Opportunities for Raters:

The ENERGY STAR Multifamily High Rise Program

2014 RESNET Conference - Atlanta, Georgia

February 26, 2014

Presenters: Ted Leopkey, U.S. EPA

Gayathri Vijayakumar, Steven Winter Associates, Inc.

Today's Session

- ENERGY STAR for Multifamily Buildings
- Overview of the ENERGY STAR Multifamily High Rise Program
- Technical Requirements and Revision 02
- ES MFHR Certified Buildings from 2013
- Lessons Learned
- Support and Future Outreach

Contact Info

ENERGY STAR Certified Homes (Low Rise Multifamily)
Main: www.energystar.gov/newhomespartners
Technical: www.energystar.gov/newhomesguidelines
Training: www.energystar.gov/newhomestraining
HVAC: www.energystar.gov/newhomesHVAC

ENERGY STAR Multifamily High Rise
Main: www.energystar.gov/mfhr
Questions: mfhr@energystar.gov
Benchmarking/Management: http://www.energystar.gov/multifamilyhousing

Now on Twitter and Facebook!

facebook.com/energystar

@energystarhomes

Audience Poll

- Is this your first time learning about ENERGY STAR MFHR?
- Did you attend last year's presentation?
- Did you attend our Nov. Rev02 webinar?
- Are you currently working on a building pursuing ENERGY STAR MFHR?
- Have you done ASHRAE 90.1-Appendix G energy modeling?

ENERGY STAR Residential Program

- Has guidelines that apply to:
  - Single Family Homes (detached and attached)
  - Factory Built Homes (manufactured and modular)
  - Low Rise MF Residential Buildings

  Certified Homes

  - Mid and High Rise MF Residential Buildings*

    MFHR
    - Covers buildings previously ineligible for ENERGY STAR certification
    - Launched mid-2011

*Criteria defining Mid and High Rise available at www.energystar.gov/mfhr

ENERGY STAR Program Eligibility

- ENERGY STAR Certified Homes, v3
  - All Multifamily buildings with ≤3 stories; and
  - 4 and 5 story multifamily buildings with distributed HVAC and DHW systems, and less than 20% residential associated common space

- ENERGY STAR Multifamily High Rise
  - 4 and 5 story buildings with distributed HVAC and DHW systems, and more than 20%; and
  - 4 and 5 story buildings with central HVAC and/or DHW system; and
  - All buildings with ≥6 stories

MF Building Eligibility Examples

- 6 story, 4 units, central system
  - ENERGY STAR Certified Homes Version 3
- 3 story, central system, 50% residential-associated common area
  - ENERGY STAR Certified Homes Version 3
- 7 story, 2 stories of garage, 5 stories above with residential units, all in-unit systems, 70,000 ft^2 (but garage is 20,000 ft^2, apartments are 45,000 ft^2, and common areas are 5,000 ft^2)
  - ENERGY STAR Certified Homes Version 3
- 7 story, mixed-use, 2 stories of retail, 5 stories above with residential units, all in-unit systems, 70,000 ft^2 (but retail is 20,000 ft^2, apartments are 45,000 ft^2, and common areas are 5,000 ft^2)
  - ENERGY STAR MFHR Program Version 1.0
- 5 ½ story, all in-unit systems, less than 20% common area
  - ENERGY STAR MFHR Program Version 1.0

Program Requirements for Multifamily High Rise Projects (MFHR)

- Each ENERGY STAR certified mid and high rise project is verified to be at least **15%** more energy efficient than a building built to the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2007.

ENERGY STAR MFHR Partnership

- EPA created a new partnership category for Multifamily High Rise Developer
  - Follow ENERGY STAR Logo Guidelines
  - Provide a project application for each project that enters the program
  - Design with intent to meet ENERGY STAR MFHR requirements
  - Work with a Licensed Professional to validate completion of ENERGY STAR MFHR requirements
  - Commit to benchmarking building for at least 2 years after occupancy

Role of the Verifier for High Rise Residential Buildings

- Developers must work with a Licensed Professional to gain the ENERGY STAR certification.
- Licensed Professionals are Registered Architects or Professional Engineers who:
  - Oversee a team of verification providers (e.g. HERS Rater, HVAC Contractor, Test and Balance Engineer)
  - Validates program reporting requirements (Stamped and Signed)
- More information on Licensed Professionals can be found at www.energystar.gov/mfhr

ENERGY STAR Certified Multifamily High Rise Buildings

Make a Commitment to Energy-Efficient Multifamily High Rise Buildings

Developers across the nation are constructing or substantially rehabilitating Multifamily High Rise (MFHR) buildings to earn the ENERGY STAR, improving building quality and occupant comfort while lowering energy demand and reducing air pollution. Become an ENERGY STAR MFHR Developer Partner and demonstrate your commitment to energy-efficient, quality buildings.

BECOME A PARTNER →

WORKING WITH ENERGY STAR

Partners


MFHR Developers


Utilities

Other Stakeholders


Licensed Professionals (Architects and Engineers)


Energy Professionals


Housing Agencies

PROGRAM FEATURES AND RESOURCES

ENERGY STAR Multifamily High Rise (MFHR) Program Requirements

Each ENERGY STAR certified multifamily mid and high rise building is designed to be 15% more energy efficient than a building built to the 2007 ASHRAE 90.1 standard. Multifamily mid and high rise buildings can earn the ENERGY STAR using either the Performance or Prescriptive Path.

Learn More >


Program Requirements


Building Eligibility


Certification Process


Guidance Documents


Training Resources

Guidance Documents

For an MFHR project to earn the ENERGY STAR, EPA or its designated agent must approve a complete Proposed Design Submittal and a complete As-Built Submittal.

All required program documentation for both submittals is available as a .zip file download below. The downloadable file includes folders with documentation specific to the Performance and Prescriptive paths as well as the Testing & Verification documents. Consult the Licensed Professionals page for details on the requirements for both the Proposed Design Submittal and the As-Built Submittal.

Additional information on submittals and required documentation is available in the Licensed Professional's Guide to the ENERGY STAR Label for MFHR Buildings (636KB) that is also included in the .zip file.

DOWNLOAD ALL MFHR GUIDANCE DOCUMENTS (.ZIP)

MFHR RESOURCES

- Program Requirements
- Building Eligibility
- Certification Process
- **Guidance Documents**
- Training Resources

Testing & Verification Documents

(Performance and Prescriptive Path)

The *Testing & Verification Protocols* are mandatory requirements for the inspection, testing, and verification of each of the energy-related components and systems that exist in participating projects. **Compliance with the Testing & Verification Protocols is required for both the Performance and Prescriptive paths.**

The results of the inspections must be documented in the *Testing & Verification Worksheets* and *Photo Folder Template* and provided to EPA or its designated agent at the completion of construction. Inspections should be conducted throughout the project construction phase at a time that is best suited to determine whether the energy efficiency element is installed to specification.

TESTING & VERIFICATION (T&V) PROTOCOLS	This guide outlines the Testing & Verification Protocols (817KB) for the MFHR Program.
TESTING AND VERIFICATION WORKSHEETS	The Testing and Verification Worksheets (2.3MB) are used to document that each prerequisite and each energy conservation measure included in the completed building meet all requirements and follow the *T&V Protocols*. The *T&V Worksheets* are a key component to the program's submittals and must be submitted to EPA or its designated agent as part of the Proposed Design Submittal and the As-Built Submittal.

Partner Resources
Manufacturers
Retailers
New Home Industry
Benefits
Next Generation
Resources
Affordable Housing
RE Ready Home
Utilities/EEPS
Residential & Commercial Products Programs
Service & Product Providers
Buildings & Plants
Small Businesses
Congregations
For Contractors
For Federal Agencies
Join ENERGY STAR

The Role of Licensed Professionals

Licensed Professionals work closely with Developer Partners to ensure that all of the MFHR program requirements are met including the submittal of design and verification documentation to EPA.

To verify energy savings and protect the integrity of the ENERGY STAR brand, a Licensed Professional working on behalf of the ENERGY STAR Multifamily High Rise (MFHR) Developer Partner must provide EPA or its designated agent with program specific submittals. These submittals are used to demonstrate that the program's requirements have been met, that all mandatory measures are included, and that each energy conservation measure is installed to specification.

The Licensed Professional must be a Professional Engineer or Registered Architect in good standing and possess a current license. The Licensed Professional should also have:

- A license in a discipline related to residential and/or commercial building systems (e.g. mechanical engineering or commercial/residential architecture)
- Working knowledge of building systems, ASHRAE Standard 90.1–2007, ASHRAE Standard 62.1–2007, and ASHRAE Standard 62.2–2007.

MFHR RESOURCES


Program Requirements


Building Eligibility


Certification Process


Guidance Documents


Training Resources

The ENERGY STAR MFHR Developer partner or the Licensed Professional working on their behalf may engage a third party, who may not be a licensed professional, to conduct some or all of the inspections and diagnostic testing required per the ENERGY STAR MFHR Testing & Verification Protocols. However, the *ENERGY STAR MFHR Submittal Validation Form* must bear the seal and signature of the Licensed Professional who remains responsible for all work performed by others under his or her direction and control. The Certification Process page also outlines the responsibilities of both Developer Partners and Licensed Professionals during the design and construction phases.

ENERGY STAR MFHR Project Application and Submittals

The Licensed Professional or Developer Partner must submit an ENERGY STAR MFHR Project Application (67.1KB) to EPA for each project. This will ensure each project is allowed to adhere to the program requirements in place at the time the Project Application is submitted, and will not be subjected to additional requirements as the program progresses. Once the Project Application has been accepted and the building has been designed, the Licensed Professional must submit a complete Proposed Design Submittal. After construction, the Licensed Professional must submit a complete As-Built Submittal. EPA or its designated agent will not approve incomplete submittals but will communicate with

Partner Resources

- Manufacturers
- Retailers
- New Home Industry
  - Benefits
  - Next Generation
  - Resources
  - Affordable Housing
  - RE Ready Home
- Utilities/EEPS
- Residential & Commercial Products Programs
- Service & Product Providers
- Buildings & Plants
- Small Businesses
- Congregations
- For Contractors
- For Federal Agencies

Join ENERGY STAR

MFHR Developers

Partnering with EPA's ENERGY STAR Multifamily High Rise Program ("MFHR") helps developers design and construct energy-efficient mid and high rise multifamily buildings that benefit owners, residents and communities.

