FirstEnergy’s Energy Efficient New Homes Program

• Builder incentives
  • $400 per unit + $0.10/kWh in projected savings

• Eligibility
  • Located in service area of a FirstEnergy Utility
  • Certificate of Occupancy Dates:
    • FirstEnergy Ohio utilities: after March 23, 2011
    • Met-Ed, Penelec, and Penn Power: after October 28, 2009
    • West Penn Power: after June 1, 2013
  • 15% more efficient than 2009 IECC (or relevant code when permitted)

• ENERGY STAR® certification
Overview of This Webinar

- Basic Concepts
- Ventilation Systems and Strategies
- Overview of requirements for ENERGY STAR V3.0
- Communicating the benefits of fresh air to buyers
- Review of FirstEnergy incentives and ENERGY STAR marketing resources
Things to know about air

- **Living creatures need oxygen to survive**

- **Earthling air contains gases:**
  - 79% Nitrogen
  - 21% Oxygen
  - 1% > Other Stuff (argon, carbon dioxide, helium, krypton, neon, xenon)

- **Earthling air also contains:**
  - Natural and Man-made pollutants
Natural Pollutants

• *Naturally polluting nature!*
  • Volcanos - produced dust and sulfur
  • Forest fires – contaminate air with soot and smoke
  • Radon – A radioactive gas
  • Swamp gases, sea salt, sand particles
  • Gas and oil leaking to the surface
  • Other living creatures – carbon dioxide, ammonia, and methane gas
  • Pollen, mold spores
  • Bacteria, viruses
Man-made Pollutants

• One day a caveman brought a campfire into a cave

• Since then we have found many more ways to contaminate our air
  • From burning fossil fuels to the creation of new and improved space age polymers, humans are responsible for hundreds of pollutants

• Many of these pollutants originate inside the house
  • Paints, adhesives, caulking, cleaning products, pets, home furnishings, burnt cooking, and devices, devices, devices
  • Which break down to off-gas Volatile Organic Compounds (VOCs), like formaldehyde, and many other difficult to pronounce words
Categories of Indoor Air Pollutants

- **Biological pollutants**
  - Dust mites, mold, bacteria, fungi, viruses and pollen.

- **Pesticides**
  - The things used to eradicate the above pollutants are usually also pollutants.

- **Metals**
  - Who remembers eating lead paint chips?

- **Minerals**
  - Examples include asbestos and fiberglass.
Categories of Indoor Air Pollutants

- **Smoking**
  - Leading cause of lung cancer

- **Radiation**
  - Radon – (second leading cause of lung cancer) Radioactive gas that emits during the natural decay of Radium and occurs everywhere on the planet.

- **Gases**
  - Combustion appliances can emit carbon monoxide and carbon and nitrogen dioxide (CO kills people)
  - VOCs (Are known to cause Cancer and usually outgas more when temperature and humidity levels increase)
Moisture

• *Produced by:*
  - Normal human and pet metabolism
  - Cooking and cleaning habits
  - Plants

• *Leads to:*
  - Increased Heat Gains
  - Condensation
  - Mold/Mildew
  - Air Quality Issues
Air Movement

1. Must be a path for air to travel
2. Must be an air-pressure difference
The amazing “breathing” house

- No control over air flow
- Expensive to heat and cool
- Hot and cold spots in the house
- Condensation issues which
  - Increase pollutants
  - Decrease durability
- Pressure differences due to stack effect
New homes are built tighter

- High control over air flow
- Less costly to heat and cool
- More comfort from decreased hot and cold spots
- Reduced pressure differences
- Improved control over humidity
  - Decreased condensation
  - Improving durability and air quality
Reducing Indoor Air Pollution

**Control Source Pollution**

- Range hoods – decrease acrolein emitted from burnt cooking oil
- Filter incoming air or house air to reduce bringing in outside air pollutants
- Bath fans (bioeffluence, moisture, personal care products, chloroform)
- Building material selection (low/no VOC, urea formaldehyde)
- Household product selection (avoid pesticides, harsh cleaning products)
Poll Question
Two Main Reasons for Ventilation

