

ENERGY STAR for Homes: Guide for Structural Insulated Panel (SIP) Manufacturers



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INTRODUCTION

This Guide was developed for the structural insulated panel (SIP) industry and provides information necessary to build homes under the ENERGY STAR program.

WHAT IS ENERGY STAR?

ENERGY STAR is a nationally recognized, voluntary labeling program to identify and promote energy efficient products to consumers and business owners across the United States. Initiated by the U.S. Environmental Protection Agency (EPA) in 1992, ENERGY STAR is now a joint effort of EPA and the U.S. Department of Energy, with each agency taking responsibility for promoting the ENERGY STAR label in particular product categories. The EPA is responsible for administering ENERGY STAR labeled homes.



WHAT IS AN ENERGY STAR LABELED HOME?

An ENERGY STAR labeled home is at least 30% more energy efficient in its heating, cooling and water heating than a comparable home built to the Model Energy Code (MEC). This increased level of energy efficiency can be met by successfully integrating three key home components:

- Energy efficient building envelope (effective insulation, tight construction, advanced windows)
- Energy efficient air distribution (tight, well-insulated ducts)
- Energy efficient equipment (heating, cooling and hot water)

WHY SIP MANUFACTURERS SHOULD PARTICIPATE IN ENERGY STAR?

There are at least four basic reasons why a SIP manufacturer should consider making the commitment to producing ENERGY STAR labeled homes.

1. The ENERGY STAR label can be a powerful sales tool. ENERGY STAR is a nationally recognized brand backed and promoted by two federal agencies. Affiliating with this brand is a 'badge of honor' distinguishing truly energy efficient homes.
2. The ENERGY STAR label brings a reputation for high-performance homes that can help the SIP industry get credit for inherent performance advantages that are invisible to uneducated home buyers.
3. ENERGY STAR verification procedures extend quality control beyond the building envelope helping the SIP industry deliver a more consistent high-performance home.
4. ENERGY STAR is better for business because total home performance and cost advantages can only help improve customer satisfaction while increasing revenues and profits.

HOW CAN A SIP MANUFACTURER PARTICIPATE IN ENERGY STAR?

Securing the benefits of ENERGY STAR involves the following steps:

- 1. Getting Ready (Chapter 1)**
SIP manufacturers and their builder customers become ENERGY STAR partners and develop prescriptive packages that assure compliance with ENERGY STAR.
- 2. Verification Solutions (Chapter 2)**
All ENERGY STAR labeled homes must be verified by a third-party. Securing a preferred verification solution is a critical step in becoming a successful ENERGY STAR partner. Several options and sources of verification services are available.
- 3. Field Installation (Chapter 3)**
Responsibilities for completing field installed measures rest with each SIP manufacturer's builders. Each manufacturer will need to coordinate field installation procedures necessary for ENERGY STAR with their builders and be actively involved in completing the verification process.
- 4. Marketing Solutions (Chapter 4)**
ENERGY STAR is a powerful marketing tool, but you give it away if you don't tell the story. EPA provides a number of tools to help begin the process, but it will be up to each manufacturer to integrate ENERGY STAR with its overall marketing efforts. The final marketing solutions then need to be coordinated with each manufacturer's builders.

All four parts are straightforward, but require a commitment of time and resources necessary to market and sell the ENERGY STAR brand.

ACCESS TO RESOURCES

Additional information for partnering with ENERGY STAR labeled homes - including marketing materials, copies of forms, logos, Builder Option Packages, and the ENERGY STAR label - is available on EPA's web site at www.energystar.gov/homes.

Additional information on working with ENERGY STAR labeled homes is available from the Structural Insulated Panel Association (SIPA) at www.sips.org or by phone at (253) 858-7472.

GETTING READY


Producing ENERGY STAR labeled SIP homes starts with manufacturers and builders becoming ENERGY STAR partners. Each manufacturer should also identify prescriptive options that assure compliance with ENERGY STAR.

ENERGY STAR Partnership Agreement

SIP manufacturers and their builders will need to submit an ENERGY STAR for Homes Partnership Agreement to EPA. Signing this agreement entitles partners to use the ENERGY STAR logo, to be listed on the ENERGY STAR web site, and to access a wide range of regional programs supporting ENERGY STAR labeled homes. In turn, partners are committed to constructing at least one labeled home each year, and to use the ENERGY STAR logo consistent with EPA guidelines.

Agreements should be submitted separately for each SIP plant. Make sure to list *each state served* under "Major metro area served" so each plant is included appropriately on the ENERGY STAR web site locator map.

A copy of the ENERGY STAR for Homes Partnership Agreement can be found in Appendix A as well as on the EPA web site.



ENERGY STAR is a broad partnership designed to promote products, buildings, and homes that use less energy without sacrificing quality.

ENERGY STAR FOR HOMES seeks to demonstrate that energy-efficient homes can improve builder profitability, improve home quality and homeowner comfort, lower energy demand, and reduce air pollution.

ENERGY STAR labeled homes use at least 20 percent less energy than the reference house defined in the National Association of State Energy Officials (NASEO) Home Energy Rating System Technical Guidelines. A home built to these levels would achieve a minimum Home Energy Rating System (HERS) score of 85.

To receive an ENERGY STAR label, homes must be verified by an accredited, independent third party and shown to meet the performance threshold specified above. Visit www.energystar.gov/homes for more information.

***Please mail or fax this form to:**
ENERGY STAR FOR HOMES
TURNKEY SUPPORT COORDINATOR
US EPA (MAIL CODE 6202)
1200 PENTAGON AVE, NW
WASHINGTON, DC 20460
***A/C 202-565-2079**
Visit www.energystar.gov/homes for additional information.

ENERGY STAR Hotline:
1-888-STAR-YES
(1-888-782-7937)

ENERGY STAR® PARTNERSHIP AGREEMENT:
ENERGY STAR FOR HOMES

Through this agreement you join in partnership with ENERGY STAR. Through this partnership, the ENERGY STAR name and/or labels can be used in association with qualified homes.

To be completed by authorized company representative:
(Please type or print clearly - Information to be displayed on the ENERGY STAR Web site)

Organization Name: _____

Address: _____

City/State/Zip: _____

Telephone: _____ Fax: _____

E-mail: _____ Web site: _____

Major metro area served (for listing on our Web site): _____

What organization referred you to ENERGY STAR? _____

Partner Type:

For Home Builders (please specify):

➤ Site-built Home Builder: Local Builder/Developer Division/Subsidiary Corporate (National)

➤ Manufactured Home Builder: Plant* Retailer/Community Corporate (HQ/Division)

* Provide a list with name, city, state, phone # of any retailer/community you wish to be affiliated with on our Web site.