Benefits of Partnership for Developers

Developers face a variety of unique challenges based on the particular markets they serve. The ENERGY STAR MFHR Program can benefit all participating developers in a number of ways:

- **Capitalize on the ENERGY STAR brand recognition and logo**
- **Market units that are comfortable and affordable to live in**
- **Receive incentives in selected markets**
- **Ensure verification of energy efficiency measures**
- **Utilize EPA guidance and technical assistance**
- **Earn recognition through EPA's Leadership in Housing Award and Partner of the Year Award**
- **Help meet energy requirements for other green building programs for additional market distinction**

BECOME A PARTNER →

MFHR RESOURCES

 Program Requirements

 Building Eligibility

 Certification Process

 Guidance Documents

 Training Resources

The MFHR Program also has specific benefits for market rate developers and developers of affordable housing projects:

MARKET RATE DEVELOPERS

AFFORDABLE HOUSING DEVELOPERS

Join ENERGY STAR as a Residential New Construction Partner

To apply:

Becoming an ENERGY STAR partner is easy. Simply fill out an ENERGY STAR Partnership Agreement by following the appropriate link below. There is no cost to partner with ENERGY STAR or use ENERGY STAR promotional materials.

Training Requirements for Builder and Rater Partners:

Builder and Rater partners are required to complete mandatory training. For more information about the training requirements, visit ENERGY STAR for Homes Version 2.5 and 3 Guidelines.

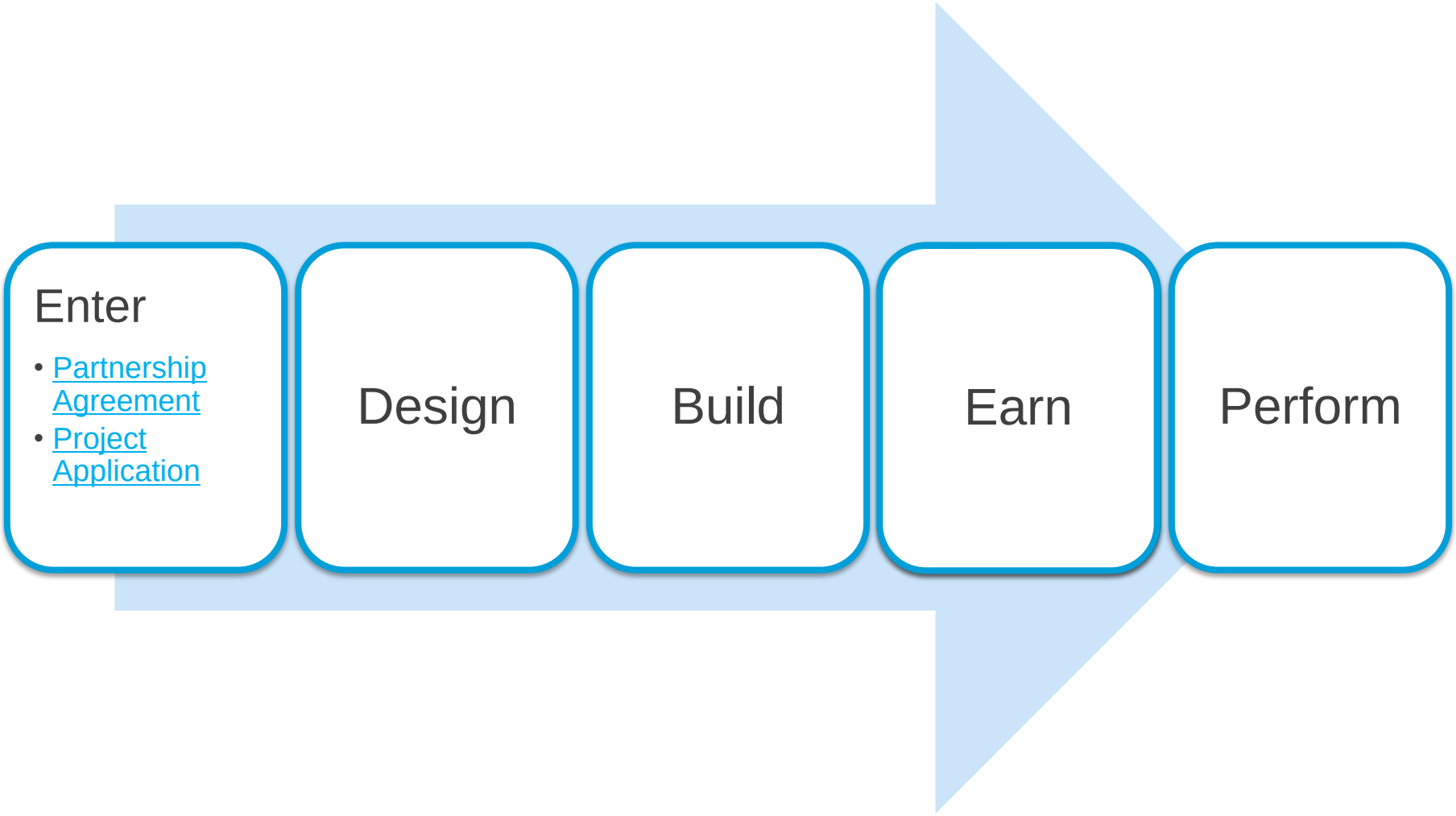
Online Partnership Agreements for:

- Builders
  Companies or individuals that plan to construct one or more new ENERGY STAR certified home for either sale or personal use. This category includes Modular Home Builders, Multifamily Low Rise Builders, Community Developers, Affordable Housing Builders, and Manufactured Home Plants/Retailers/Installers.
- Multifamily High Rise Developers
  Companies or individuals that plan to construct new ENERGY STAR certified multifamily high rise buildings.
- Home Energy Raters
  Professionals who analyze energy-efficient home plans and provide on-site verification for homes to earn the ENERGY STAR.
- Architect/Home Plan Designers
  Individuals or organizations that design residential new construction plans. The plans must be qualified by a HERS Rater to earn the ENERGY STAR designation. The constructed house, if built to plan, will earn an ENERGY STAR label.
- Utilities and Other Sponsoring Programs
  Utilities; national, regional, state, or local government entities; or other organizations (such as home builders associations and green building programs) that promote or intend to promote ENERGY STAR certified homes.

Partnership Agreement for:

- Lenders (63KB)
  Institutions or individuals who loan borrowers money for the purchase of residential structures through the use and promotion of Energy Efficient Mortgages (EEM).

Certification Process for MFHR Projects



Design

Certified Homes Program

- ENERGY STAR Reference Design
  - Approximately15% savings above 2009 IECC
- Prescriptive Path
- Performance Path
  - RESNET
  - HERS Index Target

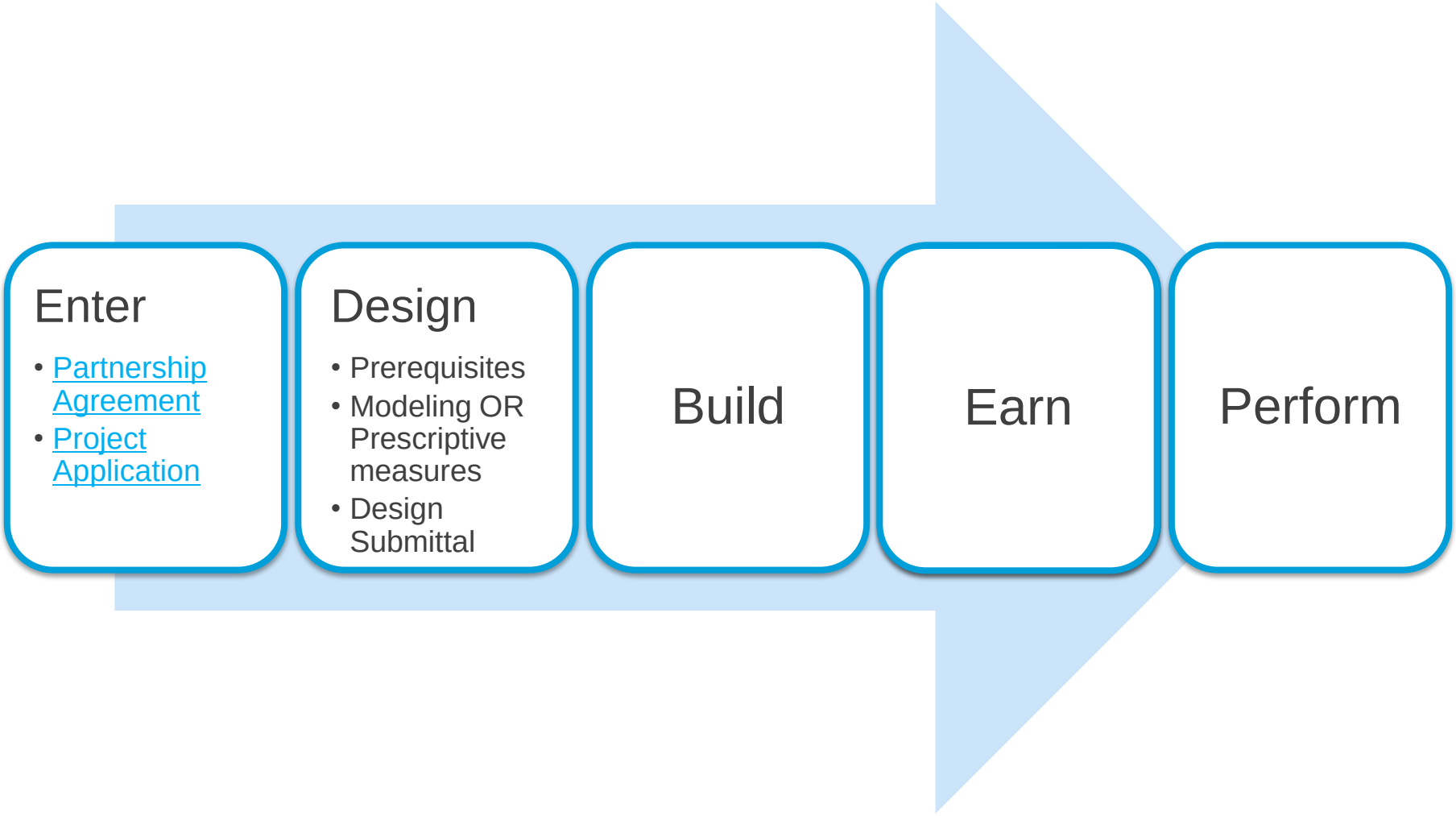
MF High Rise Program

- 15% cost savings above ASHRAE 90.1-2007
- Prescriptive Path
- Performance Path
  - ASHRAE 90.1 Appendix G
  - ENERGY STAR Simulation Guidelines

