



Guiding Principles for Conducting Electrification Energy Audits on 1 – 4 Family Dwellings



Notice

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Acknowledgements

The Building Performance Institute, Inc. would like to thank all of the dedicated professionals who have participated in the development of this document.

Disclaimer

An Electrification Energy Audit assesses and characterizes home-based energy usage, and specific health and safety hazards by integrating qualitative observations with limited quantitative diagnostics to determine and prioritize recommendations to reduce a home's use of fossil-fueled appliances. The information contained in the resulting audit report communicates recommendations to the occupant with the goal of reducing total energy usage, reducing usage of fossil-fueled appliances operating in the home, alternative energy sources, environmental health and safety upgrades, and improving quality of life.

It is understood and agreed that this audit will be of the readily accessible areas of the subject building and is limited to observations of apparent conditions existing only at the time of the audit. Latent and concealed defects and deficiencies are excluded from the audit.

Maintenance, repairs, possible fixes, recommendations, and other similar items may be discussed during the audit and referenced in the report, but they are not to be considered technically exhaustive or to cover every possible condition. The evaluation and report are not a compliance inspection or certification for past or present governmental codes, regulations, ordinances, statutes, or special utility restrictions of any kind.

The client ("Homeowner") agrees that auditor ("Contractor"), its agents and employees shall not be liable or responsible for the cost of repairing or replacing any reported or unreported energy usage, and/or health and safety hazard, either current or arising in the future; or for any and all claims, losses, expenses, injuries, or damages arising out of or in any way related to the reported or unreported energy usage, and/or health and safety hazard by reason of any act or omission, including breach of contract or negligence. The parties further agree that Contractor shall not be liable to Homeowner for any special or consequential damages, including but not limited to lost profits, loss of use, and costs of replacement, caused by the Contractor's negligence, breach of contract, or any other cause whatsoever.

The parties acknowledge that this evaluation and report are not intended, or to be used, as a guarantee or warranty, expressed or implied, regarding the adequacy, performance or condition of any evaluated structure, item, or system. The parties further acknowledge that Contractor is not an insurer and that the evaluation and report are not insurance against any health and safety hazard condition(s).

Notwithstanding the foregoing, it is understood and agreed that if Contractor is found liable to Homeowner as a result of failure to perform any of its obligations, including but not limited to failure as a result of negligence, breach of agreement, or otherwise, the liability of Contractor, its agents and employees shall be limited to a sum equal to the amount of the fee paid by the Homeowner for the evaluation and report.

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1. Scope

- 1.1. These guiding principles outline the procedures for conducting an Electrification Energy Audit on 1 – 4 family dwellings while using readily available remote or virtual resources and consumer engagement to focus on energy efficiency opportunities as a means of load/demand reduction as well as reduced energy consumption and to ready the structure for heat pump installation.
- 1.2. The audit will include limited aspects of building durability and occupant health and safety, and alternative energy sources, as a goal to provide a comprehensive report with a list of prioritized recommendations to decarbonize the dwelling.

2. Purpose

The procedures were developed to utilize available resources for completing on-site fossil-fuel reduction/removal audits on 1-4 family dwellings using remote protocols that limit the amount of time required at the site, while developing a plan to reduce energy consumption as efficiently and cost-effectively as possible.

3. Building Types

Residential building types covered are defined as existing 1-4 family dwellings. (Consistent with IRC)

4. Guideline Use

- 4.1. Electrification audits shall be based on building science principles and include the use of appropriate technologies for assessing the improvement of energy efficiency and comfort while minimizing health and safety hazards.
- 4.2. These principles do not supplant ANSI/BPI-1200-S-2017 Standard Practice for Basic Analysis of Buildings, but rather provide an alternative method for completing energy audits and collecting data for establishing a scope of work.
- 4.3. Electrification is defined as replacing systems and/or appliances that use fossil fuels (coal, oil, propane, and natural gas) with systems and/or appliances that use electricity.
- 4.4. Decarbonization is defined as the reduction, then elimination, of carbon dioxide emissions at the dwelling through the use of low carbon or no-carbon options, achieving a lower output of greenhouse gasses by moving away from energy systems that produce carbon dioxide (CO₂) and other greenhouse gas emissions.
- 4.5. There are many components to an electrification audit that can be completed remotely, virtually, or with low-touch options. To be as efficient as possible in an audit, pre-work can be done remotely but it is not required as the entire electrification audit protocol can be done in the dwelling.
- 4.6. These guidelines, while targeting fossil-fueled appliances and total energy use in 1 – 4 family dwellings are not necessarily standalone and shall be used in conjunction with BPI's parent document Guiding Principles for Conducting Remote Audits on Single-Family Homes.
- 4.7. Not all audits will be able to be completed strictly remotely or virtually and may require some portion of an on-site visit for verification or data collection/diagnostic testing. The guiding principles are divided into four areas reflecting this:
 - 4.7.1. **Remote Audit** – The remote audit can be a low-touch, cost-effective way to gather information that is obtained online, through discussion with the homeowner/occupant, images and pictures, and inferred such as codes in place at time of construction.

- 4.7.2. **Virtual Audit** – Virtual audits can also be a low-touch, cost-effective way using available technologies, such as streaming technology between the auditor and the occupant in a guided walkthrough of the building to gather information, and/or through the use of data-driven virtual energy models using available information (e.g., public property tax information).
- 4.7.3. **On-Site Verification** – Audit information that may need further investigation/verification that couldn't be completely obtained or verified through the remote or virtual process such as heating/cooling appliance information, thermal boundaries, air sealing opportunities.
- 4.7.4. **On-Site Inspection Only** – Audit information that can only be obtained on-site such as combustion safety testing, whole building air leakage rates.

5. Audit Report Requirements

Document all findings, and where deficiencies and/or opportunities exist include recommendations for improvement measures in the audit report. Recommendations shall be in accordance with ANSI/BPI-1200-S-2017 where applicable.

6. Health and Safety Related Requirements

The health and safety requirements included in these protocols 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 dwelling.

7. Combustion Appliance and Fuel Distribution System Inspection

The audit shall include visual inspection and/or recommendations for a combustion safety assessment of those combustion appliances and fuel distribution systems not being replaced immediately.

8. Indoor Air Quality and Ventilation

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

9. Moisture Control

The audit shall include a visual/sensory inspection of each dwelling for moisture issues in accordance with ANSI/BPI-1200-S-2017.

10. Building Enclosure

The audit shall include an evaluation of the building enclosure to include both pressure and thermal boundaries, completed in accordance with the Pressure and Thermal Boundary Checklists provided in Annexes D and E of these Principles.

11. Heating, Cooling, and Domestic Water Heating Systems

The audit shall include an inventory of the heating, cooling, and domestic water heating systems in the dwelling.

12. Baseload Energy Efficiency

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

13. Best Practices

- 13.1. Electrification audits shall be completed remotely or virtually when possible. However, not all electrification energy audits can be completed strictly remotely or virtually and may require some portion of an on-site visit. All efforts shall be made to utilize cost-effective, low-touch strategies to reduce the amount of the time on site.
- 13.2. The use of online resources to allow the homeowner to directly upload information needed to complete a reliable and valid electrification audit such as user-friendly energy audit software and smartphone apps shall be utilized.
- 13.3. Homeowner shall be provided information on the upgraded vs. not upgraded energy usage and cost.
- 13.4. Not all locations are candidates for full electrification and/or decarbonization efforts. The audit shall include an assessment of supply-side capabilities, and shall include construction and property details to identify roadblocks for the routing of wiring, installation of equipment, air sealing and insulation measures, etc.
- 13.5. All efforts shall be made to reduce the existing electrical energy usage before electrification or decarbonization attempts of the building. Energy efficient lighting and plug load measures shall be prioritized to achieve this.
- 13.6. All efforts shall be made to reduce the heating and cooling load of the building prior to installing electric heating/cooling sources such as heat pumps. The building's thermal and pressure boundary shall be a priority by recommending air sealing and insulation measures along with energy efficient windows and doors to achieve this.
- 13.7. When a heat pump is proposed to be installed prior to reducing the heating and cooling load of the building, it is recommended to size a heat pump to future reduced loads and provide supplemental backup to match existing load. Customers shall be informed of the difference in heat pump sizing with and without load reduction work.
- 13.8. The recommended decommissioning guidelines are based on best practices. The participating contractor overseeing work is responsible for complying with all applicable federal, state, and municipality laws, regulations, and codes whenever a homeowner elects to have an existing fossil fuel space heating or domestic hot water (DHW) heating appliance retired or removed in conjunction with the installation of an eligible heat pump system.