➤ System Building (e.g., modular, SIP, ICF, panel, etc.) Specify system type: _____

Plant* Retailer/Local Builder Corporate (HQ/Division)

* Provide a list with name, city, state, phone # of any retailer/local builder you wish to be affiliated with on our Web site.

• Parent company, if applicable: _____

• Average number of homes built per year: _____

• **100% Commitment Option.** Builders interested in special recognition can commit to building and labeling 100% of their homes with the ENERGY STAR label. This commitment will be denoted with a special 100% icon on the ENERGY STAR for Homes Web site locator map. To make this commitment please initial here: _____

For Verification Organizations (please specify):

Accredited HERS/BOP Provider Certified HERS Rater/BOP Inspector

• If a Rater or Inspector, please name the Accredited Provider with whom you are affiliated: _____

Authorized Company Representative (printed name): _____

Title: _____

Signature: _____ Date: _____

To be completed by US EPA:
 Kathleen Hogan, Director, Climate Protection Partnerships Division, U.S. Environmental Protection Agency

Signature: _____ Date: _____

Selecting an ENERGY STAR Specification

The purpose of this step is to prepare each manufacturer with prescriptive packages customized for SIP construction that assure ENERGY STAR compliance for builders using their product. These packages will specify a number of energy measures in addition to SIP panels such as:

- tight construction;
- sealed ducts;
- high-performance windows; and
- high-efficiency heating and cooling equipment.

There are two ways to determine ENERGY STAR compliant prescriptive energy packages. First, a Home Energy Rating System (HERS) rater can develop customized recommendations for popular builder models. Second, EPA provides a wide range of prescriptive energy efficiency specifications called Builder Option Packages (BOPs) that are available on the EPA's ENERGY STAR web site (www.energystar.gov/homes/bops). BOPs are configured for each climate zone used by the national building code (International Energy Conservation Code or IECC). As a result, they make it easy for SIP manufacturers to advise their builder customers on how to meet ENERGY STAR in specific locations. They can also be used to develop one or more specifications for the broad geographic areas served by each SIP plant. This can be done by first compiling BOPs best matched to builders' preferences for all relevant climate zones in the plant's service territory. A plant ENERGY STAR specification is developed by identifying a set of energy measures that meet or exceed the requirements of all compiled BOPs. Multiple specifications may be required where no single package of measures can satisfy all climate zones served. Manufacturers can use the services of a BOP provider (typically a HERS rater or energy consultant) to assist in this process. Appendix B provides a more detailed explanation of how BOPs work and an example of how BOPs can be used to develop a plant specification.

VERIFICATION SOLUTIONS

Securing third-party technical verification solutions for builders is critical for a successful ENERGY STAR partnership. In addition, verification can help extend performance advantages of SIP construction to the entire home.

ENERGY STAR Verification Requirements

All ENERGY STAR homes are third-party verified to use at least 30 percent less energy than a comparable home built to the MEC. Third-party verifiers can be either a HERS rater or BOP provider.

Verification Options

A HERS rater can implement either a custom HERS rating or a BOP. A BOP provider only implements BOPs. The only difference between these two verification options is how required energy measures are selected. HERS ratings are customized for one or more plans, and BOPs are prescriptive measures that insure compliance with ENERGY STAR for large geographic regions.

Once ENERGY STAR measures are identified, than both verification options require field inspection and testing to insure all measures were installed and air and duct leakage requirements are met. Note that homes with SIP walls and roof construction resulting in ducts inside the conditioned space will not need testing. This is because ducts inside conditioned space don't leak air to outside and SIPs can reliably deliver tight construction if field inspections visually check for completely sealed construction including the foundation seal, panel joints, all window and door perimeters and all penetrations. Hybrid homes with SIP walls and conventionally framed roofs would still need to be tested.

Field inspection and testing can be done for each individual home, or with a random sampling protocol (minimum 15% of homes - see Appendix C). However, if the sampling protocol is used, the builder must build at least 85 homes per year or use SIPs for the entire envelope (walls and roof).

Sources of Verification Support/Services

Across the country, many different groups provide verification solutions including:

- **HERS/BOP Providers** (see locator map on ENERGY STAR web site)
These fee-for-service professionals are the most traditional source of ENERGY STAR labeled home verification services.
- **Utilities** (see locator map on ENERGY STAR web site)
Approximately 50 utilities partner with ENERGY STAR labeled homes, many providing free verification services along with other marketing support and financial incentives.
- **State Administrators** (see locator map on ENERGY STAR web site)
State programs such as those in New York (NYSERDA) and Wisconsin (WECC) can provide free verification services along with marketing support and financial incentives.

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- ***Manufacturer/Vendor Programs***
A number of insulation manufacturers/vendors provide verification as part of their product offering (i.e., Certainteed, Green Fiber, Johns Manville, and Masco). This would probably be most relevant to hybrid applications where conventional roof framing and insulation are combined with SIP walls.

 - ***SIP Manufacturers Become Accredited BOP Providers***
SIP manufacturers can choose to take charge of the verification process by becoming an accredited HERS or BOP Provider. They have this option because manufacturers, even where they set the panels, are not the builders of record, and thus represent a "third-party". This could entail taking on full responsibility for testing and inspection with plant staff, or simply subcontracting inspections and testing to qualified and trained technicians. Manufacturers choosing this option would have to submit a simple application to the Residential Energy Services Network (RESNET) for approval. The applications and requirements are posted on the RESNET web site (www.natresnet.org).

Coordination with Builders

Most SIP home builders are small operations, often with minimal resources to take on new procedures such as HERS ratings and BOP inspections. Thus, a successful ENERGY STAR partnership often requires initiative by each manufacturer partner to facilitate one or more verification options for their builders. Possible actions range from a simple handout linking builders to the most appropriate source(s) of verification to a full turn-key verification service arranged by the plant. Providing verification solutions is in the manufacturer's business interest because it builds a reputation for providing high-performance homes both for the company and the SIP industry, and can extend the quality reputation of SIP construction to the fully constructed home.