Documentation: Proposed Design

- Proposed Design Submittal (Pre-Construction)
  - Model output summary that confirms design is 15% above ASHRAE 90.1-2007 Baseline (*Performance Path only*)
  - Plan review confirming Prerequisite and/or Prescriptive measure are in construction documents
  - Validation Form signed and stamped by Licensed Professional

Certification Process for MFHR Projects



Build

Certified Homes Program

- ENERGY STAR Version 3 Inspection Checklists
  - Thermal Enclosure System
  - HVAC System (Contractor and Rater)
  - Water Management System
- Verification performed by certified HERS Rater

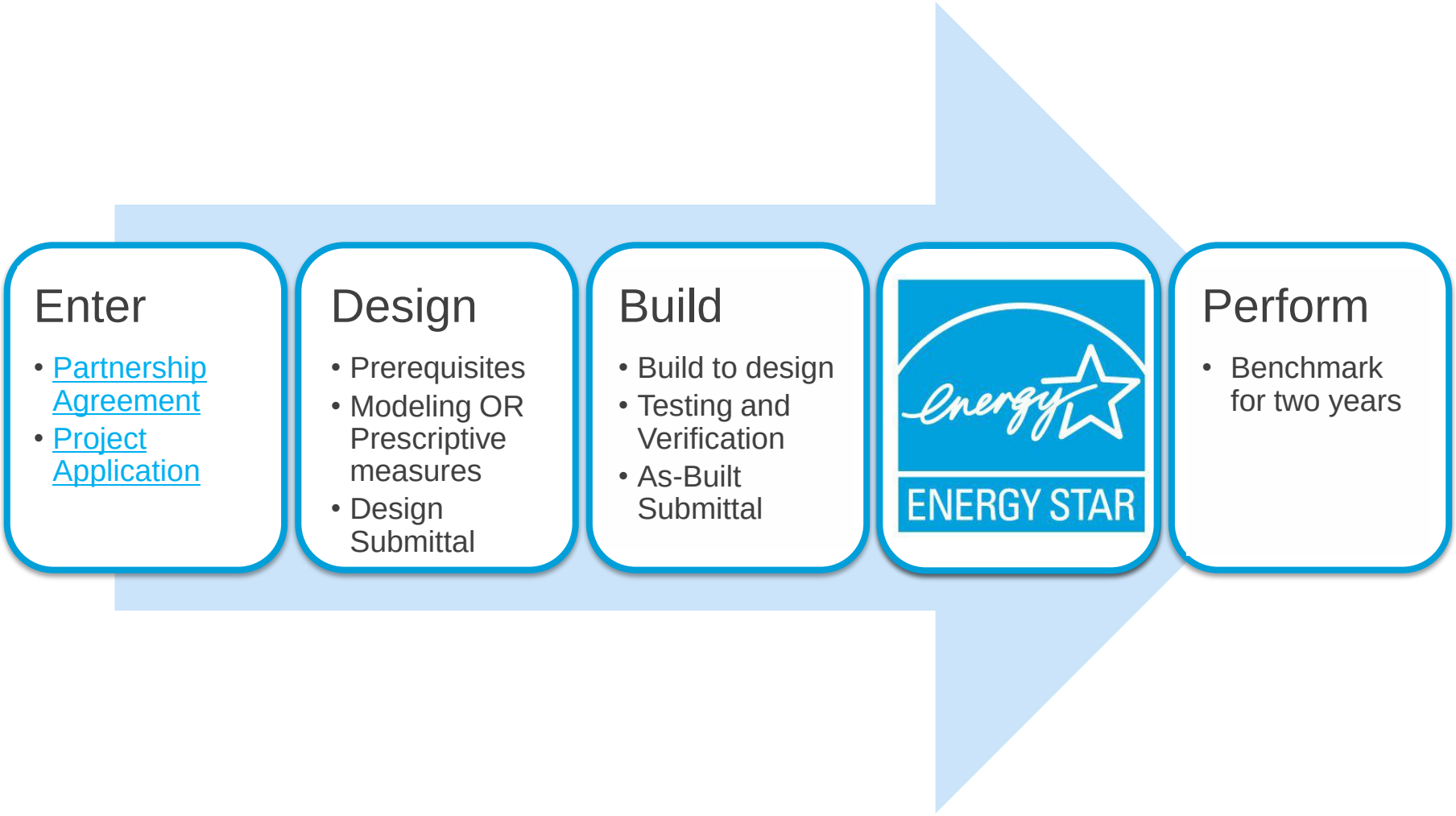
MF High Rise Program

- ENERGY STAR Testing & Verification Worksheets
  - Thermal Enclosure System
  - HVAC & DHW System
  - Lighting, Motors, Pumps, Etc
- Verification performed by an energy consultant(s) and validated by a licensed professional

Documentation: As-Built Building

- As-Built Submittal (Post Construction)
  - Model updated to reflect actual building conditions (*Performance Path only*)
  - Energy conservation measures are tested and Verified to ensure they meet EPA's ENERGY STAR MFHR Testing and Verification requirements
  - Validation Form signed and stamped by Licensed Professional

Certification Process for MFHR Projects



The ENERGY STAR MFHR Technical Requirements

Two Paths to ENERGY STAR MFHR

- **Performance Path**
  - Meet Prerequisites
  - Conduct Energy Modeling
  - Build according to Design
  - Conduct Testing and Verification
- **Prescriptive Path**
  - Meet Prerequisites
  - Build according to Prescriptive Requirements
  - Conduct Testing and Verification

Two Paths to ENERGY STAR MFHR

- **Performance Path**
  - Meet Prerequisites
  - Conduct Energy Modeling
  - Build according to Design
  - Conduct Testing and Verification
- **Prescriptive Path**
  - Meet Prerequisites
  - Build according to Prescriptive Requirements
  - Conduct Testing and Verification

Meeting the MFHR Prerequisites

- ENERGY STAR certified appliances
- ENERGY STAR certified lighting in 80% of light fixtures or 100% high-efficacy lighting
- Occupancy sensors for lighting in some common spaces
- Right-sized heating and cooling equipment
- Double-pane, low-e windows
- Low-flow faucets (≤ 2.0gpm) & WaterSense showerheads and toilets
- Total duct leakage for in-unit systems ≤8 CFM25 per 100ft^2 of conditioned floor area
- Air-sealing to achieve infiltration <0.30 CFM50/ft^2 of enclosure
- Ventilation per ASHRAE 62-2007 (apts. and common areas)

*Not all Prerequisites have been listed here; see ENERGY STAR MFHR Performance Path V1.0 Revision 2

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(Items in red are different from ENERGY STAR Certified Homes V3)

Testing and Verification Protocols

- Protocols are similar to Guidebooks in ES Version 3.
- Mandatory requirements for the inspection, testing and verification of components related to the building's energy performance.
- The intent of the protocols is to verify that
  - the construction documents & final building include all Prerequisites.
  - measures used to achieve the Performance levels predicted by the model have been installed and perform as modeled.
  - all measures specified by the Prescriptive Path have been installed.
- Changes to the initial design noted during inspections must be reflected in a revised energy model and submitted as the As-Built model, or must still comply with Prescriptive Path requirements.

Testing and Verification Protocols

1. ENERGY STAR Certified Appliances
2. Domestic Water Heating (Central or In-Unit Systems)
3. Envelope Construction/Insulation, R-value/U-value/SHGC
4. Garage
5. Heating and Cooling (Central or In-Unit Systems)
6. Lighting (In-unit, common area, exterior, controls)
7. Pump Motors
8. Air-sealing and testing; Ventilation and testing
9. Metering

