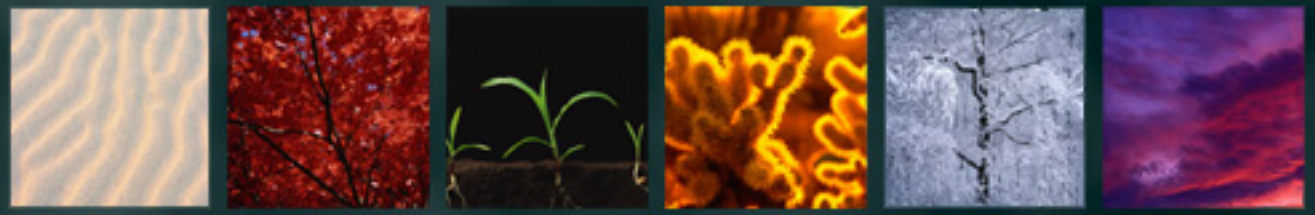

Thinking Out of the Box

Rating Multifamily Buildings

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Home Energy Ratings

- Not optimally configured for large or complex buildings
  - Minimum requirements (“rated features”)
  - Infiltration/Ventilation
  - Mechanical systems
    - No AFUE / HSPF/ SEER / EF ratings

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Technical Issues:

- Whole Building vs. Individual units
- Use of Sampling in field testing
- Blower door testing
- Mechanical systems

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Whole Building vs. Individual units

- NE-HERS Alliance: steer towards whole building
  - Modeling “worst case” may end up over-spec’ing average
  - **Can’t do** individual if there is any central mechanical equipment: reference home issues
- Individual
  - Townhouse development or similar
    - Modular repetition, varied configurations
    - “Worst Case” type and orientation, apply spec to all
  - Or for individual owner (not typical with Energy Star)
- Don’t try to create an “average” unit!

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Field Inspections Schedule

- Initial (pre-drywall)
  - Completed on majority of units, at rater's discretion
  - Look at all sections of building and all unique models
  - Look for consistency, unique problems in specific areas, etc.
- Initial inspection includes:
  - Assessment of air-sealing between units, according to initial project specs
  - Checking insulation levels, installation quality, duct sealing, and other relevant features

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Final inspection (Minimum)

# of Units in Building	Minimum # of Units to be Tested	Minimum # of Units to be Visually Inspected	Minimum # re-tested if 1 fails *	Minimum # of Units to be Visually re-Inspected
2-5	100%	50%	100%	50%
6-20	Minimum 5	30%	Minimum 5	30%
21-40	20%, minimum 5	20%	20%, minimum 5	20%
41+	20%, min. 10	10%	20%, min. 10	10%

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Blower door testing

- Types of multi-family buildings
  - Single zone: “Garden apartments”, smaller buildings—common entrances
  - Duplex/2-Zone, separate entrances
  - Townhomes / attached, separate entrances
  - Multi-zone, separate entrances

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Single zone—common entrances

- Test the building as a single zone as possible
  - Use multiple blower doors if necessary
  - Always pressurize the building to at least 35 Pascals
    - “Can’t Reach Fifty” factors are less accurate at house pressures below 35 Pa
- Don’t Add Fan Pressures
  - Add CFM’s of fan flow
- Use representative interior (not restricted) building reference pressure(s)

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Inaccessible units

- IF <20% of envelope
  - And IF generally representative of envelope
- Get pressure differentials under doors
- Calculate multiplier *C = (Pzo/ Phouse)^.65*
- *CFM =* $\frac{\text{Measured CFM} * 100}{(\%\ \text{building open} + (\ C * \%\ \text{building closed}))}$
  - Calculation may be extended for varying DP's

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2-Zone, separate entrances

- Use 2 Blower Doors
- Can calculate individual leakages, common surface leakage
- Special case of modular (townhouse)

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Townhouse, separate entrances

- Test Unit A alone
- Test Units A and B with separate blower doors, at the same house pressure
- Common wall leakage is $A_{alone} - A_{with\ B}$
- Outdoors leakage is $A_{with\ B}$

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Continued…

- Test B alone
- Test Units B and C with separate blower doors, at the same house pressure
- Common wall leakage is $B_{alone} - B_{with\ C}$
- Outdoors leakage is $B_{with\ C} - Common_{AB}$
  - (Or, if you have a 3rd blower door, outdoors leakage is B with both A and C at the same pressure)

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Multi-zone, separate entrances

- Test all units together with a blower door installed in each separate entrance. Use the same house pressure in all units at once.
  - OR –
- Test individual units (or areas) with a blower door, using additional blower door(s) to pressurize adjacent units and calculate inter-unit leakage, as shown in the previous section

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Remember:

- Do not use arbitrary assumptions about inter-unit leakage if the building cannot be tested with multiple blower doors!
- Don’t assume common wall leakage is the same as envelope leakage
  - It’s typically very different

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Mechanical systems

- Central space-conditioning systems
  - Two pipe and 4-pipe systems w/ air handlers
  - Any central boiler or chiller system
  - Package systems (PTAC)
- Water heating storage tanks with boilers

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Off-line calculations:

- EER for central cooling systems:
  - EER = Capacity (Btuh) ÷ Input (Watts), where:
  - Input = chiller watts + cooling tower fan watts + cooling tower pump watts + chilled water pump watts + fan coil blower watts
- Heating efficiency
  - AFUE = boiler capacity (in Btuh) ÷ Input (in Btuh) , where
  - Input = boiler input Btuh + (hot water pumping watts × 3.41) + (fan coil blower watts × 3.41)

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