14. Conducting Electrification Audits

Refer to Table 14.1.

Table 14.1 Conducting Electrification Audits	
<p>Homeowner Generated</p> <ol style="list-style-type: none"> 1. Homeowner completes a portion or all of the audit using: <ol style="list-style-type: none"> a. Data collection forms to be completed by homeowner <ol style="list-style-type: none"> i. Online/internet-based software or smartphone app ii. Contractor-guided streaming technology conducted by the homeowner using smart device <p>Auditor/Contractor Generated</p> <ol style="list-style-type: none"> 2. Auditor collected data using: <ol style="list-style-type: none"> a. Web-based accessible resources either directly or through software or an app that compiles this data <ol style="list-style-type: none"> i. Utility bills ii. Tax rolls iii. Multiple Listing Service iv. Flood tracking database 3. Interview with homeowner (in-person, phone, video call, etc.) <ol style="list-style-type: none"> a. Inventory of baseload appliances and lighting b. Inventory of fossil-fueled appliances c. Concerns about comfort, IAQ, etc. 	
Homeowner Qualification	<ol style="list-style-type: none"> 1. Determine if the homeowner has the ability and resources to complete a remote audit or participate in virtual audit. 2. Greet homeowner and determine ability (physically, technically, etc.) of homeowner to participate in the audit. If homeowner is willing and able to participate in remote or virtual audit, schedule audit call.
Data Collection	When possible, obtain building data through online research, homeowner interviews, and/or pre-audit data collection. Data collection forms completed by homeowner are encouraged.
Building Characteristics	Obtain building characteristics, such as year built, housing type, conditioned floor area, orientation, number of bedrooms, using online research, publicly available data sets, or Annex A Homeowner/Occupant Questionnaire, or both.
Utility Data	<ol style="list-style-type: none"> 1. Obtain available building utility data, including account name and usage information for each account and fuel type. 2. Use energy consumption records, when available, to perform a baseline energy use analysis.

Table 14.1 Conducting Electrification Audits (cont.)

Introduction and Homeowner Interview	<ol style="list-style-type: none">1. Introductory conversation and overview of audit process and goals.2. Review of homeowner concerns and goals, planned projects, recently completed projects, etc.3. Determine homeowner interests including moving plans, completed or planned construction projects including solar, completed or planned major purchases including electric vehicle(s), etc.4. Discuss high-level budget, timing, and priority concerns.5. With homeowner, assess risk of water intrusion in severe weather.6. Verify information obtained from other resources with homeowner.
On-Site Verification	
Verify questionable data and other data that could not be fully determined during remote or virtual audit.	
On-Site Inspection	
Collect data that could not be obtained during remote or virtual audit.	

15. In-Home Energy Education

Refer to Table 15.1.

Table 15.1 In-Home Energy Education	
Element	Full Text
Remote/Virtual Aspects	
Homeowner Energy Education	<ol style="list-style-type: none"> 1. Direct homeowner to information from utility/state energy efficiency programs and other reliable sources to provide energy efficiency education including benefits of electrification, and advice on user-controlled energy conservation strategies. 2. Help the homeowner develop an action plan and roadmap discussing benefits of building envelope upgrades, and the order of the installation of measures (loading order) to reduce their energy use and to move away from fossil-fuel appliances to clean energy options. 3. Review energy usage upgraded vs. not upgraded. 4. Direct homeowner to information on clean energy options including on-site solar, community solar, battery storage, heat pumps and electric vehicles, e.g., NYSERDA Heat Pump Planner. https://www.nyserda.ny.gov/All-Programs/Heat-Pump-Program/Heat-Pump-Planner
On-Site Verification	
Verify questionable data and other data that could not be fully determined during remote or virtual audit.	
On-Site Inspection	
Homeowner Energy Education	<ol style="list-style-type: none"> 1. Provide on-site energy efficiency education to help the homeowner develop an action plan and roadmap to reduce their energy use and to move away from fossil-fuel appliances to clean energy options. 2. Review analysis on how the dwelling will perform upgraded vs. not upgraded. 3. Review energy usage upgraded vs. not upgraded. 4. Direct homeowner to information on clean energy options including on-site solar, community solar, battery storage, heat pumps and electric vehicles, e.g., NYSERDA Heat Pump Planner. https://www.nyserda.ny.gov/All-Programs/Heat-Pump-Program/Heat-Pump-Planner

16. Energy Efficiency Opportunities, Reduced Energy Consumption, and Load Reduction

Refer to Table 16.1

Table 16.1 Energy Efficiency Opportunities, Reduced Energy Consumption, and Load Reduction	
Appliance Lighting and Plug Load	
Element	Full Text
Remote/Virtual Aspects	
<p>Provide homeowner/occupant with Annex B Appliance and Electrical Device Data Collection Worksheet (or similar document) to obtain information on major appliances, domestic water heating (DHW) system, and heating and cooling appliances.</p> <p>Information provided on Annex B Appliance and Electrical Device Data Collection Worksheet (or similar document), can be used to complete Annex C NEC Standard Electrical Load Calculation Worksheet to document existing load.</p> <p>Alternately, another method can be used to document the following information:</p>	
Appliances (Large)—refrigerators, freezers, washers, dryers, stove/oven/range, cooktop, warming drawers, wine cooler, dishwasher, etc.	<ol style="list-style-type: none"> 1. Obtain list of appliances in the dwelling. 2. Obtain information such as make, model number, age, fuel type, condition, and ENERGY STAR® rating, if available, of the appliances. 3. Determine how appliances are used (e.g., is extra refrigerator or standalone freezer used to full capacity, how many loads of laundry are done each week, how often is dishwasher used, etc.). 4. Determine which appliances are due for replacement/upgrade with new ENERGY STAR® rated appliances, if available. 5. Determine which appliances have been replaced with new ENERGY STAR® rated appliances.
Domestic Water Heating	Obtain information for all domestic water heating appliances such as make, model, serial number, fuel type, condition, ENERGY STAR® rating if available, location in the dwelling, age.
Space Comfort—heating, cooling, dehumidification, air purification, portable space heaters, portable cooling units	<ol style="list-style-type: none"> 1. Obtain list of appliances in the dwelling. 2. Obtain information such as make and model number, age, fuel type, condition, location, distribution type, and ENERGY STAR® rating if available. 3. Determine how appliances are used (e.g., how many hours is appliance used daily/weekly, do appliances operate on timers, are appliances used seasonally, etc.). 4. For space heating/cooling, determine set points and schedules.
Optional: Small Appliances, lighting, and other electric device information shall be documented on Annex B Appliance and Electrical Device Data Collection Worksheet (or similar document).	
On-Site Verification	
Verify data that could not be fully determined during remote or virtual audit.	
On-Site Inspection	
Collect data that could not be obtained during remote or virtual audit.	

17. Heat Pump Readiness

Refer to Table 17.1

Table 17.1 Heat Pump Readiness	
Pressure Boundary Evaluation	
Element	Full Text
Remote/Virtual Aspects	
On-Site Verification	
Pressure Boundary	Verify air sealing has been completed per Annex D Pressure Boundary Checklist. Document all findings, and where deficiencies exist include recommendation for improvement measures in the
Thermal Boundary Evaluation	
Element	Full Text
Remote/Virtual Aspects	
On-Site Verification	
Thermal Boundary	Verify insulation of the building's envelope per Annex E Thermal Boundary Checklist. Document all findings, and where deficiencies exist include recommendation for improvement measures in the audit report.
On-Site Inspection	
Attic Thermal Boundary	Note potential vermiculite.
Evaluation of Minor Repairs	Visual inspection, evaluation, and documentation of minor repairs that are necessary to ensure maximum efficiency from the provision of qualified energy efficiency services.
Space Heating/Cooling Distribution Evaluation	
Element	Full Text
Remote/Virtual Aspects	
Duct Type	Determine and document the condition, materials, and type of ductwork. Ask for photos as needed.
Duct Location	Determine location of ductwork.
Insulation	Determine if the ductwork is insulated.
Air Sealing	Determine if ductwork is air sealed if visually available.
Duct Condition	Determine if there is any damaged or disconnected ductwork.
Duct Accessibility	Determine if there is any ductwork in locations not accessible by the homeowner.
Duct Capacity/Size	Determine how many return and supply registers are in the dwelling and their locations.
On-Site Verification	
Duct Type	Verify distribution system(s) type.
Duct Location	Verify distribution system(s) location.
Insulation & Air Sealing	Verify duct insulation and air sealing ANNEX F Duct Sealing and Duct Insulation Checklist.
Duct Accessibility	Determine duct system accessibility.