Testing and Verification Protocols

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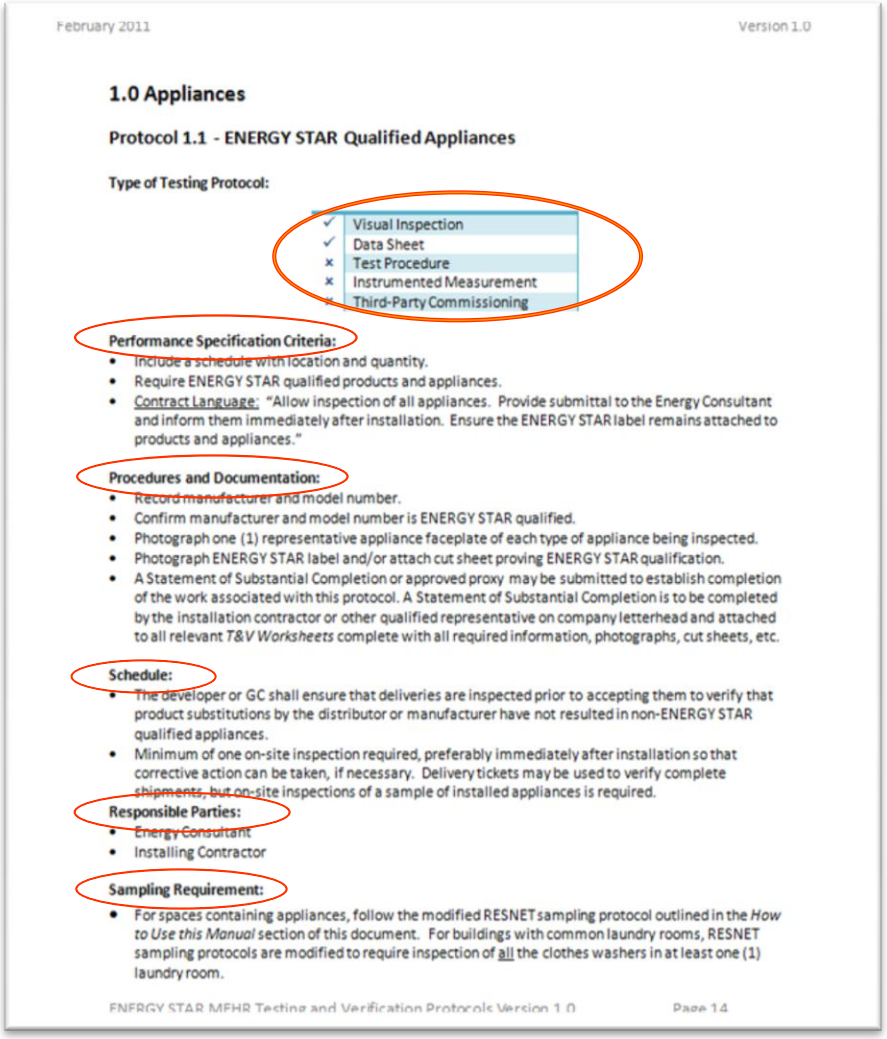
(Items in red are different from ENERGY STAR Certified Homes Version 3)

Testing and Verification Protocols



February 2011 Version 1.0

1.0 Appliances

Protocol 1.1 - ENERGY STAR Qualified Appliances

Type of Testing Protocol:

✓	Visual Inspection
✓	Data Sheet
×	Test Procedure
×	Instrumented Measurement
×	Third-Party Commissioning

Performance Specification Criteria:

- Include a schedule with location and quantity.
- Require ENERGY STAR qualified products and appliances.
- Contract Language: "Allow inspection of all appliances. Provide submittal to the Energy Consultant and inform them immediately after installation. Ensure the ENERGY STAR label remains attached to products and appliances."

Procedures and Documentation:

- Record manufacturer and model number.
- Confirm manufacturer and model number is ENERGY STAR qualified.
- Photograph one (1) representative appliance faceplate of each type of appliance being inspected.
- Photograph ENERGY STAR label and/or attach cut sheet proving ENERGY STAR qualification.
- A Statement of Substantial Completion or approved proxy may be submitted to establish completion of the work associated with this protocol. A Statement of Substantial Completion is to be completed by the installation contractor or other qualified representative on company letterhead and attached to all relevant *T&V Worksheets* complete with all required information, photographs, cut sheets, etc.

Schedule:

- The developer or GC shall ensure that deliveries are inspected prior to accepting them to verify that product substitutions by the distributor or manufacturer have not resulted in non-ENERGY STAR qualified appliances.
- Minimum of one on-site inspection required, preferably immediately after installation so that corrective action can be taken, if necessary. Delivery tickets may be used to verify complete shipments, but on-site inspections of a sample of installed appliances is required.

Responsible Parties:

- Energy Consultant
- Installing Contractor

Sampling Requirement:

- For spaces containing appliances, follow the modified RESNET sampling protocol outlined in the *How to Use this Manual* section of this document. For buildings with common laundry rooms, RESNET sampling protocols are modified to require inspection of all the clothes washers in at least one (1) laundry room.

ENERGY STAR MFHR Testing and Verification Protocols Version 1.0 Page 14

- Types of Testing Protocol
- Performance Specification Criteria
- Procedures and Documentation
- Schedule
- Responsible Parties
- Sampling Requirements
- Statement of Substantial Completion
- Recommended Equipment List
- Referenced Standards

Testing and Verification Worksheets

- Worksheets are similar to Inspection Checklists in Version 3.
- Mandatory Excel-based worksheets that document the results of plan reviews, inspections, verification, and performance testing.
  - Provide inspection worksheets that can be used in the field that follow the Testing and Verification Protocols, but are organized for the convenience of the site inspector.
  - Provide a central file to store building information relevant to all members of the design team: architect, energy modeler, site inspector, project manager, plan reviewer, etc.
  - Must be submitted once prior to construction to document results of the plan review and once after construction is complete, to document the results of testing and verification.

Photo Template

- This Word-based template was designed so that pictures used to provide photo-documentation required by the T&V Protocols could be easily formatted and consistently reported.
- Photo documentation must be submitted to the EPA at the end of construction.
- The Photo Template need only be submitted for the Developer's first three certified buildings. Also, if the Licensed Professional or Developer has submitted at least three Photo Templates, the requirement is waived.

TESTING & VERIFICATION (T&V) PROTOCOLS	This guide outlines the Testing & Verification Protocols (817KB) for the MFHR Program.
TESTING AND VERIFICATION WORKSHEETS	The Testing and Verification Worksheets (2.3MB) are used to document that each prerequisite and each energy conservation measure included in the completed building meet all requirements and follow the *T&V Protocols*. The *T&V Worksheets* are a key component to the program's submittals and must be submitted to EPA or its designated agent as part of the Proposed Design Submittal and the As-Built Submittal. View a sample of the T&V Worksheets (2.4MB) with examples of documentation at various stages of the project.
PHOTO TEMPLATE	The Photo Template (ZIP) (2.2MB) is a companion to the *T&V Worksheets* and provides photographic evidence that all requirements of the *T&V Protocols* are met in the completed building. (As-Built Submittal Only). See below for the three formatting options available for Licensed Professionals to submit photo documentation or view the Options for Photo Documentation & Submission Instructions (307KB) guide for more information. **Option 1 – Protocols Consolidated into One Template** (233KB) View a sample of the Photo Template Option 1 (3.5MB) **Option 2 – Templates Separated by Protocol** (ZIP) (1.7MB) **Option 3 – Photo Folders** (ZIP) (112KB)
ASHRAE 90.1–2007 COMPLIANCE FORMS	ASHRAE 90.1–2007 Compliance Forms (1.4MB) are included to help Developer Partners and Licensed Professionals verify compliance with the Mandatory Provisions of the standard, which are prerequisites in the MFHR program. These forms will not be reviewed by EPA or its designated agent and are not required as part of the Proposed Design Submittal or the As-Built Submittals.

ENVELOPE – WINDOWS – PROTOCOL 5.4

Include a photo of each unique window type with third party verification (NFRC label if applicable) of U-value, SHGC, and Energy Star certification (if applicable).

Notes: NFRC window label

Notes: Typical installed window

Include a photo of installed window that verifies proper fit and effective connections to envelope's weather and air barriers.

Prescriptive vs. Performance (MFHR)

MEASURE	PRESCRIPTIVE	PERFORMANCE (Baseline ASHRAE 90.1-2007)
Appliances	ENERGY STAR Certified	ENERGY STAR Certified
Heating	CZ 1-3: 80% AFUE CZ 4-5: ENERGY STAR CZ 6-8: 90-95% AFUE	None (local code or federal standards)
Cooling	CZ 1-2: SEER 16 CZ 3-5: ENERGY STAR CZ 6-8: SEER 13	None (local code or federal standards)
Heating and Cooling Distribution	Total duct leakage <8 CFM25/100 ft^2	Total duct leakage <8 CFM25/100 ft^2
Envelope	Climate Specific Requirements that meet or Exceed AHSRAE 189.1-2009 Maximum Allowable Glazing Area: 30% Window to Wall Ratio	Local code for insulation Double-pane, low-e windows
Ventilation and Infiltration	Compartmentalized units with ASHRAE 62-2007 ventilation (can't exceed ASHRAE by more than 50%)	Compartmentalized units with ASHRAE 62-2007 ventilation
Domestic Hot Water	High Efficiency (Same as ENERGY STAR Homes) Lower Flow Faucets and Showerheads	No DHW efficiency requirements Low Flow Fixtures and Toilets
Lighting	ENERGY STAR certified lighting in 80% of fixtures and Occupancy Sensors in Halls and Stairs Maximum lighting power allowance	ENERGY STAR certified lighting in 80% of fixtures or 100% high-efficacy

Prescriptive vs. Performance (MFHR)