FIELD INSTALLATION

Although a SIP envelope is a great start for an energy efficient home, a number of energy measures have to be installed in the field along with completion of the ENERGY STAR verification process.

Field Installed Measures

Field installation of ENERGY STAR labeled SIP homes involves installing the plant-made envelope system on the foundation in the field and incorporating other energy measures in the completed home such as efficient windows, basement insulation, heating/cooling systems and water heating equipment. For best practices on installing panels, consult SIPA and their available training programs. For other measures, SIP manufacturers will need to insure their builders are properly trained to complete field installation and verification responsibilities.

Installing SIP Panels

If the plant is responsible for installing SIP panels, it is also responsible for tight construction details. If the builder is responsible for installing the panels, the plant needs to insure builders are following through on these details. Panel sealing details include:

- Panels sealed to foundation (foam gaskets and/or sealant)
- Panels sealed to each other (gaskets, caulking and/or foam sealant)

Installing Other Energy Efficiency Measures

The builder is typically responsible for finishing the home after the panels are installed. Other energy efficiency measures will need to be installed including:

- Efficient windows (required U-value and SHGC)
- Air sealing all penetrations and cracks (e.g., plumbing, HVAC, wiring, windows) (foam sealant)
- Foundation insulation (either slab perimeter, crawl space, or basement)
- Heating plant (required AFUE furnace or boiler, or HSPF heat pump)
- Air conditioning (required SEER)
- Water heater (required Energy Factor)
- Duct sealing and insulation where outside conditioned space (required R-value, air-tightness)

Complete ENERGY STAR Verification


Completed BOP checklists or HERS ratings are needed to document the installation of all energy measures. Regardless of which verification method is used, field inspection and testing (air infiltration and duct leakage) are typically required. An exception would be where SIPs are used for walls and roof and duct systems are installed inside conditioned space. In this case, duct leakage and air infiltration testing are not needed as long as a detailed inspection is performed to verify air tightness.

ENERGY STAR Label

Once field verification is successfully completed, the BOP inspector or HERS rater will place ENERGY STAR sticker labels directly on homes in the field. The sticker label is most often located on an interior electric panel (they are not weather-proof). However, they can be installed in other preferred locations.

Where requested by builders, BOP inspectors or HERS raters can also provide ENERGY STAR certificates in addition to, *not instead of*, sticker labels.

BOP inspectors or the HERS raters insure that all labeled homes are reported back to EPA so builders gets credit for the number of labeled homes on EPA's ENERGY STAR web site.



An ENERGY STAR® Labeled Home

Address:

Built by:

Verified by:

Date:

Optional Information:

This home has been independently verified through an EPA-approved sampling protocol to meet ENERGY STAR guidelines for energy efficiency. ENERGY STAR labeled homes protect the environment by using less energy.
www.energystar.gov

MARKETING SOLUTIONS

Marketing is telling your story, and ENERGY STAR is a great story - better performing homes that cost less to own. Unless you tell your story, you give it away. EPA provides a number of tools to help, but SIP manufacturers will need to implement their own marketing solutions.

Marketing Message: Better Performance at Less Cost

Better performance for less cost sounds too good to be true, but that's what home buyers get with energy efficient homes. Advanced structural insulated panel envelope, tight construction, high-performance windows, and efficient equipment work together to:

- lower utility bills;
- insure even temperatures in all rooms without annoying drafts;
- provide quieter living environments;
- improve indoor air quality with better humidity control and less pollutant pathways; and
- reduce maintenance cost with less risk of mold and dry rot and longer-lived equipment.

In short, unless you're prepared to break the laws of physics, energy efficient homes have to perform better. And this performance advantage costs less because monthly utility bill savings can easily exceed small increases in the monthly mortgage attributed to the added energy efficiency measures (see example in sidebar). Since energy efficient homes use less energy, they also protect the environment by reducing air pollution produced at power plants and home heating equipment. So, energy efficiency is a great story, and the ENERGY STAR label makes it easy to demonstrate your homes are truly energy efficient.

Why Energy Efficient Homes Pay You Money!

<i>Energy Eff. Home</i>	<i>Monthly</i>	<i>Annual</i>
<i>Utility Savings</i>	\$40	\$480
<i>Additional Mortgage Costs</i>	\$15	\$180
Net Income	\$25	\$300

EPA Marketing Resources

ENERGY STAR Partners have access to a number of marketing resources provided by EPA. These include:

- **The ENERGY STAR Logo**
The logo is a widely recognized government-backed label for energy efficiency. There are no multiple performance gradients or detailed technical concepts that have to be explained. It simply demonstrates you provide a truly energy efficient home.
- **The ENERGY STAR Web Site**
The web site (www.energystar.gov/homes) promotes ENERGY STAR as a compelling choice for home buyers. In addition, partners are automatically listed on a locator map for each state noted on their Partnership Agreement. These listings also include the number of homes labeled so partners get full credit for their accomplishments. EPA marketing material and messages consistently drive consumers to this web site.

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- ***Consumer Materials***
Builders can order or directly download off the web site a wide range of consumer materials that tell the ENERGY STAR story. These include brochures and stand-up display, technology fact sheets, and cash-flow software (called HomeCalc) that can be used to calculate the cost advantage for each buyer and/or model.
 - ***ENERGY STAR Financing***
Every ENERGY STAR labeled home qualifies for preferred mortgages offered by regional and national ENERGY STAR Financing Partners. Benefits range from discounts off of closing costs to free ratings. See locator map on ENERGY STAR web site for a full list of financing partners and offerings.

SIP Manufacturer Marketing Options

The EPA resources are a good start, but it will be up to each SIP manufacturer to effectively integrate ENERGY STAR in their marketing strategy. Manufacturers are encouraged to set up a meeting with an ENERGY STAR representative to develop a customized marketing/sales action plan (see ENERGY STAR web site for a full list of Regional Account Managers). Typical marketing options for SIP manufacturers include:

- ***ENERGY STAR on Marketing Materials***
Companies should integrate the ENERGY STAR story in their company web site, corporate brochure, advertising and other marketing material.
- ***ENERGY STAR in Display Model(s)***
Many manufacturers encourage prospective customers to visit their plants for tours and to see one or more finished models at the plant or other locations. ENERGY STAR should be prominently featured in these models.
- ***Technology Displays***
Energy measures utilized to meet ENERGY STAR requirements are not visible to your prospective customers in finished homes. However, they can be effectively displayed to demonstrate the attention to detail and quality with a SIP home. In addition to SIP panels, displays can be used to show-off the performance and quality advantages of low-E windows, tight ducts, high-efficiency equipment, and ventilation systems. Monthly cash-flow advantages can also be easily shown on charts and fact sheets.
- ***Signage***
Research consistently shows that signage is one of the most important sources of information for new home buyers. Manufacturers should consider options for showcasing ENERGY STAR on signage both at the plant and construction sites.

