisture)
    - Air transfer mechanisms (e.g., stack effect, pressure differences, etc.).
- Energy modeling principles
- Energy-saving calculations
- How to determine cost estimates.

5.3.11 D3-Task 11: Generate the recommended work scope

Ability to:

- Specify health and safety measures
- Specify building durability measures
- Specify energy conservation measures
- Specify measures that address occupant concerns (e.g., comfort, carbon footprint, etc.)
- Specify incidental/related repairs
- Determine potential health and safety impacts or consequences from the recommended measures
- Specify materials, quantities, and labor hours to install measures
- Specify methods and materials to ensure the integrity and durability of the measures installed
- Determine work specifications (e.g., Standard Work Specifications, building code, etc.).

Knowledge of:

- Building science:
    - Heat transfer mechanisms (e.g., convection, conduction, radiation)
    - Moisture transfer mechanisms (e.g., water vapor, bulk moisture)
    - Air transfer mechanisms (e.g., stack effect, pressure differences, etc.).
- General construction (e.g., techniques, terminology, materials)
- General mobile/manufactured homes construction (e.g., techniques, terminology, materials)
- Energy modeling principles
- Energy-saving calculations
- How to determine cost estimates
- Interpretation of energy savings/modeling outputs
- Cost-benefit analysis

- Leveraged funding opportunities
- Allowable measures
- Available program incentives
- Sequencing of work best practices
- Effects of change orders on cost-effectiveness
- Estimating labor hours and materials.

6 EA Exams Blueprint

Table 1 outlines the percentage of domain and tasks that should appear on the written exam developed by a certifying body based on the industry validation study. The scheme committee identified tasks that should be performance-tested (e.g., field). Four field items were identified as gated by the committee (Table 2). Gated tasks are defined as tasks that must be completed successfully to pass the exam. Certifying bodies licensed to the EA scheme should develop their examinations based on this blueprint.

Table 1. EA Exam Domain/Task Percentages

Domain and Tasks	Final Percentages (Written)	Field
DOMAIN 1: Collection of Visual, Material, Dimensional, and Appliance Information About the Building for an Energy Audit	**44%**	
Task 1: Document energy consumption	2%	N/A
Task 2: Document the building history	2%	N/A
Task 3: Conduct a physical/visual inspection of the building exterior	5%	Yes
Task 4: Conduct a physical/visual inspection of the building interior	5%	Yes
Task 5: Collect health and safety data	4%	Yes
Task 6: Collect appliance and base load information	2%	Yes
Task 7: Collect conditioned building enclosure data	3%	Yes
Task 8: Collect mechanical ventilation data	2%	N/A
Task 9: Collect building insulation data (roof, attic, walls, and foundation subspace)	4%	Yes
Task 10: Collect attic data	3%	N/A
Task 11: Collect wall data	3%	Yes
Task 12: Collect window and door data	3%	Yes
Task 13: Collect foundation/subspace data	3%	N/A
Task 14: Collect roof data	3%	N/A
DOMAIN 2: Diagnostic Testing of the Dwelling Unit for an Energy Audit	**19%**	
Task 1: Prepare the dwelling unit for the test(s)	2%	Yes
Task 2: Test the electric appliances	2%	N/A
Task 3: Test indoor air-quality (e.g., carbon monoxide, combustible gases, etc.)	4%	Yes
Task 4: Determine the safety and efficiency of combustion appliances	4%	Yes
Task 5: Determine air leakage of the building envelope	4%	Yes
Task 6: Determine the performance of HVAC distribution	3%	Yes

DOMAIN 3: Evaluation of Collected Energy Audit Data to Determine the Scope of Work	37%	
Task 1: Evaluate the health and safety data	4%	N/A
Task 2: Evaluate the durability/structural integrity of the building	4%	N/A
Task 3: Evaluate the HVAC system	4%	N/A
Task 4: Evaluate the mechanical ventilation	3%	N/A
Task 5: Evaluate energy use	2%	N/A
Task 6: Evaluate the foundation/subspace	3%	N/A
Task 7: Evaluate the walls	3%	N/A
Task 8: Evaluate the attic	3%	N/A
Task 9: Evaluate the doors and windows	3%	Yes
Task 10: Conduct energy analysis	4%	N/A
Task 11: Generate the recommended work scope	4%	N/A
Total	100%	

Table 2. Gated Items

Gated Items
1. Candidate prepared combustible gas and carbon monoxide measurement instruments per manufacturer's instructions. (Domain 2-task 3)
2. Candidate tested indoor ambient carbon monoxide levels and took appropriate action according to the current standard of reference. (Domain 2-task 3)
3. Candidate tested indoor air levels for carbon monoxide throughout combustion safety and efficiency testing and took appropriate action according to current standard of reference. (Domain 2- task 3)
4. Candidate ensured that combustion appliances cannot fire during the blower door testing. (Domain 2-task 1)