Low Rise Residential Multifamily Design for ENERGY STAR 3.0

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Hosted by:

The Pennsylvania Housing Research Center

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Course Description

This webinar will cover important considerations upon which architects, engineers and multifamily builders should focus when **designing multifamily buildings to meet the requirements of ENERGY STAR Version 3.0**.

Topics will include working with a **HERS Rater, thermal bridging, foundation insulation, alignment of thermal and primary air barriers, and HVAC requirements**. The webinar will focus primarily on residential buildings ~~three~~ five stories or less that have dwelling units with independent HVAC systems and have individual utility meters. **Builder incentives** are available for these unit types across wide geographic areas of Ohio and Pennsylvania.

Learning Objectives

At the end of this program participants will be able to:

1. Understand the process of ENERGY STAR V3.0 Certification for low rise Multifamily housing including: working with a HERS Rater, checklists submittals, and HVAC Contractor Certification.
2. Understand key elements to meeting the checklist requirements such as thermal bridging, foundation insulation design, and alignment of thermal and primary air barriers.
3. Understand the benefits of meeting the ENERGY STAR certification guidelines such as marketing benefits and utility program incentives.
4. Understand key elements of HVAC system design for meeting ENERGY STAR 3.0 Checklists, such as duct leakage testing, Manual J, D, and S requirements, and consequences of oversizing equipment

Overview

- Program Design & Implementation
  - **FirstEnergy OH New Homes**
  - **FirstEnergy PA New Homes**
  - FirstEnergy Whole-House (with Honeywell)
  - Philadelphia Gas Works Whole-House
- Software
  - TREAT
  - Green Energy Compass
- Training
  - HQUITO (HVAC Quality Installation Training and Oversight Organization)
  - BPI, RESNET, ENERGY STAR V3.0 and advanced options

Overview

- Why build multifamily projects to ENERGY STAR standards?
  - Lower energy bills for residents
  - Increased comfort for residents
  - Marketing advantages for builders, developers, property owners
  - Utility Program Incentives
  - Other incentives (e.g. low-income tax credits)

Eligible Building Types

Eligible construction types for ENERGY STAR Homes:

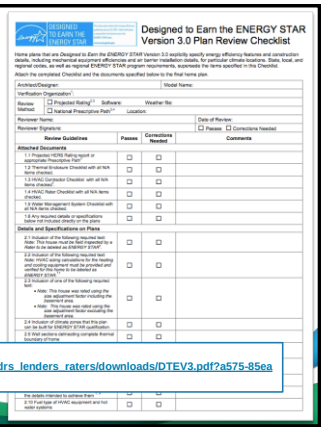
- Detached dwelling units (e.g. single-family homes)
- Dwellings units in any multifamily building with 4 units or fewer
- Dwelling units in multifamily buildings with 3 stories or fewer above-grade
- Dwelling units in multifamily buildings with 4 or 5 stories above-grade that have:
  - **Their own heating, cooling, and hot water systems**
  - Dwelling units occupy 80% or more of the occupiable space

DESIGNED TO EARN THE ENERGY STAR

- Design for ENERGY STAR upfront
- Make appropriate notes in plans
- Work with HERS Rater during design process
- Make ENERGY STAR Checklists part of construction documents
- Make project intentions clear to all bidders and subcontractors
- HERS Rater should review plans and fill out checklist

Suggestion: Put HERS Rater contact information on title sheet as contact for ENERGY STAR related questions

DESIGNED TO EARN THE ENERGY STAR


Designed to Earn the ENERGY STAR Version 3.0 Plan Review Checklist

http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/DTEV3.pdf?a575-85ea

Working with a HERS Rater

- What is a HERS Rater?
  - Trained in building science and energy efficiency
  - Trained to operate a blower door and duct blaster
  - Trained to use software (e.g. REM/Rate) to perform building energy simulations
  - Experts in ENERGY STAR certification

Working with a HERS Rater

- Find a rater using:
  - The ENERGY STAR Partner locator: www.energystar.gov
  - RESNET Find a Professional: www.resnet.us
  - FirstEnergy New Homes websites:
    - Pennsylvania: www.energysavepa-newhomes.com
    - Ohio: www.energysaveohio-newhomes.com