Coordinate Marketing Solutions with Builders

SIP manufacturers need to coordinate marketing solutions with their builders including how ENERGY STAR is being featured at model homes, company marketing materials, company web site, marketing spiffs, point-of-purchase displays, and signage. In addition, SIP manufacturers need to assist builders in developing their own ENERGY STAR marketing materials. If builders are convened at a single venue, an ENERGY STAR representative may be available for training support. If your builders don't help you tell your ENERGY STAR story, you give it away!

PARTNERSHIP AGREEMENT

The ENERGY STAR for Homes Partnership Agreement shown here is available electronically on the web at: www.energystar.gov/homes.



ENERGY STAR is a broad partnership designed to promote products, buildings, and homes that use less energy without sacrificing quality.

ENERGY STAR FOR HOMES seeks to demonstrate that energy-efficient homes can improve builder profitability, improve home quality and homeowner comfort, lower energy demand, and reduce air pollution.

ENERGY STAR labeled homes use at least 30 percent less energy than the reference house defined in the National Association of State Energy Officials' (NASEO) Home Energy Rating System Technical Guidelines. A home built to these levels would achieve a minimum Home Energy Rating System (HERS) score of 86.

To receive an ENERGY STAR label, homes must be verified by an accredited, independent third party and shown to meet the performance threshold specified above. Visit www.energystar.gov/homes for more information.

Please mail or fax this form to:

ENERGY STAR FOR HOMES
PARTNER SUPPORT COORDINATOR
US EPA (MAIL CODE 6202J)
1200 PENNSYLVANIA AVE, NW
WASHINGTON, DC 20460

FAX: 202-565-2079

Visit www.energystar.gov/homes for additional information.

ENERGY STAR Hotline:
1-888-STAR-YES
(1-888-782-7937)

ENERGY STAR® PARTNERSHIP AGREEMENT: ENERGY STAR FOR HOMES

Through this agreement you join in partnership with ENERGY STAR. Through this partnership, the ENERGY STAR name and/or labels can be used in association with qualified homes.

To be completed by authorized company representative:

(Please type or print clearly - Information to be displayed on the ENERGY STAR Web site)

Organization Name: _____

Address: _____

City/State/Zip: _____

Telephone: _____ Fax: _____

E-mail: _____ Web site: _____

Major metro area served (for listing on our Web site): _____

What organization referred you to ENERGY STAR? _____

Partner Type:

For Home Builders (please specify):

➤ Site-built Home Builder:

Local Builder/Developer Division/Subsidiary Corporate (National)

➤ Manufactured Home Builder:

Plant* Retailer/Community Corporate (HQ/Division)

* Provide a list with name, city, state, phone # of any retailer/community you wish to be affiliated with on our Web site.

➤ System Building (e.g., modular, SIP, ICF, panel, etc.) Specify system type: _____

Plant* Retailer/Local Builder Corporate (HQ/Division)

* Provide a list with name, city, state, phone # of any retailer/local builder you wish to be affiliated with on our Web site.

• Parent company, if applicable: _____

• Average number of homes built per year: _____

• **100% Commitment Option.** Builders interested in special recognition can commit to building and labeling 100% of their homes with the ENERGY STAR label. This commitment will be denoted with a special 100% icon on the ENERGY STAR for Homes Web site locator map. To make this commitment please initial here: _____

For Verification Organizations (please specify):

Accredited HERS/BOP Provider Certified HERS Rater/BOP Inspector

• If a Rater or Inspector, please name the Accredited Provider with whom you are affiliated:

Authorized Company Representative (printed name): _____

Title: _____

Signature: _____ Date: _____

To be completed by US EPA:

Kathleen Hogan; Director, Climate Protection Partnerships Division, U.S. Environmental Protection Agency

Signature: _____ Date: _____



The ENERGY STAR labeled home performance target can be met through any combination of:

- Envelope upgrades;
- Controlled air infiltration;
- Upgraded heating and air conditioning systems' and
- Upgraded water heating equipment.

EPA encourages builder Partners to protect the health of occupants by equipping ENERGY STAR labeled homes with features that will improve indoor air quality. Additional information can be found on the ENERGY STAR Web site.

ENERGY STAR builder Partners are encouraged to equip ENERGY STAR labeled homes with energy-efficient lighting and appliances or to offer such equipment as upgrades. Additional information, including a list of labeled products, can be found on the ENERGY STAR Web site.

Visit www.energystar.gov/homes for additional information.

ENERGY STAR® PARTNERSHIP AGREEMENT: ENERGY STAR FOR HOMES

ENERGY STAR Commitments to Partners

1. Increase awareness of the ENERGY STAR label by distributing key messages on the benefits of ENERGY STAR qualified homes and homes-related products.
2. Provide (via the ENERGY STAR Web site, Hotline, e-mail or other means) current ENERGY STAR news, information, and reference documents.
3. Provide ENERGY STAR Partners with public recognition through the Internet (in accordance with the ENERGY STAR Web Linking Guidelines), special awards, and media campaigns for their efforts in ENERGY STAR and role in protecting the environment.
4. Respond expeditiously to any Partner requests for information or clarification on ENERGY STAR policies.