Table 17.1 Heat Pump Readiness (cont.)	
Duct Capacity/Size	Verify how many return and supply registers are in the dwelling and their location.
On-Site Inspection	
Evaluate Ducted Distribution System/s	<ol style="list-style-type: none"> 1. Evaluate condition of return and supply duct connections. 2. Evaluate duct insulation, if present, and document R-value. 3. Inspect for restrictions to duct system airflow. 4. Inspect for gaps, leaks, and disconnected duct work. 5. Evaluate the need for duct balancing, improvements, sealing, repair, and insulation.
Duct Condition	Identify distribution system/s condition including gaps, leaks or disconnected duct work, and condition of return and supply duct connections.
Determine Duct System Efficiency	Quantify duct leakage and make recommendations for duct improvements using methods detailed in ANSI/BPI-1200 Sections 11.6.2 -11.6.4.
Thermostat/Controls	
Remote/Virtual Aspects	
Element	Full Text
Thermostat/Controls	<ol style="list-style-type: none"> 1. Identify the type and number of thermostat/s and/or other mechanical system controls. 2. Ask for photos of each thermostat or control device. 3. Ask for the current set points and schedules for each thermostat. 4. Determine if thermostat controlling the HVAC system will be used to control the heat pump, if applicable.
Uneven Room Temperatures	Ask homeowner if there are uneven room temperatures or rooms that are closed off seasonally.
On-Site Inspection	
Collect data that could not be obtained during remote or virtual audit.	
Solid Fuel Appliances	
Remote/Virtual Aspect	
Element	Full Text
Woodstoves, Wood Boilers, Wood Furnaces, Pellet Stoves, Fireplaces with Insert, etc.	<ol style="list-style-type: none"> 1. Identify solid fuel burning appliances. Ask for photos as needed. 2. Ask homeowner to report any appliances installed on carpets, wood floors or other combustibles. 3. Determine if the appliance is the primary or secondary heating source. 4. Note the type and condition of flooring material where the appliance is installed. 5. Determine when the chimney and vent connector were last cleaned and inspected.
On-Site Verification	
Solid Fuel Burning Appliance Inspection	<ol style="list-style-type: none"> 1. Visually inspect and note the type and condition of flooring material where the appliance is installed. 2. Verify integrity of solid fuel burning appliance and vent for safe operation.
On-Site Inspection	
Collect data that could not be obtained during remote or virtual audit.	

18. Heat Pump Sizing, Design, Equipment Selection

Refer to Table 18.1.

Table 18.1 Heat Pump Sizing, Design, Equipment Selection	
Heating Load Evaluation	
Element	Full Text
Remote/Virtual Aspects	
Sizing	<ol style="list-style-type: none"> 1. Complete heating and cooling load calculation in accordance with the recommendations included in the <i>NEEP Guide to Sizing & Selecting Air-Source Heat Pumps in Cold Climates</i>. https://neep.org/sites/default/files/Sizing%20%26%20Selecting%20ASHPs%20In%20Cold%20Climates.pdf 2. If a ducted system will be recommended: Complete a duct sizing calculation according to ACCA Manual D or equivalent to ensure existing, or to be installed ductwork is properly sized for the space(s) being heated/cooled.
Design	<ol style="list-style-type: none"> 1. Determine homeowner intended use based on: <ol style="list-style-type: none"> a. Heating only b. Heating and cooling c. Isolated zone 2. Determine system type based on existing site conditions such as: <ol style="list-style-type: none"> a. Existing heating type (forced-air, boiler/forced hot water, etc.) b. Barriers in utilizing existing systems such as: <ol style="list-style-type: none"> i. Non-accessible undersized ductwork ii. Homeowner funding level iii. Construction details iv. Property details v. Climate c. Homeowner Need/Goal <ol style="list-style-type: none"> i. Whole-house heating ii. Zoned system iii. Air-to-Air vs. ground coupled
Equipment Selection	<p>Select equipment according to manufacturers' recommendations, ACCA Manual S, and the <i>NEEP Guide to Sizing & Selecting Air-Source Heat Pumps in Cold Climates</i>. https://neep.org/sites/default/files/Sizing%20%26%20Selecting%20ASHPs%20In%20Cold%20Climates.pdf</p>
On-Site Verification	
<p>Verify data and all information needed to complete a heating and cooling load calculation, and for the recommendations included in the <i>NEEP Guide to Sizing & Selecting Air-Source Heat Pumps in Cold Climates</i>. https://neep.org/sites/default/files/Sizing%20%26%20Selecting%20ASHPs%20In%20Cold%20Climates.pdf</p>	
On-Site Inspection	
Collect data that could not be obtained during remote or virtual audit.	

Table 18.1 Heat Pump Sizing, Design, Equipment Selection (cont.)

Electrical Service Panel Evaluation	
Element	Full Text
Remote /Virtual Aspects	
Type	<ol style="list-style-type: none"> 1. Determine the manufacturer. 2. Determine type (plug fuse, circuit breaker).
Condition	<ol style="list-style-type: none"> 1. Determine and document the condition (missing or broken panel cover, signs of water intrusion, rust, fuse disconnect, open knockouts, mismatched breakers, missing or mismatched fasteners on cover, etc.). 2. Ask for photos of the electrical panel as directed.
Size/Capacity	Determine the amperage rating of the main disconnect.
Location/Accessibility	<ol style="list-style-type: none"> 1. Document the location of the electrical service panel and any subpanels. Ask for photos as needed. 2. Determine main panel accessibility and accessibility of any subpanels.
Additional Subpanel	Document any subpanels, determine the amperage and purpose.
On-Site Verification	
Verify data that could not be fully determined during remote or virtual audit.	
On-Site Inspection	
Collect data that could not be obtained during remote or virtual audit.	

19. Challenges to Electrification Implementation

Refer to Table 19.1

Table 19.1 Challenges to Electrification Implementation

Element	Full Text
On-Site Verification	
Building Construction	<ol style="list-style-type: none"> 1. Document construction details that prohibit proper installation of equipment. 2. Document construction details that prohibit proper air sealing and/or insulation. 3. Document construction details that prohibit proper electrical installations of equipment.
Existing HVAC Systems	<ol style="list-style-type: none"> 1. Document improperly sized and inaccessible ductwork. 2. Document location of existing system.
Electrical Panel	<ol style="list-style-type: none"> 1. Assessment by qualified individual to determine if an upgrade to the electrical service is required to support recommended measures based on , condition, amperage rating, and branch circuit capacity.
Homeowner	<ol style="list-style-type: none"> 1. Determine what the goals of the homeowner are. 2. Determine if any fossil fuel appliances cannot be replaced. 3. Assess homeowner ability to fund project.
Location Details/Code Restrictions	Determine location has the appropriate site to locate and meet property line requirements, homeowner association requirements, historic district requirement, etc.
On-Site Inspection	
Collect data that could not be obtained during remote or virtual audit.	