Overview of ENERGY STAR Requirements

Prescriptive Path Versus Performance Path

Prescriptive Path

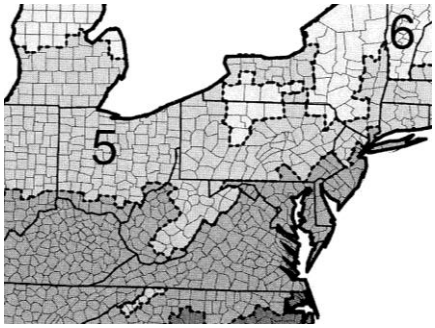
- No tradeoffs
- Requirements for:
  - HVAC efficiencies
  - Air infiltration rates
  - Window U/SHGC
  - DWH efficiencies
  - Duct Leakage
  - Lighting and appliances

Performance Path

- Tradeoffs allowed
- Prescriptive requirements make up the reference home
- Hard limits on duct leakage

http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_v3_guidelines

Know your Climate Zone



HVAC

- Individual heating and cooling equipment for each unit
- Prescriptive/reference home heating efficiencies:
  - 90 AFUE gas furnace
  - 85 AFUE oil furnace, ENERGY STAR qualified
  - 85 AFUE boiler, ENERGY STAR qualified
  - Air-source heat pump – SEER 14.5, EER 12
    - 8.2 HSPF with gas backup
    - CZ4: 8.5 HSPF with electric backup
    - CZ5: 9.25 HSPF with electric backup
    - CZ6: 9.5 HSPF with electric backup
  - Ground-source heat pump, ENERGY STAR qualified

HVAC

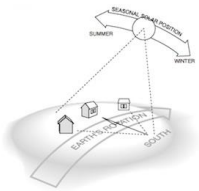
- HVAC credentialing requirements
  - Contractors must be credentialed under either:
    - ACCA's Quality Assured Contractors Program: http://qacontractors.org/new-homes/contractors/
    - Advanced Energy's Quality-Assured Professional (QAP) Program: http://www.advancedenergy.org/QAP/

JUN 19 **ENERGY STAR HVAC Contractor Training**
When: June 19, 9:00 am - 4:00 pm
Where: Courtyard by Marriott, York, PA
Price: $225

QAP QUALITY-ASSURED PROFESSIONAL | Credentialing Quality Energy Efficiency Professionals

HVAC

- HVAC design requirements
  - ACCA Manuals J, S, and D for *each* unit
  - Not all units have the same loads
    - Exposed area (e.g. corner unit versus middle unit)
    - N, S, E, W orientation
    - Varying overhangs



Whole-House Mechanical Ventilation

- Each unit must have mechanical ventilation installed to meet ASHRAE 62.2 – *Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings*

Windows

- Prescriptive/reference home U-factor and SHGC
  - CZ4: U-0.32, SHGC-0.40
  - CZs 5 and 6: U-0.30, SHGC - any

Water Heaters

- Individual equipment for each dwelling unit
- Performance path - Minimum Energy Factor (EF) requirements
- Performance path - Baseline for reference home
- EF varies by fuel and size

Appliances

- Prescriptive path - Appliances must be ENERGY STAR qualified when provided
- Performance path – reference home efficiencies equal to ENERGY STAR appliances
  - Refrigerators
  - Dish washers
  - Ceiling fans
  - Exhaust fans

Lighting

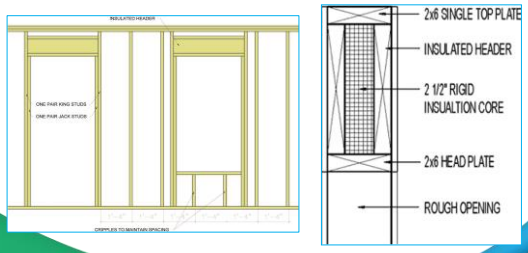
- Prescriptive/reference home - 80 percent of bulbs or fixtures must be ENERGY STAR qualified