General Commitments for ENERGY STAR Partners

1. Label at least one qualified home with the ENERGY STAR label within any ongoing 12-month period. Partners not fulfilling this requirement will be placed on 'Inactive' status, thereby forfeiting all rights to: the ENERGY STAR name, logo, and other materials; eligibility for ENERGY STAR awards; and inclusion on lists of ENERGY STAR Partners used on the ENERGY STAR Web site and in advertising materials. Partners placed on 'Inactive' status can be reinstated and regain all benefits by labeling a qualified home with the ENERGY STAR label.
2. Use the Partnership and the ENERGY STAR label to promote energy efficiency as an easy and desirable option for new home buyers to prevent pollution, protect the environment, and save on energy bills.
3. Build and maintain the meaning of ENERGY STAR as a trustworthy symbol that makes it easy to make a difference for the environment while saving money.
4. Adhere to the ENERGY STAR Logo Use Guidelines (available at www.energystar.gov/logos) and ensure that authorized representatives, such as advertising agencies, distributors, and subcontractors, also comply.
5. Adhere to the ENERGY STAR Web Linking Guidelines (available at www.energystar.gov/partners). Failure to do so can result in the loss of linking privileges from the ENERGY STAR Web site.
6. For accredited HERS or BOP providers, certified rater or BOP inspectors, and certified manufactured home plants, provide an ENERGY STAR label for each ENERGY STAR qualified home.
7. For accredited HERS or BOP providers and certified manufactured home plants, submit quarterly reports to ENERGY STAR specifying the number of homes verified as meeting ENERGY STAR performance specifications, listed by builder name (for providers) or by retailer (for manufacturing plants).
8. For manufactured home partners electing to manage the distribution of ENERGY STAR labeling materials at the corporate headquarters, divisional, or regional level, provide labeling materials only to qualified plants and coordinate the reporting and recordkeeping processes for each plant as described in ENERGY STAR Labeled Manufactured Homes: Design, Manufacturing, Installation and Certification Procedures (available at www.energystar.gov/homes).

General Terms and Disclaimers

1. Partner will not construe, claim, or imply that its participation in ENERGY STAR constitutes federal government approval, acceptance, or endorsement of anything other than the Partner's commitment to ENERGY STAR. Partnership does not constitute federal government endorsement of the Partner or its homes or services.
2. Partner understands that the activities it undertakes in connection with ENERGY STAR are voluntary and not intended to provide services to the federal government. As such, the Partner will not submit a claim for compensation to any federal agency.
3. Partner and ENERGY STAR will assume good faith as a general principle for resolving conflict and will seek to resolve all matters informally, so as to preserve maximum public confidence in ENERGY STAR.
4. This agreement is voluntary and can be terminated by either party at any time or any reason, with no penalty.
5. Failure to comply with this Partnership Agreement or the ENERGY STAR Logo Use Guidelines can result in termination of this Agreement and authorization to use the logo marks.
6. ENERGY STAR will actively pursue actions for resolving issues of logo use noncompliance.

ENERGY STAR Logo Mark Usage Summary

This information is presented for reference only. Please refer to the ENERGY STAR Logo Use Guidelines for a complete explanation of the authorized usage of each logo mark.



Certification Mark
Used to label an ENERGY STAR qualified home



Partnership Mark
Used to highlight your ENERGY STAR Partnership



Promotional Mark
Used to educate the public about ENERGY STAR



Linkage Phrase Marks
Used to promote your services and products and link to ENERGY STAR

Builder Option Packages (BOPs)

HOW BOPS WORK

There are individual BOPs for each of the 19 climate zones used in the Model Energy Code and International Energy Conservation Code (IECC). All BOPs can be accessed from a 'BOP Tool' featured on the EPA web site (www.energystar.gov/homes/bops). Each BOP has three pages: an introduction; a matrix listing all the various options; and detailed notes. A sample BOP is shown below and on the next page with explanations about how each page is configured.

These are standard notes on all BOPs that provide general guidance on how to use BOPs and work with a BOP provider.



Instructions for Using ENERGY STAR® Builder Option Packages



Builder Option Packages (BOPs) are a prescriptive method for labeling new homes ENERGY STAR. BOPs specify levels and limitations for the thermal envelope (insulator windows), HVAC and water heating equipment efficiencies for a specific climate zone. BOPs require a third-party verification, including testing the leakage of the envelope system, to ensure the requirements have been met. Follow these steps to build an ENERGY STAR labeled home using a BOP:

1. To find the BOP, visit the ENERGY STAR Web site at www.energystar.gov/homes/bops. Check the website regularly to ensure that you are using the most current available.
2. Choose the state and county where the home will be built, and open the File. Opening the BOP files requires Adobe Acrobat Reader; a free version of Adobe Acrobat Reader can be downloaded from www.adobe.com.
3. Identify the package (i.e., BOP Number) that you are interested in building. There may be more than one page of BOPs to choose from, depending on your location. Make sure that the house you are building meets the limitations of the package. For example, if the prospective home has 16% window area, the BOP selected must meet or exceed the corresponding limitation - i.e., choose a BOP that allows \leq 18% or 21% window area.
4. Build the home, following all the BOP specifications. For clarification on certain items please read the attached "Footnotes" section.
5. Contact a BOP provider to get your home inspected and labeled ENERGY STAR. BOP providers can be located on the Locator Map of the ENERGY STAR Web site at www.energystar.gov/homes.
6. The BOP provider will send a BOP inspector to verify the home meets or exceeds all requirements listed in the BOP. Verification of the home typically includes testing the leakage of the envelope and duct system. If the home complies with the BOP, the inspector will sign and date the BOP sheet. This sheet is then filed with the BOP Provider's records.
7. For home buyers interested in an ENERGY STAR mortgage, Fannie Mae requires estimated monthly energy cost savings. For BOPs, these estimates are determined using a monthly cost savings table developed for each climate zone, such as the table below. To use this table:
 - Choose the appropriate number of stories, foundation type, and home size that most closely fits the home being built and locate the estimated monthly savings.
 - Insert the estimated monthly cost savings in the appropriate line at the bottom of the BOP sheet. Note that these estimated savings should NOT be used as basis for guaranteeing utility bills. This should only be done on a case by case basis with a qualified energy modeling tool.
 - Submit a copy of the signed BOP, which includes the estimated monthly cost savings, with your loan request forms, and indicate your interest in receiving an ENERGY STAR mortgage.

Number of Stories:	Single Story									Double Story							
	Slab-on-grade			Basement			Crawlspace			Slab-on-grade		Basement		Crawlspace			
Home Size (SF):	1,000	2,000	2,500	1,000	2,000	2,500	1,000	2,000	2,500	2,000	4,000	5,000	2,000	4,000	5,000	2,000	4,000
Estimated Monthly Savings:	\$15	\$20	\$25	\$15	\$20	\$25	\$15	\$20	\$25	\$25	\$40	\$45	\$30	\$40	\$50	\$30	\$45

This table provides annual energy bill savings for each climate zone. However, the numbers should only be considered rough "ball park" estimates of the financial benefit associated with each BOP. Lenders will require this savings estimate before processing an ENERGY STAR mortgage or traditional energy efficient mortgage (EEM). The specific savings number to use would be selected based on the best match to actual home size, foundation type and number of stories. Note #7 on the instructions provides more detail.