20. Decommissioning Evaluation

Refer to Table 20.1

Table 20.1 Decommissioning Evaluation	
Element	Full Text
Remote/Virtual Aspects	
General Statement	The evaluation shall require the recommendation of new or upgraded wiring needed to replace any fossil-fueled appliance with an electrical appliance.
Space Heating/Cooling Appliances	<ol style="list-style-type: none"> 1. Document the appliances to be decommissioned for electrification and decarbonization of the dwelling. 2. Document any fuel storage system to be removed as part of decommissioning. 3. Document any fuel delivery system to be removed as part of decommissioning. 4. Document any appliance venting systems to be removed as part of decommissioning.
Water Heating Appliances	<ol style="list-style-type: none"> 1. Document the appliances to be decommissioned for electrification and decarbonization of the dwelling. 2. Document any fuel storage system to be removed as part of decommissioning. 3. Document any fuel delivery system to be removed as part of decommissioning. 4. Document any appliance venting systems to be removed as part of decommissioning.
Common Exhaust Vent	If more than one fossil fuel appliance shares a common exhaust vent, a best practice is to decommission both appliances. ¹
Cooking Appliances	<ol style="list-style-type: none"> 1. Document the appliances to be decommissioned for electrification and decarbonization of the dwelling. 2. Document any fuel storage system to be removed as part of decommissioning. 3. Document any fuel delivery system to be removed as part of decommissioning.
Clothes Dryer Appliances	<ol style="list-style-type: none"> 1. Document the appliances to be decommissioned for electrification and decarbonization of the dwelling. 2. Document any fuel storage system to be removed as part of decommissioning. 3. Document any fuel delivery system to be removed as part of decommissioning. 4. Document any appliance venting systems to be removed as part of decommissioning.

Table 20.1 Decommissioning Evaluation (Cont.)

Thermostat/Controls	If existing thermostat/s is not to be used for heat pump control, determine options for removal and proper disposal.
Project Timeline	<ol style="list-style-type: none"> 1. Dependent on existing fuel types, determine the proposed order of operations for decommissioning from project initiation through completion. <ol style="list-style-type: none"> a. Remove fossil fuel appliances. b. Permanently seal any exhaust vent openings. c. Remove fuel delivery. d. Remove chimney or vent. e. Seal off fuel fill. f. Remove fuel storage.* <p>*If there is no longer going to be any use of heating/fuel oil in the building after the installation of equipment, then the heating/fuel oil storage tank(s) must be removed or abandoned in compliance with all applicable federal, state, and municipal laws, regulations, and codes.</p>
On-Site Verification	
Verify all appliances, fuel storage and delivery systems to be decommissioned are accounted for.	
On-Site Inspection	
Collect data that could not be obtained during remote or virtual audit.	

¹Health and safety concerns may arise from leaving a fossil fuel DHW system “orphaned” on an exhaust venting that it previously shared with a fossil heating system, which is usually the primary appliance on shared exhaust venting. Removal of the primary appliance can cause the exhaust venting to be oversized for the smaller DHW system, preventing it from establishing draft during cold weather start-up and leading to the spillage of dangerous levels of carbon monoxide into the building.

21. Electric Vehicle (EV) Charging Station Evaluation

Refer to Table 21.1

Table 21.1 EV Charging Station Evaluation	
Element	Full Text
Remote/Virtual Aspects	
Existing Vehicles	<ol style="list-style-type: none"> 1. List number of current and anticipated vehicle/s. 2. Document vehicle fuel type. 3. Document average miles per year.
Purpose/ Use of New Electric Vehicle	Document the following: <ol style="list-style-type: none"> 1. What distances and how often will the vehicle be driven? 2. What size vehicle? 3. What is the charging demand? 4. Is any charging done outside the dwelling (work, gym, etc.)?
Location	Document the following: <ol style="list-style-type: none"> 1. Where the vehicle be parked while charging 2. Parking location (inside or outside)
Electrical Panel Space and Capacity	Document the following: <ol style="list-style-type: none"> 1. How far is electrical service panel from the vehicle storage location? 2. What is the amperage of that service panel? 3. Are there available circuits?
Permits Required	Determine if permits will be required for any of the recommended work.
Local Code Requirements	Observe local code, homeowner association requirements, and historic district requirements when designing and installing an EV charging station.
On-Site Verification	
Electrical Panel Space and Capacity	Verify electrical panel has the capacity to support EV charging station.
On-Site Inspection	
Collect data that could not be obtained during remote or virtual audit.	

22. On-Site Solar Power Generation Evaluation

Refer to Table 22.1

Table 22.1 On-Site Solar Power Generation Evaluation	
Element	Full Text
Remote/Virtual Aspects	
Roof installation assessment	<ol style="list-style-type: none"> 1. Determine roof pitch. 2. Determine roof material and condition. 3. Determine roof orientation. 4. Determine accessibility. 5. Determine available area for solar panel capacity. 6. Determine amount of shading.
Pole mount installation assessment	<ol style="list-style-type: none"> 1. Determine available square footage. 2. Determine shading. 3. Determine accessibility. 4. Determine connection requirements.
Permits Required	Determine what permits will be required for any of the recommended work.
Storage Assessment	Determine on-site potential for electrical storage.
Local Code/Homeowner Association Requirements	Observe local code and homeowner association requirements for designing and installing on site solar panel arrays.
On-Site Verification	
Roof assessment	Verify roof pitch, material, condition, and shading.
On-Site Inspection	
Collect data that could not be obtained during remote or virtual audit.	

23. Indoor Environment Evaluation

Refer to Table 23.1

Table 23.1 Indoor Environment Evaluation	
Health and Safety	
Element	Full Text
Remote/Virtual Aspects	
Smoke Detectors	<ol style="list-style-type: none"> 1. Identify and document the number and location of existing smoke detectors. 2. Ask if hard wired or battery powered.
CO Detectors	<ol style="list-style-type: none"> 1. Identify and document the number and location of existing CO detectors. 2. Ask if hard wired or battery powered.
Heat Detector(s)	<ol style="list-style-type: none"> 1. Identify and document the number and location of existing heat detectors in garage or enclosed area where EV charging does or will take place. 2. Recommend addition of same if not present.
Electrical Hazards	Identify and document potential electrical hazards such as knob and tube wiring, broken outlet covers or switch covers, exposed wiring, non-IC rated recessed lighting, or other obvious electrical hazards.
Potentially Hazardous Materials	Identify and document any areas containing known or suspected hazardous materials, including but not limited to, lead (peeling paint), asbestos like material (ALM), chemicals, radon, or mold like substance (MLS).
Evaluation of Minor Repairs	Identify and document minor repairs, including but not limited to, disconnected duct work, blocked registers, furnace/boiler cleaning, missing air filter, which are necessary to ensure maximum efficiency from the provision of qualified energy efficiency services.
On-Site Verification	
Smoke Detectors	<ol style="list-style-type: none"> 1. Visually inspect, evaluate, and document presence of smoke detectors. 2. Determine if the smoke detectors are in working condition (i.e., test button).
CO Detectors	<ol style="list-style-type: none"> 1. Visually inspect, evaluate, and document presence of CO detectors. 2. Verify the CO detector is in working condition (i.e., test button).
Heat Detectors	<ol style="list-style-type: none"> 1. Visually inspect, evaluate, and document presence of heat detectors. 2. Determine if the heat detectors are in working condition (i.e., test button).
Electrical Hazards	Visually inspect, evaluate, and document observable electrical hazards and the existence of knob and tube wiring.

Table 23.1 Indoor Environment Evaluation (cont.)

Potentially Hazardous Materials	Visually inspect, evaluate, and document areas containing known or suspected hazardous materials, including but not limited to, lead (peeling paint), asbestos-like material (ALM), chemicals, radon, or mold like substance (MLS).
Evaluation of Minor Repairs	Visually inspect, evaluate, and document minor repairs that are necessary to ensure maximum efficiency from the provision of qualified energy efficiency services.
On-Site Inspection	
Combustion Safety Testing	Complete a combustion safety test of the fossil fueled appliances actively in operation during the audit per ANNEX G Immediate Response Combustion Safety Protocols.