MEASURE	PRESCRIPTIVE	PERFORMANCE (Baseline ASHRAE 90.1-2007)
Appliances	ENERGY STAR Certified	ENERGY STAR Certified
Heating	CZ 1-3: 80% AFUE CZ 4-5: ENERGY STAR CZ 6-8: 90-95% AFUE	None (local code or federal standards)
Cooling	CZ 1-2: SEER 16 CZ 3-5: ENERGY STAR CZ 6-8: SEER 13	None (local code or federal standards)
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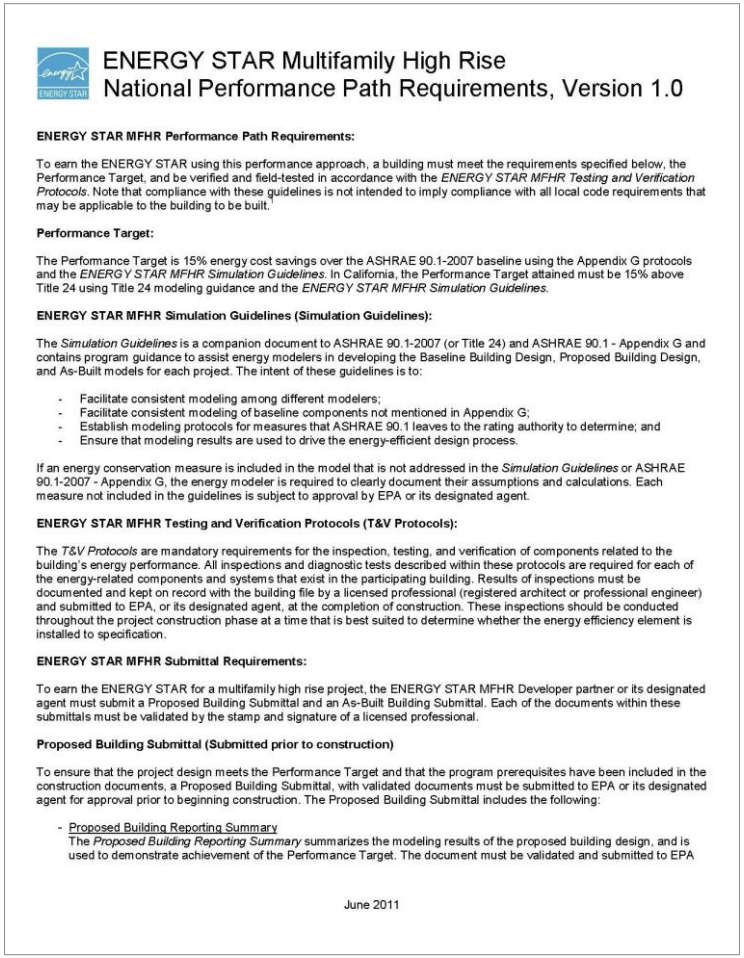
Domestic Hot Water	High Efficiency (Same as ENERGY STAR Homes) Lower Flow Faucets and Showerheads	No DHW efficiency requirements Low Flow Fixtures and Toilets
Lighting	ENERGY STAR certified lighting in 80% of fixtures and Occupancy Sensors in Halls and Stairs Maximum lighting power allowance	ENERGY STAR certified lighting in 80% of fixtures or 100% high-efficacy

(Items in red are different from ENERGY STAR Certified Homes Version 3)

MFHR Performance Path

MFHR Performance Path Requirements

- Meet program Prerequisites
- **Meet Performance Target**
  - **15% better than ASHRAE 90.1-2007 as defined by Appendix G and Simulation Guidelines**
- **Supporting Tools: Excel calculator and checklist**
- Third-party verification and performance testing throughout construction
- Commit to Benchmarking in Portfolio Manager for at least two years



ENERGY STAR Multifamily High Rise
National Performance Path Requirements, Version 1.0

ENERGY STAR MFHR Performance Path Requirements:

To earn the ENERGY STAR using this performance approach, a building must meet the requirements specified below, the Performance Target, and be verified and field-tested in accordance with the *ENERGY STAR MFHR Testing and Verification Protocols*. Note that compliance with these guidelines is not intended to imply compliance with all local code requirements that may be applicable to the building to be built.[1]

Performance Target:

The Performance Target is 15% energy cost savings over the ASHRAE 90.1-2007 baseline using the Appendix G protocols and the *ENERGY STAR MFHR Simulation Guidelines*. In California, the Performance Target attained must be 15% above Title 24 using Title 24 modeling guidance and the *ENERGY STAR MFHR Simulation Guidelines*.

ENERGY STAR MFHR Simulation Guidelines (Simulation Guidelines):

The *Simulation Guidelines* is a companion document to ASHRAE 90.1-2007 (or Title 24) and ASHRAE 90.1 - Appendix G and contains program guidance to assist energy modelers in developing the Baseline Building Design, Proposed Building Design, and As-Built models for each project. The intent of these guidelines is to:

- Facilitate consistent modeling among different modelers;
- Facilitate consistent modeling of baseline components not mentioned in Appendix G;
- Establish modeling protocols for measures that ASHRAE 90.1 leaves to the rating authority to determine; and
- Ensure that modeling results are used to drive the energy-efficient design process.

If an energy conservation measure is included in the model that is not addressed in the *Simulation Guidelines* or ASHRAE 90.1-2007 - Appendix G, the energy modeler is required to clearly document their assumptions and calculations. Each measure not included in the guidelines is subject to approval by EPA or its designated agent.

ENERGY STAR MFHR Testing and Verification Protocols (T&V Protocols):

The *T&V Protocols* are mandatory requirements for the inspection, testing, and verification of components related to the building's energy performance. All inspections and diagnostic tests described within these protocols are required for each of the energy-related components and systems that exist in the participating building. Results of inspections must be documented and kept on record with the building file by a licensed professional (registered architect or professional engineer) and submitted to EPA, or its designated agent, at the completion of construction. These inspections should be conducted throughout the project construction phase at a time that is best suited to determine whether the energy efficiency element is installed to specification.

ENERGY STAR MFHR Submittal Requirements:

To earn the ENERGY STAR for a multifamily high rise project, the ENERGY STAR MFHR Developer partner or its designated agent must submit a Proposed Building Submittal and an As-Built Building Submittal. Each of the documents within these submittals must be validated by the stamp and signature of a licensed professional.

Proposed Building Submittal (Submitted prior to construction)

To ensure that the project design meets the Performance Target and that the program prerequisites have been included in the construction documents, a Proposed Building Submittal, with validated documents must be submitted to EPA or its designated agent for approval prior to beginning construction. The Proposed Building Submittal includes the following:

- Proposed Building Reporting Summary
  The *Proposed Building Reporting Summary* summarizes the modeling results of the proposed building design, and is used to demonstrate achievement of the Performance Target. The document must be validated and submitted to EPA

June 2011

ASHRAE 90.1-2007 Standard

ASHRAE 90.1-2007

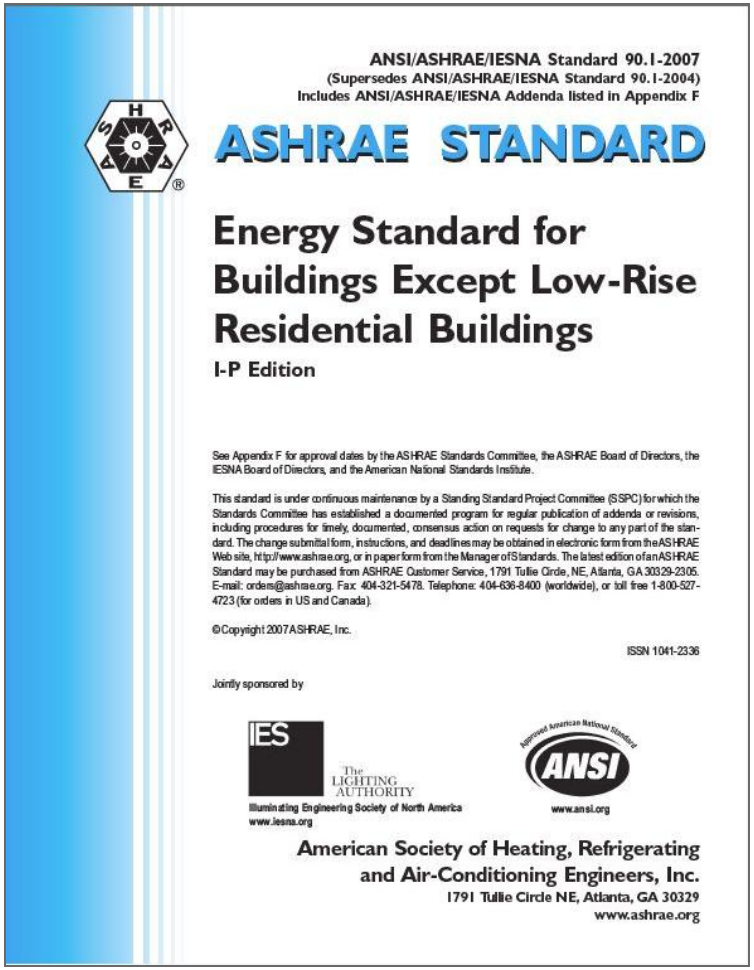
- Minimum requirements for the energy-efficient design of high-rise multifamily buildings

Appendix G

- Protocols for generating an energy performance rating for buildings that exceed the requirements of ASHRAE 90.1-2007

Program Standard

- LEED-H Mid-Rise
- Enterprise Green Communities


ANSI/ASHRAE/IESNA Standard 90.1-2007
(Supersedes ANSI/ASHRAE/IESNA Standard 90.1-2004)
Includes ANSI/ASHRAE/IESNA Addenda listed in Appendix F

ASHRAE STANDARD

Energy Standard for Buildings Except Low-Rise Residential Buildings

I-P Edition

See Appendix F for approval dates by the ASHRAE Standards Committee, the ASHRAE Board of Directors, the IESNA Board of Directors, and the American National Standards Institute.

This standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE Web site, http://www.ashrae.org, or in paper form from the Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada).