Specific information to be completed for each home by BOP inspector.

DRAFT Builder Option Packages for ENERGY STAR® Labeled Homes¹



Builder Name: _____ City: _____ State: _____
 House Address: _____

Top row indicates specifications that vary among different BOPs

Specific packages are listed across each row. Based on the package selected, the BOP provider checks the row in the left column.

Rows split in broader groups based on different levels of equipment efficiency (i.e., top group uses 90% AFUE gas furnace and lower group uses 94% gas furnace).

BOP Selected Number	Climate Zone 11 ²																
	Window Requirements			Minimum Insulation Requirements ³					Minimum Equipment Requirements ⁴								
	Window Area ⁵	Window U-value	Window SHGC ⁶	Attic	Exterior Wall ⁷	Floor Unheated Space	Basement Wall	Slab	Crawlspace Wall	Gas Furnace Htg / Elec Clg (AFUE) (SEER)	Cool (SEER)	Electric Htg / Elec Clg (HSPF) (SEER)	Oil Hydronic Htg / Elec Clg (AFUE) (SEER)	Gas Hydronic Htg / Elec Clg (AFUE) (SEER)			
1	12%	<= 0.35	<= 0.35	R-38	R-15	R-19	R-10	R-8	R-10	90%	10	--	--	82%	10	88%	10
2	15%	<= 0.35	<= 0.35	R-38	R-19	R-19	R-10	R-8	R-10	90%	10	--	--	82%	10	88%	10
3	15%	<= 0.35	<= 0.40	R-38	R-21	R-19	R-10	R-6	R-10	90%	10	--	--	82%	10	88%	10
4	15%	<= 0.50	<= 0.37	R-38	R-17	R-19	R-10	--	R-10	90%	10	--	--	--	--	--	--
5	15%	<= 0.45	<= 0.37	R-30	R-17	R-19	R-10	--	R-10	90%	10	--	--	--	--	--	--
6	18%	<= 0.35	<= 0.40	R-30	R-21	R-19	R-10	R-8	R-10	90%	11	--	--	82%	10	88%	11
7	18%	<= 0.35	<= 0.40	R-38	R-12 ICF	R-19	R-10	R-8	R-10	90%	11	--	--	82%	10	88%	11
8	21%	<= 0.35	<= 0.35	R-38	R-21	R-19	R-10	R-8	R-10	90%	13	--	--	82%	10	90%	13
9	12%	<= 0.35	<= 0.60	R-30	R-13	R-19	R-10	R-6	R-10	94%	10	--	--	82%	10	88%	10
10	12%	<= 0.40	<= 0.65	R-30	R-17	R-19	R-10	R-8	R-10	94%	10	--	--	82%	10	88%	10
11	12%	<= 0.35	<= 0.45	R-30	R-15	R-19	R-10	R-6	R-10	94%	10	--	--	82%	10	88%	10
12	15%	<= 0.35	<= 0.35	R-38	R-15	R-19	R-10	R-6	R-10	94%	10	--	--	82%	10	88%	10
13	15%	<= 0.35	<= 0.40	R-38	R-17	R-19	R-10	R-8	R-10	94%	10	--	--	82%	10	88%	10
14	15%	<= 0.40	<= 0.40	R-38	R-21	R-19	R-10	R-8	R-10	94%	10	--	--	82%	10	88%	10
15	18%	<= 0.35	<= 0.35	R-38	R-19	R-19	R-10	R-6	R-10	94%	10	--	--	82%	10	88%	10
16	18%	<= 0.40	<= 0.45	R-38	R-13	R-19	R-10	R-6	R-10	--	--	2.8 COP	13 SEER	84%	11	--	--
17	21%	<= 0.35	<= 0.35	R-38	6.5" SIP	R-19	R-10	R-6	R-10	94%	10	--	--	82%	10	90%	10
18	21%	<= 0.35	<= 0.40	R-38	R-13	R-19	R-10	R-6	R-10	--	--	2.8 COP	13 SEER	84%	11	--	--
19	21%	<= 0.40	<= 0.40	R-38	R-19	R-19	R-10	R-6	R-10	--	--	2.8 COP	13 SEER	84%	10	--	--

BOP Provider Company's Name: _____ BOP Provider's Address: _____
 BOP Provider Phone number: _____
 BOP Inspector's Name: _____ BOP Inspection Company's Name: _____
 Inspection Date: _____ Estimated Monthly Cost Savings:¹³ _____

After successful field verification, BOP inspector completes all information in this sign-off box including estimated energy savings from table on previous page.

Additional specifications that apply to *all* BOPs listed on prior page.

Notes clarifying all requirements and conditions associated with using the BOPs

Additional Requirements for Climate Zone 11						
Envelope		Equipment			Design Limitations	
Infiltration ⁸	Door	Thermostat ⁹	Water Heater Energy Factor ¹⁰	Duct Leakage ¹¹	Duct Insulation ¹²	Ventilation
<= 0.35 ach; blower door tested	>= R-5	Programmable	>= 0.56 gas; >= 0.86 elec.	<= 6% leakage (CFM/CFM) to unconditioned spaces at 25 Pascals; field verified	Insulate ducts in unconditioned spaces to R-6	Active ventilation recommended
						Above Grade Area per Floor <= 2500 S.F.
						Window Orientation can be located on the south and west

Footnotes:

- Meeting all the requirements in a Builder Option Package (BOP) qualifies an individual home as ENERGY STAR compliant. ENERGY STAR labeled homes are designed to use at least 30% less energy than the Home Energy Rating System (HERS) Reference Home in the areas of heating, cooling, and domestic water heating. Homes that do not meet the requirements in the BOPs, should be certified by a local HERS rater. Homes built to BOP specifications must be verified by a RESNET-approved BOP provider, in accordance with the EPA/RESNET Agreement on BOPs (see www.natresnet.org/bop/agreement.htm). Additional efficiency and savings can be achieved by selecting other ENERGY STAR labeled products throughout the house (e.g., lighting, appliances). For more information, visit www.energystar.gov. Regardless of these specifications, all local codes must be followed.
- To determine the appropriate climate zone for the building site, see the 2000 International Energy Conservation Code, Figures 302.1 (1-50).
- Thermal requirements vary with local building codes. Ensure that insulation levels meet all relevant codes. The BOPs were developed for homes using wood framing, unless otherwise noted [i.e., insulated concrete form (ICF) or structural insulated panel (SIP)]. If metal framing is used, consult a local HERS rater to determine additional upgrades necessary to achieve similar thermal performance, such as additional insulated sheathing. The insulation R-Value of each component (i.e., attic, exterior wall, etc.) must meet or exceed the required level designated in the BOP. The overall R-value for components with multiple insulating levels can be determined by calculating a weighted average of the R-values (based on the percentage of the total area each constituent covers). For example, if the attic insulation required is R-38, and 25% of the ceiling is cathedral insulated to R-19, the required R-value for the remaining roof would be: $0.75 / [(1 / 38) - (0.25 / 19)] = 57$, or R-57.
- Install properly sized HVAC equipment. Recommended sizing methods: size heating & cooling equipment to ACCA Manual S specifications; size ducts to Manual D specifications, both based on Manual J load calculations. Geothermal heat pump equipment is specified in the table by a heating COP and a cooling EER.
- Maximum window area is a ratio of total window unit area to total above-grade conditioned floor area (WFA). For example, a house with total above-grade conditioned floor area of 2,000 square feet and total window area of 400 square feet has a WFA of $400/2,000 = 20\%$. Regardless of the maximum window area, up to 0.5% WFA may be used for windows with decorative glass (e.g., doesn't meet U-value or SHGC requirements). Likewise, a maximum of 1.0% WFA may be used for skylights. For example, a house with total above-grade conditioned floor area of 2,000 square feet may have only 10 square feet (0.5% of 2,000) of decorative glass and 20 square feet (1% of 2,000) of skylight area. All decorative glass (solar screen SHGC) x (percent of area covered) + [window SHGC x percent of area not covered]. For example, a window with a SHGC of 0.5, using a solar screen that provides 70% shading (the equivalent of 0.3 solar heat gain coefficient) and covers 60% of the window has an overall solar heat gain coefficient of $[0.5 \times 0.3 \times 0.6] + [0.5 \times 0.4] = 0.09 + 0.20 = 0.29$.
- Insulated Concrete Form (ICF) walls must include a minimum 4" concrete thickness with minimum total form insulation of R-12. An ICF wall can be substituted for all BOPs with wall insulation levels <= R-19.
- A 6.5" Structural Insulated Panel (SIP) must have an overall insulation level >= R-23. A 6.5" SIP wall can be substituted for all BOPs with wall insulation levels <= R-29.
- ASHRAE Standard 62-99 requires 0.35 ach of outdoor air (but not less than 15 CFM per person) to meet ventilation requirements for residential dwellings. It allows for infiltration and natural ventilation to satisfy this requirement. However, without active ventilation the actual infiltration rate could vary significantly throughout the year. To ensure consistent indoor air quality, it is recommended that homes are built to 0.20 ach or tighter and an active ventilation system is installed to achieve a minimum of 0.35 ach. To maximize savings, use a heat recovery ventilation system in cold and moderate climates, or energy recovery ventilation in hot climates.
- Programmable thermostats used in homes with heat pumps must have "ramp-up" technology to prevent the excessive use of electric back-up heating.
- For BOPs with Oil or Gas Hydronic equipment, domestic water heating must be provided by the space heating boiler (tankless).
- Duct leakage is determined by: duct leakage (%) = measured leakage from portion of duct system in unconditioned space / design airflow. For example, duct leakage for a forced air system with a design airflow of 2,000 cubic feet/minute and a measured leakage to unconditioned space of 100 cubic feet/minute (CFM) is equal to $100 \text{ CFM} / 2,000 \text{ CFM} = 0.05$, or 5%. Duct leakage tests such as the blower door subtraction method or simultaneous duct blaster and blower door testing can be used to measure duct leakage to unconditioned space.
- A minimum of R-4 duct insulation is recommended for ducts in conditioned space to prevent condensation.
- See that attached "Monthly Utility Savings" sheet to determine estimated monthly utility savings.

Notes:

a) The symbol "*" means that the option is not available for that specific BOP.

EXAMPLE:**DEVELOPING AN ENERGY STAR SPECIFICATION FOR A SIP PLANT USING BOPs****Step One: Identify Current Plant Specifications**

For this example, consider a SIP plant supplies panels for builds homes with typically 15 percent or less window area as a percent of floor area and the following insulation values::

10 $\frac{1}{4}$ " ceiling panel:	R-40
4 $\frac{1}{2}$ " wall panel:	R-16
6 $\frac{1}{2}$ " wall panel:	R-24

Windows, heating equipment and cooling equipment are provided by builders.

Step Two: Identify States Served by Plant and Climate Zones:

Homes are shipped to states and climate zones within those states listed below:

<u>State</u>	<u>Climate Zones</u>
Pennsylvania:	10 - 14
New Jersey:	10 - 13
New York:	10 - 14
Connecticut:	12 - 14
Rhode Island:	12 & 14
Massachusetts:	12 - 14
Overall:	10 - 14

Step Three: Identify Most Appropriate BOPs

Based on EPA approved builder option packages, BOPs have been assembled below by climate zone for the entire geographic area served by the sample plant that most closely match current specifications and 15% window area configuration.

Zone	BOP #	Ceiling R-Value	Wall R-Value	Window		Furn. or Boiler % AFUE	AC SEER
				U-Value	SHGC		
current plant specifications		R-40	R-16/24	builder option		builder option	bldr. option
10	10	38	15	[0.35	[0.40	90	11
11	3	38	21	[0.35	[0.40	90	10
12	3	38	21	[0.35	[0.40	90	10
13	4	38	15	[0.35	[0.50	90	10
14	4	38	15	[0.35	[0.50	90	10

(Example continued)

Step Four: Create a Plant ENERGY STAR Specification/Checklist

A sample plant ENERGY STAR specification checklist is shown below based on the most appropriate BOPs identified in Step Three for the sample plant. Note that all specifications must meet or exceed the requirements for all Climate Zones served.