24. Retrofit Pathways

Refer to Table 24.1

Table 24.1 Retrofit Pathways

Element	Full Text
Remote/Virtual/On-Site	
Project Pathways	<ol style="list-style-type: none"> 1. Review the data collected to present full potential project pathway to electrification. 2. Develop a project plan framed around the homeowner's goals and priorities, budget, timeline, available incentives, and estimated useful life of the proposed measures.
Determine Project Pathways	<ol style="list-style-type: none"> 1. Determine which projects could be completed as staged retrofits and which projects could be completed as one-time retrofits. 2. For staged retrofits, determine order of installation of measures based on best practices (e.g., air seal and insulate before electrifying heating), homeowner's goals and priorities, budget, timeline, available incentives, and estimated useful life of the proposed measures.
Stand-Alone Project	Determine which projects could be completed at any time independent of other projects (e.g., replacing gas stove with electric stove, replacing fossil fuel water heater with electric or HPWH, replacing gas fireplace with electric, etc.).

25. Information Review and Developing the Plan

Refer to Table 25.1

Table 25.1 Information Review and Developing the Plan	
Element	Full Text
Remote/Virtual/On-Site	
Review of Potential Projects	<ol style="list-style-type: none">1. Provide an overview of potential projects framed around the homeowner's goals and priorities.2. Discuss any roadblocks found during the inspection and evaluation.3. Revisit high-level budget, timing, and priority concerns using the data collected and to prepare to map projects to Stage 1, Stage 2, Stage 3, or one-time project plans.4. Advise homeowner that plans will be based on their goals, priorities, budget, timeline, available incentives, and estimated useful life of proposed measures.5. Schedule follow up to review work scope and finalized estimate of costs, if needed.

Annex A | Homeowner/Occupant Questionnaire

The Homeowner/Occupant Questionnaire provides a list of sample questions and information on household energy behavior, building performance, and possible health and safety issues. This interview may be conducted in person, by phone, by e-mail, or by any other means convenient for the homeowner/occupant.

This document is to be completed by the homeowner/occupant or the auditor.

1. How long have you lived here?
2. Do you know the year the home was built?
3. Do you know the square footage of the living space? (do not include basement or attic unless those spaces are intentionally heated and/or cooled)
4. How many adults reside in the home?
5. How many children reside in the home?
6. How many bedrooms are in the home?
7. What is primary type of heating system?
8. What is the primary heating fuel?
 - a. For electricity or natural gas: please provide usage record for the last 12 months
 - b. For fuel oil and/or propane: Do you have, or can you obtain delivery receipts or records for the last 12 months?
9. How old is the primary heating system?
10. When was the last service/clean and tune?
11. Forced-Air Furnaces
 - a. Do you regularly change your furnace filter?
 - b. Date of last filter change?
12. Steam-Heating Boiler
 - a. Have you had to add more than a small amount of water to the boiler during the heating season?
13. Steam-Heating Boiler Distribution System
 - a. Do all radiators get hot?
 - b. Does the relief valve discharge?
 - c. Do you hear loud banging noises from the radiators or pipe?
14. Forced hot-water space heating appliance
 - a. Do all radiators get hot?
 - b. Does the relief valve discharge?
 - c. Does the system need to be bled periodically?
15. Is there a secondary heating system?
 - a. What type?
 - b. Fuel type?

- c. Location in the house?
16. Do you use other appliances for space heating?
- a. What type?
 - b. Fuel type?
 - c. Location in the house?
17. Do you have a working fireplace, woodstove or pellet stove?
- a. How often do you use it?
 - b. How often is the flue cleaned?
 - c. How often is the fireplace, woodstove or pellet stove cleaned?
18. What type of fuel is being used?
- a. Where do you store the wood or pellets?
 - b. How much fuel did you use during the last heating season?
 - c. Are there issues, such as excessive smoking or staining, when the fireplace, woodstove or pellet stove is in use?
19. Do you have the owners' manual or installation guide for the appliance?
20. What type of cookstove/oven is currently in use?
- a. What type of fuel does your stove/oven use?
 - b. For electricity or natural gas: please provide usage record for the last 12 months
 - c. For propane: Do you have, or can you obtain delivery receipts or records for the last 12 months?
21. Does your home have cold rooms or areas?
- a. Where and when does this occur?
22. Does your home have rooms or areas that are too warm?
- a. Where and when does this occur?
23. Are there drafty areas in your home?
- a. Where and when does this occur?
24. Thermostat type and location
25. Do you have programmable or smart thermostat(s)?
- a. What is the highest setting you use?
 - b. What is the lowest setting you use?
26. Do you close off any rooms to avoid heating them?
27. Are doors and windows closed when the air conditioner/heater is working?
28. Do any occupants suffer from headaches, flu, colds, or nausea during the heating season?
29. Is there a known moisture or condensation problem in the home?
- a. Where and when does this occur?
30. Is there any known mold/mildew issue in your home?
- a. Where and when does this occur?
31. Are you aware of lead paint or asbestos in your home?

32. Has your home been tested for radon?
33. Is your home equipped with a radon mitigation system?
34. Does the basement get wet at any time during the year?
35. Are you aware of any water leaks from plumbing or fixtures or any sewage leaks?
36. Have you experienced any evidence of poorly operating pumps, such as short cycling, unusual odors, or low water pressure?
37. Does ice form on the eaves or in the attic during winter?
38. Does your roof leak during any time of the year?
39. Do you have an air conditioner? Is it a window unit or central?
40. Are there windows or doors that are hard to open or close?
41. Are there windows that have broken glass or do not latch properly?
42. Does your home have an attached or tuck under garage?
43. Are there any known electrical issues (e.g., knob and tube wiring)?
44. Are there broken outlet covers or switch covers, exposed wiring, or other known electrical hazards?
45. Are there other electrical issues, such as flickering lights or inoperative switches/outlets?
46. What types of light bulbs are predominately used in your home? Incandescent, CFL, LED
47. Are some lights turned off in the daytime to take advantage of natural light?
48. Are lights turned off at the end of the day or when rooms are unoccupied?
49. Do you leave exterior lighting on for extended periods (overnight or stay on in daytime)?
50. Are timers or motion sensors used for exterior lighting?
51. Are you using smart power strips or other smart controls?
52. Are your television(s) CRT or newer LED models?
53. Is your computer monitor CRT or newer LCD/LED models?
54. Is your computer, laptop, monitor and/or printer turned off when not in use, or does this equipment stay in standby mode?
55. How many loads of laundry do you wash/dry per day (or week)?
56. Is your clothes dryer vented to the exterior of the home?
57. Do you hang the majority of your clothing to dry?
58. Are clothes hung to dry inside or outside?

59. Approximately how many showers/baths per day?
60. Do you have bath fans and are they used during/after each bath or shower?
61. Is your home equipped with water saving devices, such as faucet aerators, low flow showerheads, touch control faucets, water saving toilets, or HE clothes washers?
62. What is the hot water temperature as measured at the kitchen or bathroom tap?
63. Are there issues with the water heater, such as not maintaining temperature or water leakage at the heater?
64. Do you have functioning smoke alarms?
- a. How many?
 - b. Where are they located?
65. Do you have functioning CO alarms?
- a. How many?
 - b. Where are they located?
66. Has a home energy audit been performed on your home?
67. Has professional air sealing been performed in your home?
68. Has insulation been added to your home since you have lived here?
69. Have you ever had a home inspection, and, if so, do you have the report?
70. Are there any damaged or deteriorated interior or exterior stairs?
71. Are there any damaged, missing, or deteriorated handrails?
72. Is there evidence of pests such as mice, rats, bats, ants, cockroaches existing in the home including non-occupied areas (attics, garages, crawlspace, etc.)?
73. Are there specific health and safety or comfort issues you would like to discuss?
74. Are there any major renovations, such as additions, remodeling kitchens or bathrooms, finishing of basement or attic, planned in the next 12 months?
75. Are you interested in learning more about renewable energy, such as solar energy, heat pumps, or geothermal?
76. Are you interested in purchasing an electric vehicle (EV)?

Annex B | Appliance and Electrical Device Worksheet

Complete information for existing appliances. If item does not exist, leave blank. Enter N/A if data is not available.