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MFHR Performance Path Support

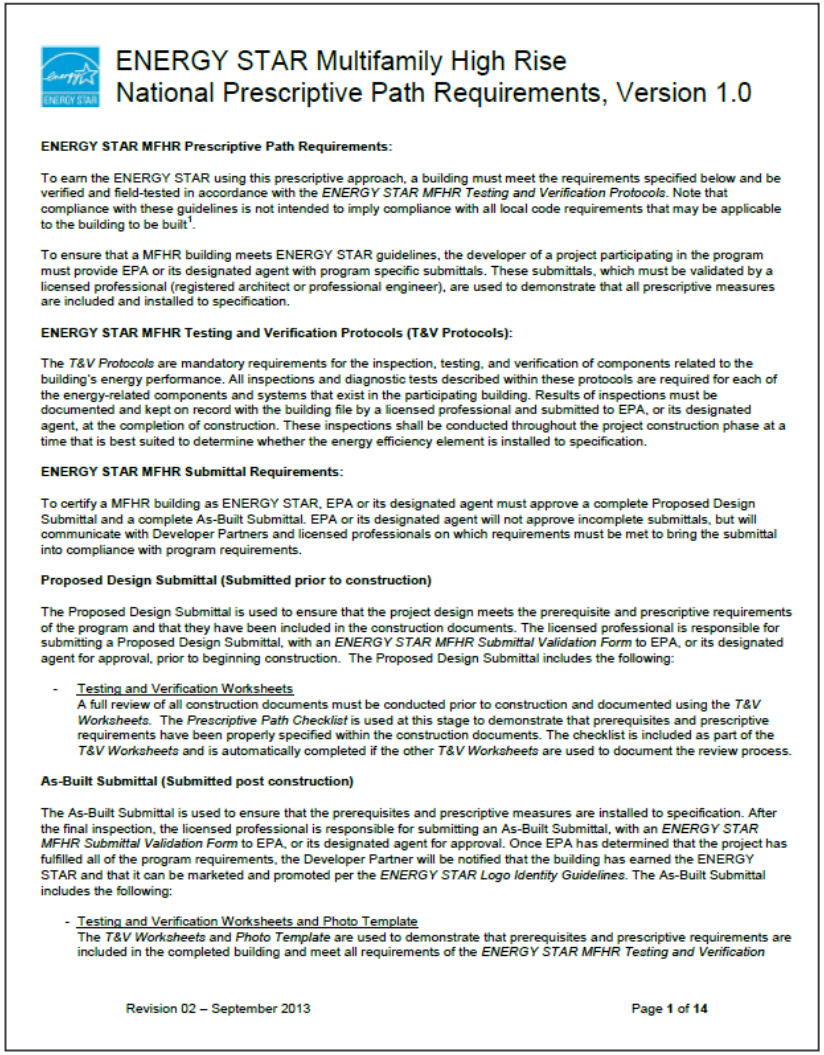
- Simulation Guidelines
  - Facilitate consistent modeling of baseline components not mentioned in Appendix G and among modelers
- Performance Path Calculator
  - Excel-based worksheets designed to provide the exact calculations described by the Simulation Guidelines and a Reporting Summary for EPA
- Energy Modeling QC Checklist
  - Optional checklist developed to provide energy modelers with a quality control checklist of simulation requirements for use prior to submission of results which draw attention to commonly missed requirements

MFHR Performance Path Overview

- Become an ENERGY STAR MFHR Developer Partner
- Submit a MFHR Project Application for each project
- Include Prerequisites in design
- Conduct energy modeling
- Review plans and submit Proposed Building Submittal
- Build according to design
- Conduct testing and verification
- Update model, submit As-Built Building Submittal
- Earn the ENERGY STAR
- Benchmark in Portfolio Manager for at least 2 years

MFHR Prescriptive Path

MFHR Prescriptive Path Requirements



ENERGY STAR Multifamily High Rise
National Prescriptive Path Requirements, Version 1.0

ENERGY STAR MFHR Prescriptive Path Requirements:

To earn the ENERGY STAR using this prescriptive approach, a building must meet the requirements specified below and be verified and field-tested in accordance with the *ENERGY STAR MFHR Testing and Verification Protocols*. Note that compliance with these guidelines is not intended to imply compliance with all local code requirements that may be applicable to the building to be built[1].

To ensure that a MFHR building meets ENERGY STAR guidelines, the developer of a project participating in the program must provide EPA or its designated agent with program specific submittals. These submittals, which must be validated by a licensed professional (registered architect or professional engineer), are used to demonstrate that all prescriptive measures are included and installed to specification.

ENERGY STAR MFHR Testing and Verification Protocols (T&V Protocols):

The *T&V Protocols* are mandatory requirements for the inspection, testing, and verification of components related to the building's energy performance. All inspections and diagnostic tests described within these protocols are required for each of the energy-related components and systems that exist in the participating building. Results of inspections must be documented and kept on record with the building file by a licensed professional and submitted to EPA, or its designated agent, at the completion of construction. These inspections shall be conducted throughout the project construction phase at a time that is best suited to determine whether the energy efficiency element is installed to specification.

ENERGY STAR MFHR Submittal Requirements:

To certify a MFHR building as ENERGY STAR, EPA or its designated agent must approve a complete Proposed Design Submittal and a complete As-Built Submittal. EPA or its designated agent will not approve incomplete submittals, but will communicate with Developer Partners and licensed professionals on which requirements must be met to bring the submittal into compliance with program requirements.

Proposed Design Submittal (Submitted prior to construction)

The Proposed Design Submittal is used to ensure that the project design meets the prerequisite and prescriptive requirements of the program and that they have been included in the construction documents. The licensed professional is responsible for submitting a Proposed Design Submittal, with an *ENERGY STAR MFHR Submittal Validation Form* to EPA, or its designated agent for approval, prior to beginning construction. The Proposed Design Submittal includes the following:

- Testing and Verification Worksheets
  A full review of all construction documents must be conducted prior to construction and documented using the *T&V Worksheets*. The *Prescriptive Path Checklist* is used at this stage to demonstrate that prerequisites and prescriptive requirements have been properly specified within the construction documents. The checklist is included as part of the *T&V Worksheets* and is automatically completed if the other *T&V Worksheets* are used to document the review process.

As-Built Submittal (Submitted post construction)

The As-Built Submittal is used to ensure that the prerequisites and prescriptive measures are installed to specification. After the final inspection, the licensed professional is responsible for submitting an As-Built Submittal, with an *ENERGY STAR MFHR Submittal Validation Form* to EPA, or its designated agent for approval. Once EPA has determined that the project has fulfilled all of the program requirements, the Developer Partner will be notified that the building has earned the ENERGY STAR and that it can be marketed and promoted per the *ENERGY STAR Logo Identity Guidelines*. The As-Built Submittal includes the following:

- Testing and Verification Worksheets and Photo Template
  The *T&V Worksheets* and *Photo Template* are used to demonstrate that prerequisites and prescriptive requirements are included in the completed building and meet all requirements of the *ENERGY STAR MFHR Testing and Verification*

Revision 02 – September 2013 Page 1 of 14

- **Install climate specific prescriptive requirements that meet or exceed Prerequisites**
  - **Approximately equivalent to 15% better than ASHRAE 90.1-2007, but no modeling**
- Third-party verification and performance testing throughout construction
- Commit to benchmarking in Portfolio Manager for at least two years

MFHR Prescriptive Path Overview

- Become an ENERGY STAR MFHR Developer Partner
- Submit a MFHR Project Application for each project
- Include Prerequisites & Prescriptive requirements in design
- Review plans and submit Proposed Building Submittal
- Build according to design
- Conduct Testing and Verification
- Submit As-Built Building Submittal
- Earn ENERGY STAR
- Benchmark in Portfolio Manager for at least 2 years

Version 1, Revision 2 Update

- ENERGY STAR MFHR Performance Path
- ENERGY STAR MFHR Simulation Guidelines
- ENERGY STAR MFHR Performance Path Calculator, V1.3
- ENERGY STAR MFHR Energy Modeling Quality Control Checklist
- ENERGY STAR MFHR Prescriptive Path
- ENERGY STAR MFHR Testing and Verification Protocols
- ENERGY STAR MFHR T&V Worksheets, V1.5

General changes

Multiple Program Documents

- All references to ‘Qualified’ homes and products have been revised to ‘Certified’ homes and products to align with the current terminology of the ENERGY STAR program.
- The use of the word “shall” has been defined as action that is mandatory and the word “should” as action that is recommended, but not required. The use of these words has been revised where applicable.

Performance Path Calculator, Version 1.3 and the T&V Worksheets, Version 1.5

- Both Excel-based tools have been updated to reflect changes in program and improve functionality.

Performance & Prescriptive Path

- Where continuous exterior or interior insulation is required to reduce thermal bridging, this insulation has been defined to be at least R-3. Projected balconies have been clarified as being exempt from this continuous insulation requirement.

- If an NFRC label is not available, LBNL's WINDOW 6.3 software or NFRC's CMAST may be used to establish the assembly U-values.

- Insulated through-wall AC covers no longer have a minimum required R-value due to issues obtaining consistent documentation.

Performance & Prescriptive Path

- The Domestic Water Heating prerequisite was clarified such that indirect water heaters with or without storage are acceptable.

- Prerequisites related to low-flow plumbing fixtures are based on GPM at 80 psi. WaterSense labeled faucets or aerators must be installed if flow ratings for those low-flow fixtures are not rated at 80 psi.

- Plenums and dropped ceilings within garages have been explicitly included in the garage prerequisite that prohibits heating in that space.

Performance & Prescriptive Path

- Pipe insulation requirements have been revised to require different heating and cooling pipe insulation thicknesses, to align with ASHRAE 90.1-2010.

- For hydronic distribution systems, automatic balancing valves are now an accepted alternative to designing supply/return headers in a “reverse return” configuration.

- 100% “high efficacy” lighting has been added as an alternative path to the 80% ENERGY STAR certified lighting requirement. A definition has been added to the Appendix and aligns with 2012 IECC.

Performance & Prescriptive Path

- To align with ENERGY STAR Certified Homes (Rev. 07), an alternative total duct leakage test may be performed at rough-in with a maximum of ≤4 CFM25 per 100ft^2, with air handler and all ductwork installed.