Common Technical Issues for Multifamily Construction

Reduced Thermal Bridging

- Above Grade Walls
  - Continuous insulation (≥R-3 in CZ4, ≥ R-5 in CZ5 and 6), **OR**
  - Advanced framing
    - Corners insulated ≥R-6 to edge, and
    - Headers insulated, and
    - Framing limited at windows and doors (no unnecessary jack studs), and
    - 24" o.c. framing for 2x6 walls in CZs 5 and 6, OR
    - ≥R-20 cavity insulation (no UA tradeoff allowed), **OR**
  - SIPS, ICFs, etc.

Reduced Thermal Bridging



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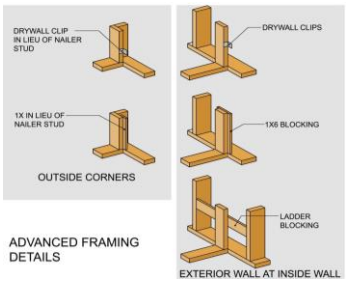
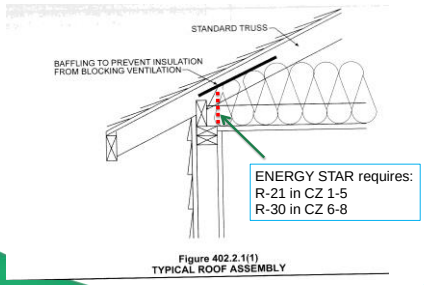


Reduced Thermal Bridging



Reduced Thermal Bridging

- Slabs
  - All slabs ≤ 12" below grade must be insulated to ≥ R-5
  - Insulation extends downward from top of slab
  - Then vertically or horizontally for:
    - 2 ft. in CZs 4 and 5
    - 4 ft. in CZ 6

Be careful with porches and garages – need thermal break between interior slab

Reduced Thermal Bridging

- Slabs

A. Slab insulation does not extend to the top of the slab.

Slab insulation extends to the top of the slab.

Reduced Thermal Bridging

- Slabs

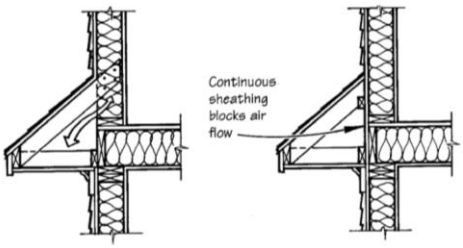
A. Slab insulation does not extend to the top of the slab.

Slab insulation extends to the top of the slab.

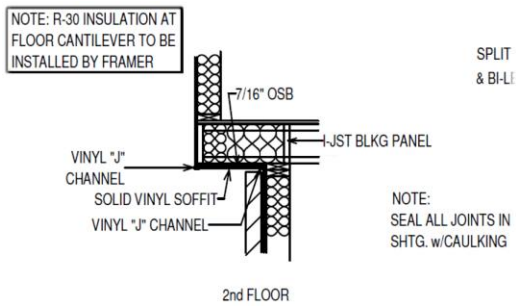
Air Sealing Shaft Walls

Air Sealing Shaft Walls

Porch Detail



Cantilever Detail



Air Infiltration Testing

- Each unit must be tested with a blower door
- Prescriptive/reference home
  - ≤ 5 ACH50 in CZ4
  - ≤ 4 ACH50 in CZs 5 and 6

Duct Leakage Testing

- All ducts must be tested
  - Total leakage ≤ 8 CFM25 per 100 SF
  - Leakage to outdoors ≤ 4 CFM25 per 100 SF*

* With all duct inside a *tight* thermal enclosure, we can waive leakage to outside, but not total leakage tests.

Quality Assurance by Using Checklists

- Thermal Enclosure System Rater Checklist
- HVAC System Quality Installation Rater Checklist
- HVAC System Quality Installation Contractor Checklist
- Water Management System Builder Checklist

Become familiar with these during the design phase and include in construction documents.