**CHECKLIST FOR ENERGY STAR LABEL CERTIFICATION
Climate Zones 10,11,12,13,14**

The following must be verified by a field inspection:

- Basement wall insulation R-Value μ 10, installed in the field
- Furnace AFUE rating μ 90
- Air Conditioner SEER rating μ 10 (except 11 in Climate Zone 10)
- Gas Water Heater Energy Factor, EF μ 0.56
- Programmable Thermostat
- All cracks and penetrations fully caulked and sealed
- Ducts inside conditioned SIP envelope
- Low-E windows with U = [0.35 and SHGC = [0.40
- Window area [62% on the south and west sides

(*SIP manufacturer name*) provides the following:

1. R-40 SIP panels for roof
2. R-24 SIP panels for exterior walls
3. Panels precut with window area [15% of the floor area

Company Name

Inspector Name

Phone Number

Inspector Signature

Inspection Date

SAMPLING PROTOCOL

EPA has developed a sampling protocol for verification organizations to use when testing and inspecting homes for production builders (i.e., build a minimum of 85 homes per year). The protocol is intended for builders who have demonstrated a consistency in their specifications and production processes. The sampling protocol allows 3rd party verifiers to randomly test and inspect a minimum of 15 percent of homes from a batch of homes located within the same climate region (typically the same subdivision). It is intended to minimize production interruptions and verification costs while ensuring homes meet or exceed the criteria for labeling homes ENERGY STAR.

Sampling Protocol Guidelines

These Guidelines provide the specifications for using sampling in verifying homes meet the ENERGY STAR criteria. Two sets of guidelines are given: required procedures and best practices. While the required procedures must be followed, the best practices are given to help users successfully implement the Sampling Protocol.

ENERGY STAR Labeled Homes - Sampling Protocol Guidelines and Requirements		
Phases of Implementation	Required Procedures	Best Practice
1. Builder Qualification	<ul style="list-style-type: none"> Builder signs EPA <u>Partnership Agreement</u> to become an ENERGY STAR Partner. To be eligible for sampling the builder must build a minimum of 85 homes per year. 	<ul style="list-style-type: none"> Builder demonstrates consistency in their specifications and production processes.
2. Select the initial subdivision and the energy efficient measures needed to meet ENERGY STAR.	<ul style="list-style-type: none"> Builder selects an initial subdivision and contacts a 3rd party verifier (from Locator Map on www.energystar.gov/homes). 3rd party verifier identifies energy efficient measures (options) needed to meet or exceed ENERGY STAR based on <ul style="list-style-type: none"> - HERS rating of individual plans for each model in the subdivision, <i>or</i> - EPA-approved Builder Option Packages (BOPs). If custom HERS analyses are used to select energy measures, plan reviews must be based on a worst case configuration (e.g., worst orientation, all options that increase window area, and should consider options like extended family rooms, sunrooms, etc.). Builder selects energy efficient measures based on 3rd party verifier recommendations. 	<ul style="list-style-type: none"> 3rd party verifier performs diagnostics on an existing model home to get a baseline for current air infiltration and duct leakage. This enables the 3rd party to identify the improvement needed in these areas. Builder should select one set (i.e., "spec") of energy efficient measures for entire subdivision.

Phases of Implementation	Required Procedures	Best Practice
3. Builder builds first home	<ul style="list-style-type: none"> This is the first of three homes that will be fully tested and inspected before the sampling protocol can be initiated. 	<ul style="list-style-type: none"> 3rd party verifier works with the builder and their sub-contractors, especially the HVAC contractor to identify any changes required, and trains them on the verification/inspection process: <ul style="list-style-type: none"> - Air sealing and duct sealing should be a strong focus - Repeat with every new subdivision, or if the builder changes subcontractors. - This training should also be repeated for new crews and on a periodic (e.g., annual) basis.
4. Initial Testing	<ul style="list-style-type: none"> 3rd party verifier performs full testing and inspecting of the first 3 homes built within the first subdivision. This is required only for the first subdivision. If any home fails to meet specifications, the initial testing phase will continue until 3 consecutive homes pass. 	<ul style="list-style-type: none"> 3rd party verifier should select different models for initial testing. Recommend repeating Initial Testing step for new subdivisions, especially if there is a change in sub-contractors. If any of the three homes fail, particularly regarding the performance of sub-contractors on air sealing and duct sealing, an extended phase-in period should be considered where every home is tested until there is consistency in the house and duct tightness.
5. Selecting Batches	<ul style="list-style-type: none"> Builder identifies a batch of homes. A "Batch" is a group of homes ready for diagnostics (i.e., drywall complete, interior door jams installed, HVAC system installed, and final air sealing completed.) These homes are likely to be concurrently under construction within a block of time (e.g., month). 	<ul style="list-style-type: none"> The builder and 3rd party verifier should keep the batch sizes small to catch mistakes faster and enable the builder to quickly correct any systemic problems that may be found. (Any batch with even one failure must have the entire batch tested.)

Phases of Implementation	Required Procedures	Best Practice
6. Testing / Inspecting of \geq 15% of batch	<ul style="list-style-type: none"> 3rd party verifier randomly selects at least 15% of homes from a batch for testing and inspecting. Depending on the verification method, testing and inspecting includes performing a full HERS rating or a full BOP inspection. 	<ul style="list-style-type: none"> When selecting the homes from an available batch for testing and inspecting, the 3rd party verifier should select different models to ensure an effective sample.
7. All Tested / Inspected Homes PASS:	<ul style="list-style-type: none"> If each of the tested homes within the batch PASSES then all homes with the batch PASS. 	<ul style="list-style-type: none"> 3rd party should address any minor problems that may have been found during testing/inspecting by facilitating root-cause analysis and remediation with the builder and/or subcontractors.
OR	<p>8. Any Tested / Inspected Home FAILS</p> <ul style="list-style-type: none"> If any rated home within the identified batch fails, the entire batch fails. The root-cause of the failure must be assessed and fixed in every home in the batch. Each home must receive full testing and inspecting to be labeled ENERGY STAR. 	<ul style="list-style-type: none"> During the testing and inspecting of each home in the failed batch, assess whether or not the problem is an isolated failure. Notify the builder and/or subcontractors to ensure the cause of the failure will be corrected in the tested home, each home within the failed batch, and in all future homes. In general, keeping batch size small will help avoid a failure from being widespread. After a failure has been found, the sampling rate should be increased before resuming normal sampling procedures.
9. 3 rd Party Verifier Reports to Labeled Homes to EPA	<ul style="list-style-type: none"> 3rd party verifier will keep a record of every home within the batch - both tested and not. 3rd party verifier or their provider will report to EPA on a quarterly basis the number of homes receiving full inspections and the remaining number of homes that were not inspected. 	