Major Appliances

Appliance	Type	Manufacturer	Model No.	Energy Star	Replacement Recommended	Notes
Refrigerator 1	<input type="checkbox"/> Combo <input type="checkbox"/> Mini/dorm <input type="checkbox"/> Wine cooler <input type="checkbox"/> Garage rated			Yes/No	Yes/No	
Refrigerator 2	<input type="checkbox"/> Combo <input type="checkbox"/> Mini/dorm <input type="checkbox"/> Wine cooler <input type="checkbox"/> Garage rated			Yes/No	Yes/No	
Freezer 1	<input type="checkbox"/> Upright <input type="checkbox"/> Chest <input type="checkbox"/> Self-defrost <input type="checkbox"/> Garage rated			Yes/No	Yes/No	
Freezer 2	<input type="checkbox"/> Upright <input type="checkbox"/> Chest <input type="checkbox"/> Self-defrost <input type="checkbox"/> Garage rated			Yes/No	Yes/No	
Stove	<input type="checkbox"/> Cooktop <input type="checkbox"/> Gas/Propane <input type="checkbox"/> Electric <input type="checkbox"/> Induction <input type="checkbox"/> Dual fuel			Yes/No	Yes/No	
Oven	<input type="checkbox"/> Freestanding <input type="checkbox"/> Gas <input type="checkbox"/> Electric <input type="checkbox"/> Microwave			Yes/No	Yes/No	
Oven	<input type="checkbox"/> Freestanding <input type="checkbox"/> Gas <input type="checkbox"/> Electric <input type="checkbox"/> Microwave			Yes/No	Yes/No	
Dishwasher	<input type="checkbox"/> Built-in <input type="checkbox"/> Portable			Yes/No	Yes/No	
Garbage Disposal	<input type="checkbox"/> Batch feed <input type="checkbox"/> Continuous feed			Yes/No	Yes/No	
Clothes Washer	<input type="checkbox"/> Front Load <input type="checkbox"/> Top Load <input type="checkbox"/> Combo			Yes/No	Yes/No	
Clothes Dryer	<input type="checkbox"/> Electric <input type="checkbox"/> Gas/Propane <input type="checkbox"/> Condensing			Yes/No	Yes/No	
Other:						

Domestic Water Heating

Type	Manufacturer	Model No.	Capacity (gallons)	Fuel Type	Energy Star	Replacement Recommended	Notes
Conventional					Y/N	Y/N	
Tankless					Y/N	Y/N	
Heat Pump					Y/N	Y/N	
Boiler combo					Y/N	Y/N	
Solar					Y/N	Y/N	
Other:							

Central Heating and Cooling

Type	Manufacturer	Model No.	BTU/ hr	Fuel Type	Energy Star	Replacement Recommended	Notes
Furnace 1					Y/N	Y/N	
Furnace 2					Y/N	Y/N	
Boiler					Y/N	Y/N	
AC unit					Y/N	Y/N	
Geothermal					Y/N	Y/N	
Mini-split					Y/N	Y/N	
Heat Pump					Y/N	Y/N	
Other:							

Notes:



Small Appliances (optional)

Appliance	Type	Energy Star	Replacement Recommended	Notes
Pumps	Well	Yes/No	Yes/No	
	Sump	Yes/No	Yes/No	
	Pool	Yes/No	Yes/No	
	Hot tub	Yes/No	Yes/No	
	Sewage grinder	Yes/No	Yes/No	
	Hydroponic	Yes/No	Yes/No	
	Other:			
Portable Space Comfort (heating/cooling)	Dehumidifier	Yes/No	Yes/No	
	Air purifier/filtration	Yes/No	Yes/No	
	Space heater	Yes/No	Yes/No	
	Window AC 1	Yes/No	Yes/No	
	Window AC 2	Yes/No	Yes/No	
	Cooling unit	Yes/No	Yes/No	
	Other:			
Ventilation	Energy recovery ventilator (ERV)	Yes/No	Yes/No	
	Heat recovery ventilator (HRV)	Yes/No	Yes/No	
	Whole-house fan	Yes/No	Yes/No	
	Attic fan	Yes/No	Yes/No	
	Bath fan	Yes/No	Yes/No	
	Range hood	Yes/No	Yes/No	
	Cooktop downdraft	Yes/No	Yes/No	
	Other:			
Seasonal Items (with significant usage)	Pipe wrap	Yes/No	Yes/No	
	Gutter heater/ice melt	Yes/No	Yes/No	
	Heated walkways/driveway	Yes/No	Yes/No	
	Other:			

Annex C | NEC Standard Electrical Load Calculation for Single Family Dwellings

(Only for Service Ratings of 120/240V, 225 Amps Max)

Owner: _____ Location: _____

Total Floor Area of Dwelling (NEC 220.12) _____ SQFT.

Factor	Quantity	Volt Amperes (VA)
"General Lighting"		
1. General Lighting (SQFT X 3 VA/SQ FT (Table 220.12))	3 X sqft	
2. Small Appliance Circuits (1500 VA per circuit) (NEC 220.52(A)) (minimum 2)	1500 X	
3. Laundry Circuit (1500 VA per circuit) (NEC 220.52(B))	1500 X	
4. Total General Lighting Load (Add lines 1, 2 & 3):		
5. First 3000 VA @ 100%:		3000
6. Total General Lighting Load – 3000 = _____ @ 35% = _____		
7. Net General Lighting Load (Per NEC 220.42) (Add lines 5 & 6):		
*Fixed Appliances (if insufficient space, use back):	YES	NO
✓ Garbage Disposal		
✓ Bathroom Fan		
✓ Microwave		
✓ Dishwasher		
✓ Other:		
✓ Other:		
	Total	
8. 3 or less Appliances, Total Appliance VA; 4 or more Appliances, 75% of Total Appliance VA (NEC 220.53):		
*Other Loads (including motors, EV charger(s), etc.)	YES	NO
9. Electric Range (8000VA or Nameplate)**		
10. HVAC		
11. Electric Oven		
12. Electric Dryer (5000 VA minimum)**		
13. Electric Vehicle Charger		
14. Other:		
15. Other:		
16. 25% of largest motor (NEC 430.24)		
Total Service Load Volt-Amperes (VA) (Add lines 7, 8 & 9 thru 16) =		
Total Service Load Volt-Amperes / 240-volts = Amperes		
***Service Rating (Amperes)=		

* For every "YES" answer, indicate VA rating of equipment

** Nameplate rating must be used if larger

*** Service Rating shall be greater than or equal to the Service load

Annex D | Pressure Boundary Checklist

House Address _____ City _____ State _____

Pressure Boundary	Completion Guidelines	Completed	Not Applicable Provide details below
1. Pressure Boundary and Thermal Boundary	Pressure boundary is in alignment with the thermal boundary (insulation).		
2. Attic Air Sealing	Top plates and wall-to-ceiling connections are sealed.		
3. Attic Knee Walls	Pressure boundary is installed at the thermal boundary (knee wall transition or roof, as appropriate).		
4. Duct Shaft / Piping Shaft and Penetrations	Openings from attic to conditioned space are sealed.		
5. Dropped Ceiling / Soffit	Pressure boundary is fully aligned with thermal boundary; all gaps are fully sealed.		
6. Staircase Framing at Exterior Wall / Attic	Pressure boundary is fully aligned with thermal boundary; all gaps are fully sealed.		
7. Porch Roof	Pressure boundary is installed at the intersection of the porch roof and exterior wall.		
8. Flue or Chimney Shaft	Opening around flue is closed with flashing and any remaining gaps are sealed with fire-rated caulk or sealant.		
9. Attic Access / Pull-Down Stair	Attic access panel or drop-down stair is fully gasketed for an air-tight fit.		
10. Recessed Lighting	Fixtures are provided with air-tight assembly or covering where accessible.		
11. Ducts	All ductwork in attics and vented crawlspaces is sealed.		
12. Whole-House Fan Penetration at Attic	An insulated cover is provided that is gasketed or sealed to the opening from either the attic side or ceiling side of the fan.		
13. Exterior walls	Service penetrations have been sealed.		
14. Fireplace Wall	Air sealing is completed in framed shaft behind fireplace or at fireplace surround.		
15. Garage/Living Space Wall(s)	Air sealing completed between garage and living space. Pass-through door is weather-stripped.		
16. Insulated Floor above Garage	Air sealing completed at service penetrations and exposed edges of insulation.		
17. Cantilevered Floor	Air sealing of insulated cantilever at perimeter or joist transition.		
18. Common Walls Between Dwelling Units	Pressure boundary is installed to seal the gap between a gypsum shaft wall (i.e., common wall) and the structural framing between units.		