Quality Assurance by Using Checklists

- Checklist guidance at the **Building America Solutions Center**
  - Description
  - Ensuring success
  - Training
  - CAD details

http://basc.pnnl.gov/checklists/energy-star

ENERGY STAR Versus 2009 International Energy Conservation Code

2009 IECC/IRC

- "Above code programs" provision (E102.1.1)
- Insulation and Air barrier Component Criteria (E402.4.2)
- Duct testing required (in most cases) (E403.2.2)
- Manuals J, S, (E403.6) and D
- Programmable T-stats
- Minimum insulation levels
- 50% high-efficacy lamps (404.1)

ENERGY STAR for Homes

- ES plan reviews and inspections can count for code
- Thermal Enclosure System Checklist
- Duct testing required
- Manuals J, S, and D
- Programmable T-stats (ref home)
- 2009 IECC min insulation levels
- 80% high-efficacy lamps (reference home)

The ENERGY STAR Advantage

- **Differentiation and recognition using the ENERGY STAR brand**
- **Increased revenue through higher home values**
  - Numerous studies have demonstrated the positive role of energy efficiency certifications[1]
- **Enhanced customer satisfaction**
  - Efficient houses are quieter and more comfortable
  - Net positive monthly cash flow[2]
- **Reduced liability**
  - Checklists and third-party verification provide quality assurance to reduce callbacks

[1]Pfleger, W., et. al., *Market Impacts of ENERGY STAR Qualification of New Homes*, Appalachian State University, 2011
[2]EPA, ENERGY STAR Qualified Homes, Version 3 Savings and Cost Estimate Summary

Marketing Tools

Free Marketing Tools for ENERGY STAR Partners

http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_partner_resources

Utility Incentive

Utility Incentives

PPL – New Construction Program

- Rebates for builders of new homes
- All measures must be installed for a $2,000 discount
  - Air Source Heat Pump with SEER 16.0
  - ENERGY STAR heat pump water heater
  - ENERGY STAR refrigerators and dishwasher
  - Wall Insulation: R ≥ 49??
  - Ceiling Insulation: R ≥ 49

https://www.pplelectric.com/save-energy-and-money/rebates-and-discounts/residential/efficient-homes/new-construction.aspx

Utility Incentives

AEP Ohio/Columbia Gas New Homes Program

- 2012 – tiered incentives, up to $3,000 based on HERS Index
- $500 additional incentive for ENERGY STAR

For more information, contact MaGrann Associates, program management contractor for the AEP Ohio/ Columbia Gas ENERGY STAR New Homes program by calling 1-877-771-5506 or email ESHomesOH@MaGrann.com.

http://aepohio.com/save/programs/NewHomesProgram/Builders.aspx

Utility Incentives

FirstEnergy's Energy Efficient New Homes Program

- Builder incentives
  - $400 per unit + $0.10/kWh in projected savings
- Eligibility
  - New residential construction (see slide 7)
  - ENERGY STAR certification
  - 15% more efficient than 2009 IECC
  - Located in FirstEnergy's utilities' territories

Utility Incentives

- FirstEnergy's New Homes programs require a residential electric meter for each unit.

Why build to ES standards?

- Incentive example:
  - 50 unit MF project
  - Typical utility incentive of $600/unit
  - Project incentive of **$30,000**

Would your clients like to know about this?

Could having a strategy to capture this be what gets you the job?

Next Steps

1. Builders and raters enroll in the Pennsylvania or Ohio Energy Efficient New Homes Program at:

   www.energysavepa-newhomes.com

   www.energysaveohio-newhomes.com

2. Become an ENERGY STAR Home Partner
3. Contact us for more information

Rob Shearer, *Program Coordinator*, rshearer@psdconsulting.com (OH)
Mike Turns, *Senior Program Manager*, mturns@psdconsulting.com (PA)

More Information

Free EPA webinar

Cost Effective Strategies to Construct ENERGY STAR Certified Homes

Thursday, June 27

2:00 pm

http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_events_webinars

Questions

This concludes The American Institute of Architects Continuing Education Systems Course

The Pennsylvania Housing Research Center

814-865-2341

PHRC