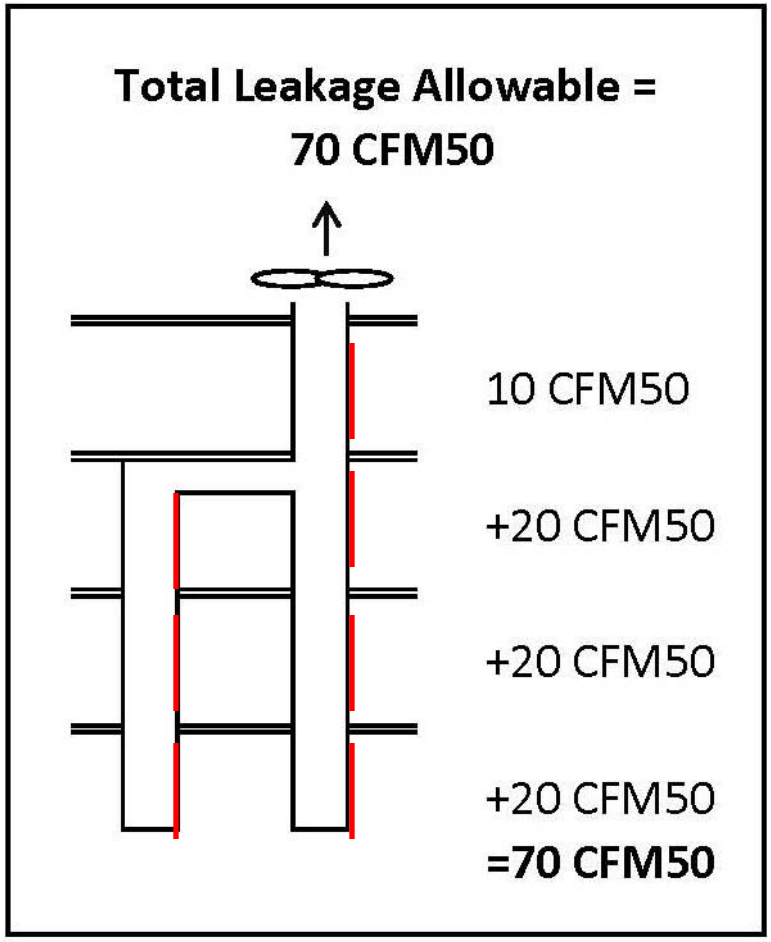
- To align with ENERGY STAR Certified Homes (Rev. 07), kitchen exhaust fans that meet prescriptive duct size requirements, are exempt from testing.

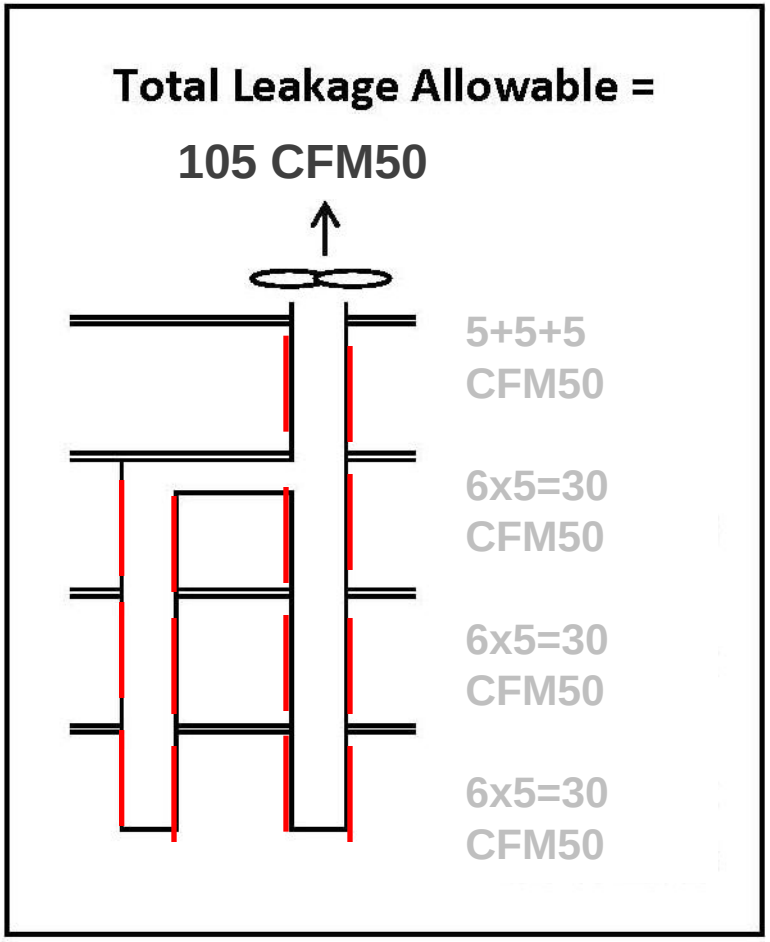
- For clarification, non-apartment spaces required to meet ASHRAE 62.1-2007, may use natural ventilation, if eligible per Section 5 of that Standard.

Performance Path ONLY

- Maximum leakage allowances for central exhaust systems serving apartments have been revised from 10 CFM per floor to the sum of 5 CFM per register per shaft plus 5 CFM per floor per shaft.
  - Supply ventilation systems and central exhaust systems not serving apartments are not subject to this duct leakage testing, but are still subject to airflow testing

Performance Path ONLY





Simulation Guidelines

- Aligned with changes to Path requirements.
- Improved organization and definitions; italicized “defined” terms and enumerated sections to facilitate referencing.
- Corrected Baseline modeling procedure of perimeter edges of intermediate floor slabs to align with ASHRAE 90.1 User’s Manual, which requires that these floor edges be modeled with the same U-factor as the steel-frame wall.
- Provided example of de-rating a wall assembly to account for thermal bridging due to metal shelf angles.
- Clarified that decorative lighting may not be used to increase the Baseline lighting allowance.
- Provided specific lighting space type mapping for spaces not specifically identified in ASHRAE 90.1-2007, Section 9.6; expanded performance credit allowance for sensors to spaces previously excluded.

Simulation Guidelines (continued)

- Limited the use of the “high” hot water demand per occupant modeling assumption to affordable housing only.
- Removed instructions to combine infiltration with ventilation in model; these should be modeled separately.
- Conversions have been provided for HSPF to COP and SEER to EER, if the modeling software does not allow HSPF or SEER as inputs.
- Clarified modeling requirements to allow exhaust fans that provide both local exhaust and whole-unit ventilation to use the greater of the two rates recommended by ASHRAE 62.2-2007, without penalty.

Simulation Guidelines (continued)

- Clarified selection of Baseline HVAC system, based on building type, heating fuel, and “predominant” conditions.
- Clarified the temperature settings to be used when modeling the auxiliary electric space heating for Baseline PTHPs.
- Clarified how to model PTAC and PTHP fan power in the Baseline; examples provided for typical HVAC configurations.
- Clarified performance credit for certain motors and for demand controlled ventilation in garages.

Prescriptive Path ONLY

- Total building UA calculation (excluding fenestration) is now acceptable for meeting the climate-specific insulation requirements of Table 2 and Table 3.
- Maximum leakage allowances for central exhaust systems serving apartments have been revised from 5 CFM50 per floor to the sum of 2.5 CFM50 per register per shaft and 2.5 CFM50 per floor per shaft.
- Garage exhaust fan sensors required in this Path must now detect both CO and NO_2.
- Lighting controls have been clarified as not being permitted to further reduce lighting power density to comply with lighting power allowances.
- Minimum equipment efficiencies for gas-fired PTACs are now explicitly provided, in conjunction with other requirements.
- Reduced minimum efficiencies for “Boiler, hot water (>300,000 Btuh)” are provided in conjunction with other requirements.

Testing and Verification Protocols

- Developer Partners or Licensed Professionals who have successfully certified 3 MFHR buildings are exempt from submitting the *Photo Template.*
- Improved organization to clarify procedures and aligned with changes to Path requirements noted above.
- Clarified terminology related to “common” and “central” systems and timing/application of central exhaust leakage testing.
- Clarified locations where weather-stripping of doors is mandatory.
- Added language for inspections of slab-on-grade insulation.

Policy Record

- EPA periodically revises the MFHR program requirements in response to partner questions and evolving standards (e.g., ENERGY STAR product specifications, NAECA standards, model energy codes).
- The purpose of this revision process is to be responsive to partner questions, to disseminate policy changes in a consistent manner, and to adapt the program as needed for success.
- Revisions will be made on an as needed basis; however, it is expected that the guidelines will not be updated more frequently than every six months.
- August 2012….September 2013….February 2014….

Lessons Learned…

- Lighting power density calculations
  - Only take credit for spaces with installed fixtures
  - Wattage MUST include the ballast power, not just bulb
- CFM50/sf means floor+ceiling+ext walls+party walls
- Air-sealing at party walls must be discussed!
- Kitchen exhaust MUST vent to the outside!
- Window U-values must be for the ASSEMBLY
- U-values must be from ASHRAE 90.1-2007, Appendix A
- A weighted R-value ≠ a weighted U-value

Lessons Learned…

- Get prerequisites into the construction documents before they go out for bid
- Document efficiency on AHRI, ENERGY STAR, and WaterSense websites
- The ASHRAE “Baseline” is almost always a steel-framed building with either a boiler+PTAC or PTHP
  - In CZ4: R-13 + R-7.5 ci, even at the floor perimeter
- Aeroseal the ventilation risers to pass the test
- Ventilation air flows (in-unit and in common spaces) must be tested or documented by TAB contractor

Certified MFHR Buildings

Skyhouse Midtown

- 23 stories, 320 units mixed-used building in Atlanta, GA
- Steel/concrete (R-13+R-10); R-30 roof; aluminum low-e windows (U-0.39, SHGC-0.23)
- Heat pumps (8 HSPF/13.5 SEER), ENERGY STAR lights & appliances, low-flow fixtures, in-unit exhaust fans
- Leakage < 0.23 CFM_{50}/ft^2
- Duct leakage < 6 $CFM_{25}/100\ ft^2$
- 16% over 90.1-2007

Novare Group
Atlanta, GA

Climate Zone 3

The Edge Lofts

- 6 stories, 35 units mixed-used building in Hoboken, NJ
- 2x6 metal-framed (R-20 ocspf+R-14 ci polyiso); R-50 roof; wood-frame, low-e windows (U-0.28, SHGC-0.28)
- 96% AFUE furnace, 16 SEER AC, ENERGY STAR lights & appliances, very low-flow fixtures, 96% central DHW, in-unit exhaust fans
- 27% over ASHRAE 90.1-2007