- Fresh air for occupants to breathe
- To dilute air pollutants and excess moisture
Fresh Air for Occupants

ASHRAE 62.2 - Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings

The only nationally recognized indoor air quality standard developed solely for residences
ASHRAE 62.2

Calculation method:

- Required fan flow = 0.01 x floor area + 7.5 x (# bedrooms + 1)
  developed solely for residences

“Example: 2,200 SF house, 4 bedrooms

Req. flow = 0.01 x 2,200 + 7.5 x 5 = 59.5 cfm.”
Prescriptive method:

Table 4.1a
Ventilation Air Requirements, cfm

<table>
<thead>
<tr>
<th>Floor area (SF)</th>
<th>0-1</th>
<th>2-3</th>
<th>4-5</th>
<th>6-7</th>
<th>&gt;7</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1500</td>
<td>30</td>
<td>45</td>
<td>60</td>
<td>75</td>
<td>90</td>
</tr>
<tr>
<td>1501-3000</td>
<td>45</td>
<td>60</td>
<td>75</td>
<td>90</td>
<td>105</td>
</tr>
<tr>
<td>3001-4500</td>
<td>60</td>
<td>75</td>
<td>90</td>
<td>105</td>
<td>120</td>
</tr>
<tr>
<td>4501-6000</td>
<td>75</td>
<td>90</td>
<td>105</td>
<td>120</td>
<td>135</td>
</tr>
<tr>
<td>6001-7500</td>
<td>90</td>
<td>105</td>
<td>120</td>
<td>135</td>
<td>150</td>
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<tr>
<td>&gt;7500</td>
<td>105</td>
<td>120</td>
<td>135</td>
<td>150</td>
<td>165</td>
</tr>
</tbody>
</table>

*Local exhaust also required in kitchens and baths
Exhaust-only ventilation

- Frequently used in colder climates.
- Use a fan (like a bath fan) to exhaust air.
- Outdoor air returns back into the home through cracks or an air intake.
Exhaust-only ventilation

Pros

- Inexpensive
- Simple installation
- Local exhaust can double as whole-house exhaust
- Low condensation risk (winter)

Cons

- Negative pressure induced on house
  - Backdrafting risk
  - Radon (unless mitigated)
- Air from unknown locations
  - Dust, fiberglass, mold
- Condensation risk (summer)
Supply-only ventilation

• *Frequently used in warmer climates.*

• *Draw in outdoor air on the return side of the air handler.*

• *Indoor air is forced out through leaks in the building shell.*
Supply-only ventilation

Pros

• Inexpensive
• Simple installation
• Air from a known location
• Air can be conditioned and filtered
• Reduces backdrafting risk
• Fresh air directly to most occupied spaces

Cons

• Condensation risk
  • Moisture forced into building cavities from house pressurization
  • Higher risk in heating-dominated climate
• HVAC-integrated
  • High electricity consumption
  • Furnace Fan vs. Bath Fan
  • Complicated damper control
Balanced ventilation

• *Used in both warm and cold climates*

• *Draw in outdoor air, while exhausting air from indoors.*

• *An equal amount of air is exhausted and supplied to the home, so air is not forced through cracks in the home.*
Balanced ventilation

• Supply fan + exhaust fan
• Exhaust and supply air at roughly equal amounts
• Adds the benefit of heat/energy recovery
  • HRV – Heat Recovery Ventilator
  • ERV – Energy Recovery Ventilator
• **HRVs deal only in sensible heat**

• **ERVs deal with sensible and latent heat**
  - They have the ability to keep humidity where it originates
Balanced ventilation

Pros

• Ability to transfer heat from outgoing to incoming air
• Improved comfort
• Reduced cost to condition ventilation air

Cons

• Up front cost


Poll Question
The ENERGY STAR approach

• Build the home tight to improve efficiency & comfort.
• Remove contaminants using occupant-controlled exhaust fan in kitchens & bathrooms and a filter in HVAC system.
• Bring in outdoor air in a controlled way to dilute contaminants.
• Include key durability details relating to water management.
• Include an exhaust fan in most bathrooms
• Include an exhaust fan in each kitchen.
• Two requirements for these fans:
  • Achieve a minimum measured air flow rate.
  • Achieve a maximum rated sound limit.
Only bathrooms with a bathtub, shower, spa, or similar source of moisture must have an exhaust fan.