Annex E | Thermal Boundary Checklist

House Address _____ City _____ State _____

Thermal Boundary	Completion Guidelines	Completed	Not Applicable Provide details below
1. Air Barrier Alignment	Thermal boundary (insulation) is installed in alignment with the pressure boundary.		
2. Attics	One hundred percent of attic floor (or roof) area is insulated; low areas treated to comply with <i>ECCC</i> , or to the limit of construction.		
3. Attic Knee Walls	Insulation is in complete alignment with pressure boundary at knee wall or rafters.		
4. Attic Ducts	Ductwork in attic spaces is insulated to comply with <i>ECCC</i> .		
5. Exterior Wall	All uninsulated exterior walls have been insulated to comply with <i>ECCC</i> or to the limit of construction.		
6. Rim/Band Joist	Sill plate/foundation connection is caulked. Space has been insulated to comply with <i>ECCC</i> .		
7. Insulated Floor Above Garage	Insulation is installed to have full contact with underside of sub floor decking.		
8. Garage/Living Space Wall(s)	Wall(s) between unconditioned/conditioned spaces have been insulated to comply with <i>ECCC</i> or limit of construction.		
9. Cantilevered Floor	Insulation is installed to have full contact with underside of sub floor decking.		
10. Recessed Lighting	Insulated covers are installed when not limited by construction or local code.		
11. Attic Eaves	Solid baffles/blockers are provided at framing bays to avoid wind washing of attic insulation.		
12. Porch Roof	Areas separating conditioned/unconditioned spaces have been insulated to comply with <i>ECCC</i> or limit of construction.		

Annex F | Duct Evaluation Checklist

House Address _____ City _____ State _____

Duct Sealing	Completion Guidelines	Completed	Not Applicable Provide details below
1. Plenum	Plenum to furnace/air handler connection, and all penetrations for piping are sealed with approved metal tape.		
2. Trunk	Trunk connections and seams are sealed with mastic.		
3. Take-offs	Trunk to take-off connections are appropriately fastened and sealed with mastic.		
4. Run-out Ducts	Accessible run-out ducts are sealed at all connections and take-offs.		
5. Floor/Ceiling Boots	Boots are appropriately fastened and sealed to floor and ceiling.		
6. Filter Slot/Access	Filter slot/access are sealed with appropriate permanent cover to allow homeowner ability to access to change filter.		
7. Panning	Panning is fastened tightly to joists and sealed with mastic. End caps are sealed.		
8. Stud Cavities Used as Return Ducts	Blockers are installed and sealed in stud cavities.		
9. Furnace Floor	Furnace has appropriate floor installed and sealed with mastic or approved metal tape.		
10. Duct Insulation: Conditioned Areas	Ducts located in conditioned areas as defined and providing air for comfort cooling and dehumidification are insulated to comply with by ANSI/BPI-1200.		
11. Duct Insulation: Unconditioned Areas	Ducts located in unconditioned areas as defined by and are insulated to comply with ANSI/BPI-1200.		
12. Duct Sizing Calculation	Complete a duct sizing calculation according to ACCA Manual D or equivalent to ensure existing, or to be installed ductwork is properly sized for the space(s) being heated/cooled.		
13. Duct Sizing Evaluation	Evaluate duct sizing to determine if the system needs improvements to accommodate for a heat pump installation. Make recommendations for review and analysis by a HVAC professional as needed.		

Annex G | Immediate Response Combustion Safety Protocols

(See next page)

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Immediate Response Combustion Safety Testing Protocols



THE SYMBOL OF EXCELLENCE FOR HOME PERFORMANCE CONTRACTORS

February 14, 202

Notice

Information in this document represents the policies at the date of publication for the BPI Immediate Response Combustion Safety Testing Protocols. Information in this document supersedes information contained in any previously published document under the same.

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Acknowledgements

The Building Performance Institute, Inc. would like to thank all the dedicated professionals who have participated in the development of this document.

Disclaimer

The Immediate Response Combustion Safety Testing Protocols assesses and characterizes specific immediate health and safety hazards of on-site space and domestic water heating combustion appliances in operation during the assessment, by integrating qualitative observations with limited quantitative diagnostics, to determine safe operation at the time of testing. The information contained in the resulting evaluation report, communicates any issues found and recommendations to the occupant, with the goal of improving appliance operation.

It is understood and agreed that this evaluation is limited to observations of apparent conditions existing only at the time of the evaluation. Latent and concealed defects and deficiencies are excluded from the evaluation.

Maintenance, repairs, possible fixes, recommendations, and other similar items may be discussed during the evaluation and referenced in the report, but they are not to be considered technically exhaustive or cover every possible condition. The evaluation and report are not a compliance inspection or certification for past or present governmental codes, regulations, ordinances, statutes, or special utility restrictions of any kind.

The client ("Homeowner") agrees that technician ("Contractor"), its agents, and employees shall not be liable or responsible for the cost of repairing or replacing any reported or unreported health and safety hazard, either current or arising in the future; or for any and all claims, losses, expenses, injuries, or damages arising out of or in any way related to the reported or unreported health and safety hazard by reason of any act or omission, including breach of contract or negligence. The parties further agree that Contractor shall not be liable to Homeowner for any special or consequential damages, including but not limited to, lost profits, loss of use, and costs of replacement, caused by the Contractor's negligence, breach of contract, or any other cause whatsoever.

The parties acknowledge that this evaluation and report is not intended, or to be used, as a guarantee or warranty, expressed or implied, regarding the adequacy, performance or condition of any evaluated appliance, item, or system. The parties further acknowledge that Contractor is not an insurer and that the evaluation and report are not insurance against any health and safety hazard condition(s).

Notwithstanding the foregoing, it is understood and agreed that if Contractor is found liable to Homeowner as a result of failure to perform any of its obligations, including but not limited to, failure as a result of negligence,

breach of agreement, or otherwise, the liability of Contractor, its agents, and employees shall be limited to a sum equal to the amount of the fee paid by the Homeowner for the evaluation and report.

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Scope

The Immediate Response Combustion Safety Testing Protocols define the criteria for conducting a limited visual and diagnostic evaluation of on-site space and domestic water heating combustion appliances in operation during the assessment, when conducting energy audits/assessments in residential homes during a pandemic or similar event. The evaluation determines specific and limited aspects of the safe operation of the combustion appliances and potential health and safety issues, with the operation of equipment being tested. The test will result in a list of recommended immediate actions improve the appliance(s) to address safety issues identified.

Purpose

The Immediate Response Combustion Safety Testing Protocols were developed to identify immediate health and safety issues with combustion appliances operating at the time of the assessment and limit exposure time within homes and therefore limit the health risk an auditor, technician, or homeowner may experience, while an energy audit is being conducted during a pandemic or similar event.

Building Types

Residential building types covered are defined as existing 1-4 family dwellings.

General Information

Immediate Response Combustion Safety Testing shall be based on building science principles and include the use of appropriate technologies and diagnostic equipment as described in ANSI/BPI-1200-S-2017 STANDARD PRACTICE FOR BASIC ANALYSIS OF BUILDINGS.

Health and Safety Related Requirement

The health and safety requirements included in these protocols are intended to identify limited issues that are deemed to pose immediate threats and safety concerns related to the operation of installed space and domestic water heating, and cooking combustion appliances, and that may negatively affect indoor air quality or otherwise cause or exacerbate an unsafe condition in the home.

