

precautions to avoid harm from these changes. See [WPN 17-7: Weatherization Health and Safety Guidance](#).

## 2.1 PURPOSES OF AN ENERGY AUDIT

An energy audit evaluates a home's existing condition and outlines improvements to the energy efficiency, health, safety, and durability of the home.

Depending on the level of the audit, an energy audit may include some or all of the following tasks.

- Inspect the building and its mechanical systems to gather the information necessary for decision-making.
- Evaluate the current energy consumption along with the existing condition of the building.
- Diagnose areas of energy waste, health and safety, and durability problems related to energy conservation.
- Recommend energy conservation measures (ECMs).
- Diagnose health and safety problems, and how the proposed ECMs may affect these problems.
- Predict savings expected from ECMs.
- Estimate labor and material costs for ECMs.
- Educate residents about their energy usage and proposed energy retrofits.
- Encourage behavioral changes that reduce energy waste.
- Provide written documentation of the energy audit and the recommendations offered.

### 2.1.1 Energy-Auditing Judgment and Ethics

The auditor's good decisions are essential to the success of a weatherization program. Good decisions depend on judgment and ethics.

- ✓ Understand the policy of the DOE WAP program.
- ✓ Treat every client with the same high level of respect.
- ✓ Communicate honestly with clients, coworkers, contractors, and supervisors.
- ✓ Know the limits of your authority, and ask for guidance when you need it.
- ✓ Develop and maintain the inspection, diagnosis, and software skills necessary for WAP energy auditing.
- ✓ Choose ECMs according to their cost-effectiveness along with DOE and State policy, and not according to personal preference or client preference.
- ✓ Don't manipulate the energy-modeling software to either select or avoid particular ECMs.
- ✓ Avoid personal bias in your influence on purchasing, hiring, and contracting.

## 2.1.2 Health and Safety Considerations

Energy auditors and inspectors must know and understand the health and safety (H&S) policies of the State weatherization program. H&S measures impact the budget and the economic viability of most weatherization jobs. An auditor may justify an H&S measure as any of the following types according to WPN 17-7.

1. An required H&S measure funded by the State's H&S budget, which protects occupants or workers but isn't justified by the energy audit and isn't included in the average cost per unit (ACPU).
2. An incidental repair measure (IRM), with H&S benefits, funded to protect an ECM or to mitigate a relatively inexpensive hazard such as a roof leak, chimney repair, or electrical repair.

3. An H&S measure that serves as a precaution or a benefit of a cost-effective ECM, and in this case, the H&S measure adds costs to the SIR calculation.
4. An H&S benefit of an ECM that isn't itself cost-effective but justifiable by the H&S benefits combined with the ECM's energy savings.

When you consider whether a measure is an ECM or an H&S, evaluate its SIR, and if cost-effective, treat it as a ECM.

## 2.2 CLIENT RELATIONS

Client satisfaction depends on the energy auditor's reputation, professional courtesy, and ability to communicate.

### 2.2.1 Communication Best Practices

Making a good first impression is important for client relations. Friendly, honest, and straightforward communication creates an atmosphere where the auditor and clients can discuss problems and solutions openly.

Setting priorities for client communication is important for the efficient use of your time. Auditors must communicate clearly and directly. Limit your communication with the client to the most important energy, health, safety, and durability issues.

- ✓ Introduce yourself, identify your agency, and explain the purpose of your visit.
- ✓ Make sure that the client understands the goals of the WAP program.
- ✓ Listen carefully to your client's reports, complaints, questions, and ideas about their home's energy efficiency.
- ✓ Ask questions to clarify your understanding of your client's concerns.
- ✓ Before you leave, give the client a quick summary of what you found.

## 2.2.2 Client Interview

The client interview is an important part of the energy audit. Even if clients have little understanding of energy and buildings, they can provide useful observations that can save you time and help you choose the right ECMs.

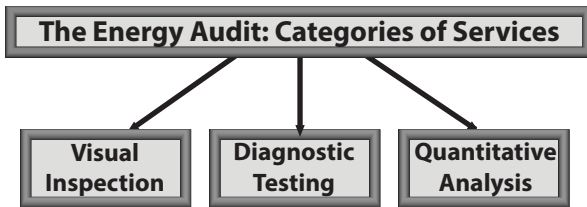
- ✓ Ask the client about comfort problems, including rooms that are too cold or too warm.
- ✓ Ask clients to see their energy bills if you haven't already evaluated them.
- ✓ Ask clients if there is anything relevant they notice about the performance of their mechanical equipment.
- ✓ Ask about family health, especially respiratory problems afflicting one or more family members.
- ✓ Discuss space heaters, fireplaces, attached garages, and other combustion hazards.
- ✓ Discuss drainage issues, wet basements or crawl spaces, leaky plumbing, and pest infestations.
- ✓ Discuss the home's existing condition and how the home may change after the proposed retrofits.
- ✓ Identify existing damage to finishes to insure that weatherization workers aren't blamed for existing damage. Document damage with digital photos.
- ✓ Ask the client to sign the necessary permissions.