Two requirements for these fans:
- Achieve a minimum measured air flow rate.
- Achieve a maximum rated sound limit.

Intermittent and continuous bath fans have different airflow and sound targets.

### Summary of Airflow Requirements for Bath Fans

<table>
<thead>
<tr>
<th>Fan Type</th>
<th>Measured Airflow</th>
<th>Rated Sound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermittent</td>
<td>≥ 50 CFM</td>
<td>≤ 3 sones</td>
</tr>
<tr>
<td>Continuous</td>
<td>≥ 20 CFM</td>
<td>≤ 1 sones</td>
</tr>
</tbody>
</table>
• Measure of Intensity of sound
• 1 Sone = 40 dB @ 1kHz
• 1kHz is a mid frequency
Like bath fans, kitchen fans must meet a minimum airflow and should meet maximum sound rating.

Requirements depend on whether the fan is intermittent or continuous, and whether it’s integrated with the range.

### Summary of Airflow Requirements for Kitchen Fans

<table>
<thead>
<tr>
<th>Fan Type</th>
<th>Integrated with Range?</th>
<th>Measured Airflow</th>
<th>Rated Sound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermittent</td>
<td>Yes</td>
<td>≥ 100 CFM</td>
<td>≤ 3 sones</td>
</tr>
<tr>
<td>Intermittent</td>
<td>No</td>
<td>Greater of ≥ 100 CFM or 5 ACH</td>
<td>≤ 3 sones</td>
</tr>
<tr>
<td>Continuous</td>
<td>n/a</td>
<td>≥ 5 ACH</td>
<td>≤ 1 sone</td>
</tr>
</tbody>
</table>

*Greater than or Equal to 5 ACH of the kitchen volume*
Kitchen exhaust requirements will be enforced for homes permitted on or after 01/01/2014.

Two alternative compliance options have been provided for kitchen exhaust fans:

- One option for fans where the airflow is difficult to measure.
- One option for fans that have no airflow rating.

Note that bath exhaust requirements are being enforced.
Whole-house mechanical ventilation

• Local mechanical exhaust system can also be the whole-house mechanical ventilation system.

• For example, a bath fan can be two things:
  1. Local mechanical exhaust for the bathroom. Used by the homeowner when they want.
  2. Exhaust-only whole-house mechanical ventilation system. Fan turns on automatically, without homeowner intervention.

• Designer must ensure that the airflow and sound requirements are met for both functions. Example:

<table>
<thead>
<tr>
<th>Function</th>
<th>Cycle Type</th>
<th>Min. Measured Airflow</th>
<th>Max. Rated Sound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local bath exhaust</td>
<td>Intermittent</td>
<td>≥ 50 CFM</td>
<td>≤ 3 sones</td>
</tr>
<tr>
<td>Whole-house vent.</td>
<td>Intermittent</td>
<td>Per ASHRAE 62.2-2010</td>
<td>≤ 3 sones</td>
</tr>
</tbody>
</table>
Example Home

- Conditioned floor area = 2,000 sqft
- Number of bedrooms = 3

ASHRAE 62.2-2010 Equation 4.1

- Continuous air flow rate as calculated by ASHRAE 62.2
  - Airflow = 0.01 \times \text{Floor Area} + 7.5 \times (\text{Bedrooms} + 1)
  - Airflow = 0.01 \times 2,000 + 7.5 \times (3 + 1)
  - Airflow = 50 \text{ CFM}
Example Home

- Conditioned floor area = 2,000 sqft
- Number of bedrooms = 3
- 16 hours on, 8 hours off (Fraction on time 16/24 = 0.66)
- Ventilation Effectiveness (Look up based on Cycle and Fractional on Time)

ASHRAE 62.2-2010 Equation 4.2

- Airflow = Cont. Airflow / (Fractional On-time * Vent Effectiveness)
- Airflow = 50 / (0.66 * 0.73)
- Airflow = 104 CFM
• Cycled systems turn on and off automatically to provide outdoor air in cycles.