Ambient Carbon Monoxide and Combustible Gases

- Auditors completing combustion safety testing shall be equipped with a dedicated ambient carbon monoxide monitor and combustible gas detector, while in the indoor work environment, to measure carbon monoxide and combustible gas levels and to take action, as required. “Work environment” includes the building being audited, ambient air, and other exposure environments preceding entry of the audited property.
- Equipment requirements for combustible gas and carbon monoxide detection, carbon monoxide measurement, and flue gas spillage tests:
 - Combustible Gas Detector (CGD)
 - CGD equipment used for testing shall:
 - Be classified to UL 913 Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations or equivalent.
 - Have a variable tick rate or changing tone based on gas concentration levels.
Note: The tick rate provides the indication of concentration, but only accounts for relative concentration changes, not necessarily identifying hazardous concentration thresholds.
 - Be capable of providing a digital display showing the percentage of Lower Explosive Limit (LEL) and/or provide an alarm when detecting combustible gas concentrations exceeding 10% Lower Explosive Limit (LEL).
 - Be calibrated and/or operation checked in accordance with the manufacturer’s recommendations, with available documentation traceable to the individual device.
 - Have the ability to zero ambient conditions.
 - Ambient CO Monitor
 - Ambient CO equipment/instruments used for measurement shall:
 - Be capable of measuring and displaying digitally, CO levels from 0 to 2,000 parts per million (ppm).
 - Be capable of calculating and displaying digitally, CO air free concentrations or have digital displays of CO as measured and O² levels to allow manual calculation of CO air free.
 - Have a resolution of 1 ppm.
 - Have an accuracy of +/- 5% of reading or +/-10ppm, whichever is greater.
 - Be equipped internally or externally with a nitric oxide filter (NO_x filter).
 - Be calibrated in accordance with the manufacturer’s recommendations, with available documentation traceable to the individual device.
 - Flue Gas Spillage Assessment
 - Equipment required for flue gas spillage assessment:
 - Mirror, smoke pencils, or other smoke visualization equipment

- Upon entering the building, the ambient air shall be sampled to determine the level of CO and/or combustible gases in the building, by conducting measurements in the occupied space.
- If the CO instrument indicates an ambient CO level of 70 ppm or greater, and/or measured concentrations of combustible gas exceed 10% of the LEL, the auditor shall immediately terminate the inspection and notify the homeowner/occupant of the need for all building occupants to evacuate the building. The auditor shall immediately leave the building and the appropriate emergency services shall be notified from outside the home.

Combustion Appliance Zone – Gas-Fired Appliances

- Inspect the Combustion Appliance Zone (CAZ) in the immediate area where the appliance is located, to determine if the area is free of rags, paper or other combustibles, and to determine if the area is free of the storage of gasoline or any flammable products, such as oil-based solvents, varnishes or adhesives.
- Check the gas line connections at the appliance (i.e., appliance gas valve/regulator housing and connections) for leaks with CGD.
- Determine whether the appliance and its vent connectors have the appropriate clearance from combustible building components.
- Inspect venting system to ensure the materials and horizontal pitch meet manufacturer's specification. In the absence of manufacturer's specifications, verify that the horizontal pitch has a ¼" rise per linear foot.
- When possible, inspect masonry chimneys to determine if they are lined.

Note: If appliance-related safety concerns or hazards were identified during the inspection, follow the appropriate action levels specified in ANSI/BPI-1200-S-2017 STANDARD PRACTICE FOR BASIC ANALYSIS OF BUILDINGS.

Combustion Appliance Zone – Oil-Fired Appliance

- Conduct an inspection of the CAZ for oil-fired appliance and fuel supply system (tank, supply lines, burner) for signs of oil leakage and other deficiencies.
- Inspect the CAZ in the immediate area where the combustion appliance is located, to determine if the area is free of rags, paper or other combustibles, and to determine if the area is free of the storage of gasoline or any flammable products, such as oil-based solvents, varnishes or adhesives.
- Determine whether the appliance and its vent connectors have the appropriate clearance from combustible building components.
- Inspect venting system to ensure the materials and horizontal pitch meet manufacturer's specification. In the absence of manufacturer's specifications, verify that the horizontal pitch has a ¼" rise per linear foot.
- When possible, inspect masonry chimneys to determine if they are lined.

Building Set Up for Combustion Safety Test

Scenario #1

For homes with atmospherically vented appliances that can be isolated from the house - The following steps shall be completed, for the purpose of placing the home under winter conditions at the time of the inspection.

- Place all combustion appliances located within the CAZ in their standby mode and prepare for operation.
- Close all building exterior doors and windows.
- Turn on vented kitchen exhaust fan, if one exists, and set to highest setting.
- Close any interior doors that isolate the CAZ from the rest of the building when possible.
- Turn on vented electric or gas-fired clothes dryers.

Scenario #2

For homes with atmospherically vented appliances, where the CAZ cannot be isolated from the house - The following steps shall be completed, for the purpose of placing the home under winter conditions at the time of the inspection.

- Place all atmospherically vented combustion appliances in their standby mode and prepare for operation.
- Close all building exterior doors and windows.
- Turn on vented kitchen exhaust fan, if one exists, and set to highest setting.
- Turn on vented electric or gas-fired clothes dryers.

Combustion Safety Test – Single Atmospherically Vented Appliance per Chimney/Vent or Orphaned Water Heater

Use the following procedures to test combustion appliances for spillage and measure CO level in undiluted flue gases, when a forced-air furnace/air handler is located in the CAZ with an atmospherically vented appliance.

- Follow lighting instructions and place appliance in operation.
- Adjust the thermostat or control, so the appliance will operate continuously.
- Turn on cooling circulation fan or wait for forced-air furnace circulation fan if one exists in the CAZ to operate.
- Check the appliance for flue gas spillage at 5 minutes of main burner operation for cold vents, OR;
- Check the appliance for flue gas spillage at 2 minutes of main burner operation on domestic water heaters or warm vents, AND;
- For Isolated CAZ with operating kitchen exhaust, open door separating CAZ from house and check for spillage again.
- Measure CO of undiluted flue gas at 5 minutes of main burner operation.

Combustion Safety Test - Multiple Atmospherically Vented Combustion Appliances Sharing Chimney and/or Venting System

Use the following procedures to test combustion appliances for spillage and measure CO level in undiluted flue gases, when a forced-air furnace/air handler is located in the CAZ with an atmospherically vented appliance and a chimney and/or venting system is shared by multiple combustion appliances.

- Start with the appliance that has the smallest BTUh input rating, follow lighting instructions and place in operation.
- Adjust the thermostat or control, so the appliance will operate continuously.
- Turn on cooling circulation fan or wait for forced-air furnace circulation fan if one exists in the CAZ to operate.
- Check the appliance for flue gas spillage at 5 minutes of main burner operation for cold vents, OR;
- Check the appliance for flue gas spillage at 2 minutes of main burner operation on domestic water heaters or warm vents, AND;
- For Isolated CAZ with operating kitchen exhaust, open door separating CAZ from house and check for spillage again.
- Measure CO of undiluted flue gas at 5 minutes of main burner operation.
- Upon completion of spillage testing and CO measurement of the first appliance, place the next largest BTUh combustion appliance in operation, while the first appliance is still firing.
- Retest the first appliance for flue gas spillage when the second appliance has reached 2 minutes of main burner operation.
- Test the second appliance for flue gas spillage immediately thereafter.
- Measure CO level in the undiluted flue gas of the second appliance at 5 minutes of its main burner operation.
- Continue this process for each additional commonly vented combustion appliance, in order of BTUh input rating from smallest to largest, until all are running simultaneously.

Combustion Safety Testing of Gas-Fired Ovens

Perform appliance testing procedures following the manufacturer's appliance procedure. In the absence of the manufacturer's appliance procedure, use the following testing procedure:

- Check the oven cavity for any stored materials and remove before testing.
- Check the gas line connections at the appliance (i.e., appliance gas valve/regulator housing and connections) for leaks with CGD.
- Turn the oven(s) on to a bake temperature of 500°F. Do not turn the oven all the way up to the broil setting or self-cleaning setting.
- After 5 minutes of the oven's main burner operation:
 - For range top ovens, record ambient CO while standing at the appliance and holding detector at face level.
 - For wall ovens, record ambient CO at face level in a central location of the kitchen.

Placing Appliances Back in Operation

If no safety concerns or hazards were identified during the inspection of the combustion appliances, return all inspected appliances and systems to their pre-test state. If appliance-related safety concerns or hazards were identified during the inspection, follow the appropriate actions levels specified in ANSI/BPI-1200-S-2017 STANDARD PRACTICE FOR BASIC ANALYSIS OF BUILDINGS.

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