- State and local repair funds
- Church, charity, and foundation funds

## 2.3 PARTS OF AN ENERGY AUDIT

Visual inspection, diagnostic testing, and numerical analysis are three types of energy auditing procedures we discuss in this section. These procedures help energy auditors to evaluate all the possible ECMs that are cost-effective according to DOE-approved energy-modeling software: Weatherization Assistant or approved equivalent.

The energy audit must also propose solutions to health and safety problems related to the energy conservation measures.



### 2.3.1 Visual Inspection

Visual inspection orients the energy auditor to the physical realities of the home and home site. Among the areas of inspection are these.

- Health and safety issues
- Building air leakage
- Building insulation and thermal resistance
- Heating and cooling systems
- Ventilation fans and operable windows
- Baseload energy uses
- The home's physical dimensions: area and volume

## 2.3.2 Diagnostic Testing

Measurement instruments provide important information about a building's unknowns, such as air leakage and combustion efficiency. Use these diagnostic tests as appropriate during the energy audit.

- Blower-door testing: A variety of procedures using a blower door to evaluate the airtightness of a home's leakage sites and parts of its pressure boundary.
- Duct leakage testing: A variety of tests using a blower door and pressure pan to locate duct leaks.
- Ventilation testing: Measure airflow through existing exhaust fans with an exhaust-fan flow meter.
- Combustion safety and efficiency testing: Sample combustion by-products and measure depressurization to evaluate safety and efficiency. Test for existing gas leaks. Test the home's ambient air for CO.
- Test for fuel leaks with a combustible gas detector.
- Infrared scanning: View building components through an infrared scanner to observe differences in the temperature of building components inside building cavities.
- Appliance consumption testing: Monitor refrigerators with a logging watt-hour meter to measure electricity consumption.

### 2.3.3 Quantitative Analysis: Energy-Audit Software

Energy auditors currently use the Targeted Investment Protocol System (TIPS), Targeted Retrofit Energy Analysis Tool (TREAT), and Energy Audit using the Queens Information Packet (EA-QUIP) to determine which ECMs have the highest Savings-to-Investment Ratio (SIR). The SIR is the number of times that an ECM repays its initial investment during its lifetime.

$$\text{SIR} = \text{LIFETIME SAVINGS} \div \text{INITIAL INVESTMENT}$$

DOE WAP and the State WAP program require that ECMs have an SIR greater than or equal to 1.

A Savings to Investment Ratio (SIR) formula is a life-cycle cost calculation. The calculation includes a present value function, which allows you to divide total savings over the life of a project — expressed in today's dollars — by its initial investment. This gives you an indication of the 'cost-effectiveness' of an ECM.

An SIR equal to or greater than 1.0 indicates a cost-effective, 'WAP-eligible' ECM — one with more savings than cost over its lifetime. Remember however, that cost-effectiveness is relative, based in part on the ranking of that ECM in the overall list from your software. The software assumes that the measures above a particular ECM are implemented prior to that ECM, which is why you can't 'skip measures'.

The auditor must collect information to inform decisions about which ECMs to choose.

- ✓ Measure the home's exterior horizontal dimensions, wall height, floor area, volume, and area of windows and doors.
- ✓ Measure the current insulation levels.
- ✓ Do a test to evaluate air leakage and duct leakage.
- ✓ Do a combustion efficiency test to evaluate the heating system's efficiency.

- ✓ Evaluate energy bills, compared to your energy model, and adjust the job's budget within limits to reflect the potential energy savings.

## 2.4 WORK ORDERS

### *SWS Detail: 2.0702.1 Warranty and Service Agreement*

The work order is a list of materials and tasks that are recommended as a result of an energy audit. Consider these steps in developing the work order.

- ✓ Evaluate which ECMs have an acceptable savings-to-investment ratio (SIR) using the energy-modeling software.
- ✓ Select the most important health and safety problems to correct based on what problems are directly related to the cost-effective ECMs.
- ✓ Provide detailed ECM specifications so that crews or contractors clearly understand the materials and procedures necessary to complete the job.
- ✓ Estimate the cost of the materials and labor.
- ✓ Verify that the materials needed are in stock at the agency or a vendor.
- ✓ Inform crews or contractors of any hazards, pending repairs, and important procedures related to their part of the work order.
- ✓ Obtain required permits from the local building jurisdiction, if necessary.
- ✓ Specify interim testing during air sealing and heating-system maintenance to provide feedback for workers.
- ✓ Consider scheduling an in-progress inspection during an important retrofit.