• The designer chooses the frequency and length of the ventilation cycles, which dictates the airflow rate.

• Cycled systems can be used to avoid running the system during a fixed period of time (e.g., hottest or coldest hours of the day).

• The ventilation system must run $\geq 10\%$ every 24 hours.
Four basic filtration requirements:

- Provide a MERV 6 or better filter in each ducted mechanical system.
- All return air and mechanically supplied outdoor air must pass through filter prior to conditioning.
- Filter must be accessible to occupants and able to be serviced.
- Filter must be gasketed to prevent bypass.
Summary of ENERGY STAR Mechanical Ventilation Benefits

Don’t sacrifice indoor air quality in exchange for efficiency.

Three major concepts:

• Bath and kitchen fans remove contaminants.
  • Generally, turned on and off by occupants.
  • Must meet airflow and sound requirements.

• Whole-house mechanical ventilation removes contaminants and/or dilutes them with outdoor air.
  • System operates automatically.
  • System types: exhaust-only, supply-only, & balanced.
  • Must meet airflow and sound requirements.

• Filters trap contaminants.
• Use the checklist as a sales tool
• Third party testing and verification = Confidence
• Don’t forget about the marketing tools available through ES and FirstEnergy Programs

Marketing Resources for Partners
Building ENERGY STAR certified homes is only the first step for partners. As an ENERGY STAR partner, you have access to a variety of resources at no cost that will help educate homebuyers of the value of an ENERGY STAR home and set your company apart from other homebuilders.
• Become an ENERGY STAR Partner

• Order ENERGY STAR Marketing Brochures

• Access My ENERGY STAR Account (MESA) for: Co-Brandable Brochures, Banners and the ENERGY STAR Consumer Video

ENERGY STAR Sales Tips
ENERGY STAR Sales Tips

The following ENERGY STAR marks are available to partners. When using any of these marks, be sure to comply with the ENERGY STAR Brand Book.

A Quick Reference Guide for New Homes Partners (2.31MB) highlights the main guidelines for proper use of the ENERGY STAR marks by partners in the ENERGY STAR Certified Homes program. This Quick Reference Guide is a clickable PDF. Please follow the instructions on page 2 of the Guide. This document supplements, rather than replaces, the ENERGY STAR Brand Book.

Any questions about the ENERGY STAR marks and the ENERGY STAR Brand Book can be sent to logos@energystar.gov.
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  • 15% more efficient than 2009 IECC (or relevant code when permitted)
  • ENERGY STAR certification
FirstEnergy Incentives – Review

Estimated Incentives

- >$1,000
- $775
- $550

These incentive amounts are not guaranteed. Incentives vary by project.
Resources

ENERGY STAR:
www.energystar.gov/newhomes

DOE Challenge Home:
http://www1.eere.energy.gov/buildings/residential/

Passive House:
http://www.passivehouse.us

Building Science Corporation:
http://www.buildingscience.com/
Resources

Obtaining Proper Ventilation

http://www.engr.psu.edu/phrc/Publications/BB0713-%20Obtaining%20Proper%20Ventilation-%20Final.pdf

Kitchen Ventilation Systems: Part 1 & 2

http://www.engr.psu.edu/phrc/Publications/BB0312-%20Kitchen%20Vent%20Systems%20FINAL%201-19-12%20USE.pdf
http://www.engr.psu.edu/phrc/Publications/BB0412-%20Kitchen%20Ventilation%20Systems%20Part%202%20FINAL.pdf

Builder America Solution Center: Bathroom Exhaust


EPA Radon Zone Maps

http://www.epa.gov/ radon/ zonemap.html
Thermal Bridging

Reducing Hot and Cold Spots in the Thermal Enclosure

Thursday, July 10th

Noon – 1:00 p.m.

Registration: https://www2.gotomeeting.com/register/746474802