Bijou Properties

Hoboken, NJ

Climate Zone 4

Thomas Place

- 4 stories, 80 units senior housing in Orland Park, IL
- 2x6 metal-framed (1” ccspf+4.5” ocspf+R-10 ci polyiso); R-54 BFG roof; vinyl-frame, low-e windows (U-0.30, SHGC-0.23)
- 95% AFUE furnace, 16 SEER AC, ENERGY STAR lights & appliances, very low-flow fixtures, 95% central DHW, in-unit HRVs
- Prescriptive Path

TPA Orland LP

Orland Park, IL

Climate Zone 5

Multifamily Market, EPA Support and Developing Opportunities

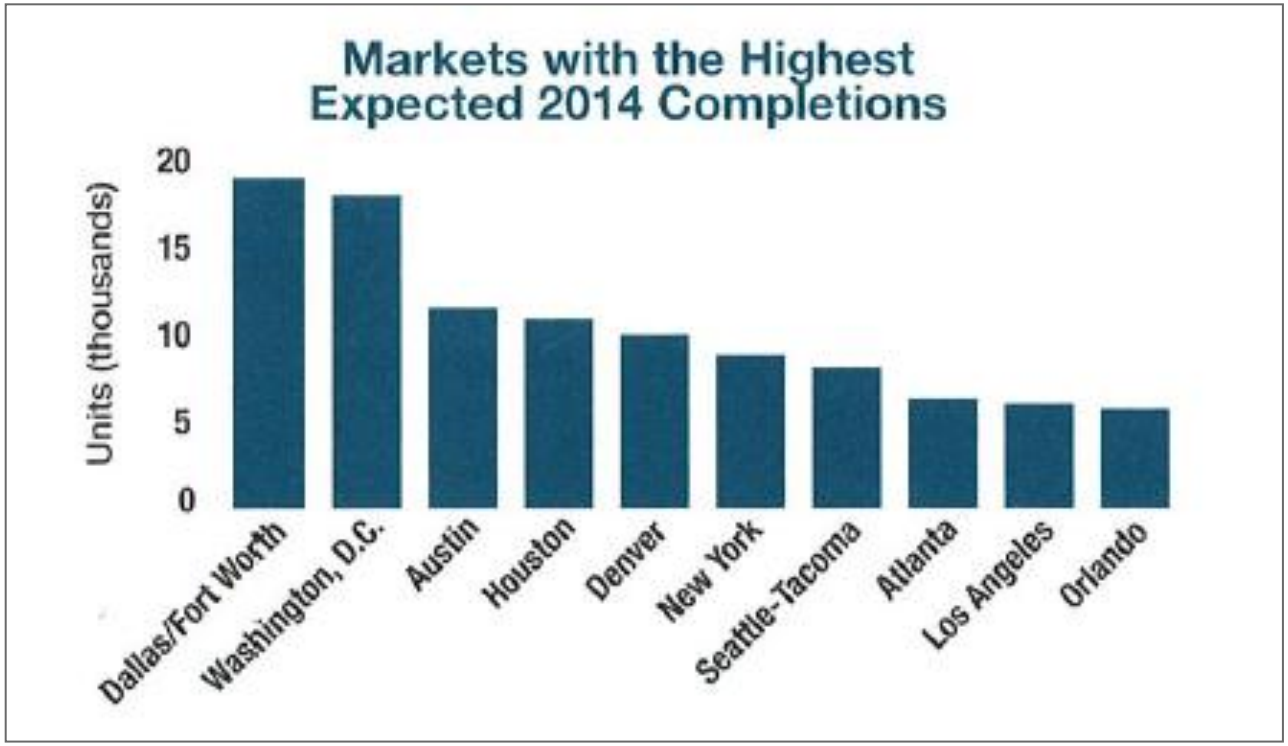
Multifamily Markets

- Tight vacancy rates and employment growth lead the market

Source: Marcus & Millichap – 2014 Annual National Apartment Index Report - 2

Multifamily Markets

- The number of new units in 2013 increased 84% over 2012 to 168,000. Another 215,000 expected for 2014



Source: Marcus & Millichap – 2014 Annual National Apartment Index Report - 2

ENERGY STAR Certified MFHR Units

- To date, ~7,000 MFHR units in 10 states have been certified (74 buildings)
- Over 21,000 more in 15 states pursuing certification (242 buildings)

Top Markets for Certified Units	Top Pipeline Markets
New York (~3,500)	New York (~15,000)
Georgia (~700)	Texas (~1,500)
Many States with ~100	North Carolina (~1,000)
	New Jersey (~900)
	Georgia and Florida (~600 each)

Benefits to Partnership

1) Access to ENERGY STAR logos to promote partnership and use in marketing collateral
2) ENERGY STAR Awards
   - Leadership in Housing
   - Partner of the Year
3) Building Profile on ENERGY STAR website

www.energystar.gov/homesPA

Join ENERGY STAR as a Residential New Construction Partner

To apply:

Becoming an ENERGY STAR partner is easy. Simply fill out an ENERGY STAR Partnership Agreement by following the appropriate link below. There is no cost to partner with ENERGY STAR or use ENERGY STAR promotional materials.

Training Requirements for Builder and Rater Partners:

Builder and Rater partners are required to complete mandatory training. For more information about the training requirements, visit ENERGY STAR for Homes Version 2.5 and 3 Guidelines.

Online Partnership Agreements for:

- Builders
  Companies or individuals that plan to construct one or more new ENERGY STAR certified home for either sale or personal use. This category includes Modular Home Builders, Multifamily Low Rise Builders, Community Developers, Affordable Housing Builders, and Manufactured Home Plants/Retailers/Installers.
- Multifamily High Rise Developers
  Companies or individuals that plan to construct new ENERGY STAR certified multifamily high rise buildings.
- Home Energy Raters
  Professionals who analyze energy-efficient home plans and provide on-site verification for homes to earn the ENERGY STAR.
- Architect/Home Plan Designers
  Individuals or organizations that design residential new construction plans. The plans must be qualified by a HERS Rater to earn the ENERGY STAR designation. The constructed house, if built to plan, will earn an ENERGY STAR label.
- Utilities and Other Sponsoring Programs
  Utilities; national, regional, state, or local government entities; or other organizations (such as home builders associations and green building programs) that promote or intend to promote ENERGY STAR certified homes.

Partnership Agreement for:

- Lenders (63KB)
  Institutions or individuals who loan borrowers money for the purchase of residential structures through the use and promotion of Energy Efficient Mortgages (EEM).

ENERGY STAR Logos

Partnership Mark

Available for developers after signing Partnership Agreement.

Designed to Earn the ENERGY STAR Mark

Available for developers once Final Proposed Submittal or Modeling Submittal is accepted.

ENERGY STAR Certification Mark

Available for developers after As-Built Submittal is accepted.

MFHR Awards

Leadership in Housing

2013 Inaugural Year for MFHR

2013 MFHR Leadership in Housing Award Winners

Developer Partners	State
Affordable Housing Associates	CA
Appleton Housing Authority/Horizon Construction	WI
Blue Sea Development Company, LLC	NY
Conifer Realty, LLC	NY
Dunn Development Corp.	NY
Eagle Flats Apartment Homes, LLC	WI
HELP Genesis	NJ
Highland Senior Residences, LLC	NY
Joy Construction	NY
Schneider Development, LLC	NY

MFHR Awards

ENERGY STAR Partner of the Year

Applications will be available by July 2014

Deadline will be December 2014

www.energystar.gov/awards

New for 2014:

- MFHR Developer Award
  - Promotion of ENERGY STAR
  - Training
  - Optional
    - Impact on Tenant Lease-up/Occupancy
    - Costs/Savings with ENERGY STAR
- EEPS get credit for MFHR programs

Building Profile

- Building name and photo
- Developer and NYSERDA Partner
- Energy features of building

The Main Street Building

123 Main Street
Washington, DC 20005

Building Developer:
ABC Development Corp.

MPP Partner:
XYZ Architectural Designs

Type:
New Construction

Sector:
Affordable

Year Labeled:
2012

Technologies Used:

- Steel frame walls with R-13 FG and R-5 rigid insulation
- 15 SEER AC
- Low-flow fixtures, ENERGY STAR appliances and CFLS

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Outreach Strategy

- Utility Program Sponsors
  - Currently over 100 programs across the country provide incentive for ENERGY STAR homes
  - EPA will work with current partners to expand offering to multifamily
  - Host webinars and create additional web resources on program design and implementation
- Housing Finance Agencies
  - Analyzing Qualified Allocation Plans across the country to identify existing and potential financial support for mid and high rise building energy efficiency
  - HUD and USDA are exploring ENERGY STAR Certification for new construction portfolio
  - Continuing to grow the market for energy efficient affordable housing

Outreach Strategy, cont.

- Market Rate Developers
  - Regions with high growth potential
  - Builders ready to capitalize on marketing advantages
  - Provide marketing support
- Green Building Programs
  - ENERGY STAR Certification is a pathway to energy points for both LEED for Homes, LEED for Mid Rise and Enterprise Green Communities
- Designers & Licensed Professionals
  - Finding champions that can showcase successes and network with new developers to encourage participation
- Home Energy Professionals (e.g., Raters)
  - Provide technical support and work with training and certification programs

Discussion

ENERGY STAR Certified Homes (Low Rise Multifamily)
Main: www.energystar.gov/newhomespartners
Technical: www.energystar.gov/newhomesguidelines
Training: www.energystar.gov/newhomestraining
HVAC: www.energystar.gov/newhomesHVAC

ENERGY STAR Multifamily High Rise
Main: www.energystar.gov/mfhr
Questions: mfhr@energystar.gov
Benchmarking/Management: http://www.energystar.gov/multifamilyhousing

Now on Twitter and Facebook!


facebook.com/energystar


@energystarhomes