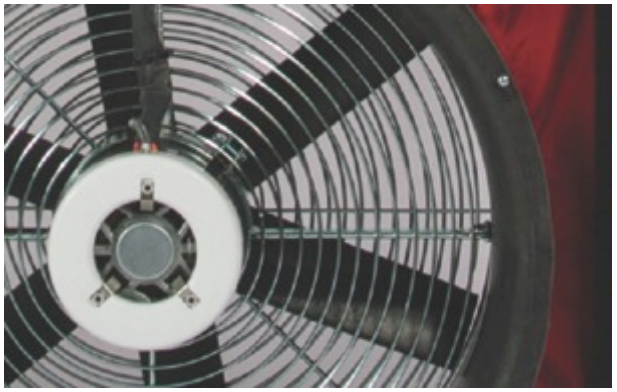
ENERGY DESIGN
conference & expo

Smart Remodeling



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MBPA
MINNESOTA BUILDING PERFORMANCE ASSOCIATION
mbpa.us

Paul Morin

In accordance with the Department of Labor and Industry's statute 326.0981, Subd. 11,

"This educational offering is recognized by the Minnesota Department of Labor and Industry as satisfying **1.5 hours** of credit toward **Building Officials and Residential Contractors code /1 hour energy** continuing education requirements."

For additional continuing education approvals, please see your credit tracking card.

Objectives

By the end of this session, participants will be able to:

- List remodeling changes that pose risk to the building or occupants
- Describe the building science behind these risky changes
- Use testing procedures that help enhance performance and develop a work scope

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Systems approach to remodeling

- Existing homes have existing problems
  - Moisture effects health and durability
  - Double edged sword – need it in the right amounts
  - Also need airflow in the right amounts – health and comfort
- The home must perform well when work is complete

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Building Performance is about solving problems

- Understanding the problems will guide your decisions
- And prevent new problems as part of your remodeling process.
- People typically have a history with the home
- You will be surprised how much they can tell you
  - Are there comfort issues
  - Are there moisture issues
  - High energy bills
  - Problems with ice dams

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Moisture

Do a visual inspection:

- Document existing conditions
- Start outside
  - Grading and gutters

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Moisture

Do a visual inspection:

- Basement
  - Foundation moisture signs

Moisture

Do a visual inspection:

- Basement
  - Foundation moisture signs
  - Insulation

Moisture

Do a visual inspection:

- Basement
  - Foundation moisture signs
  - Insulation
- 1st and 2nd floors
- Attic

Mechanical systems

Do a visual inspection:

- Basement
  - Mechanical systems

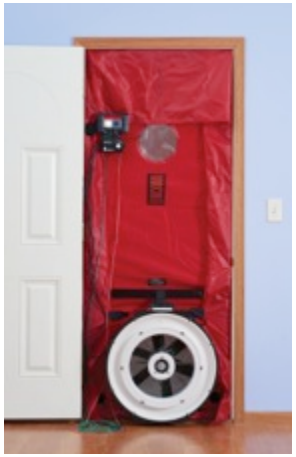
Building Performance is about solving problems

Do a visual inspection:

- Basement
  - Mechanical systems

Mechanical

- Will this remodel help or hurt this home?
- How will you know at the end if it helped?
- You will need to document and measure



Building Performance is about solving problems

- Many older homes seem to work
  - Lots of air flow – drafty
  - Very little insulation – comfort issues
  - No exhaust fans or clothes dryer

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Building Performance is about solving problems

- What can happen when we tighten a home?
  - Poor air quality
  - Less drying potential in winter
  - Exhaust fans effect pressures more

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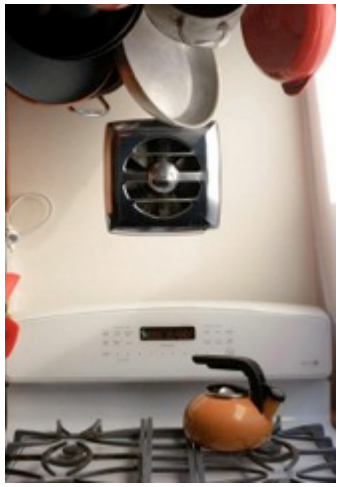
Building Performance is about solving problems

- What can happen when we add insulation?
  - Adding wall insulation reduces drying potential in wall cavity
  - Adding attic insulation can make attic colder and wetter in winter
  - Foundation insulation is risky if water issues are not dealt with first

Building Performance is about solving problems

- What can happen when we add exhaust fans?
  - Affects pressures in the home and can it lead to back drafting and carbon monoxide
  - Can affect how a fireplace operates



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Building Science Basics - Air

Performance requires extensive air management:

- Air is always moving
  - Leaking in, leaking out
  - In and out of building cavities
  - Through ductwork
  - Out through appliances
    - Fans, water heaters and furnaces
  - Cause and effect
- Airflow changes may affect energy and moisture flows throughout the house


PLUMBING STACK VENT
BATHROOM FAN VENT
RECESSED LIGHTS
ATTIC HATCH
RECESSED LIGHTS
CHASE
KITCHEN FAN VENT
ELECTRICAL OUTLET
DRYER VENT
CRAWL SPACE
OUTDOOR FAUCET
Air leaking into the house
Air leaking out of the house

Building Science Basics - Air

What's the best predictor of overall building performance?

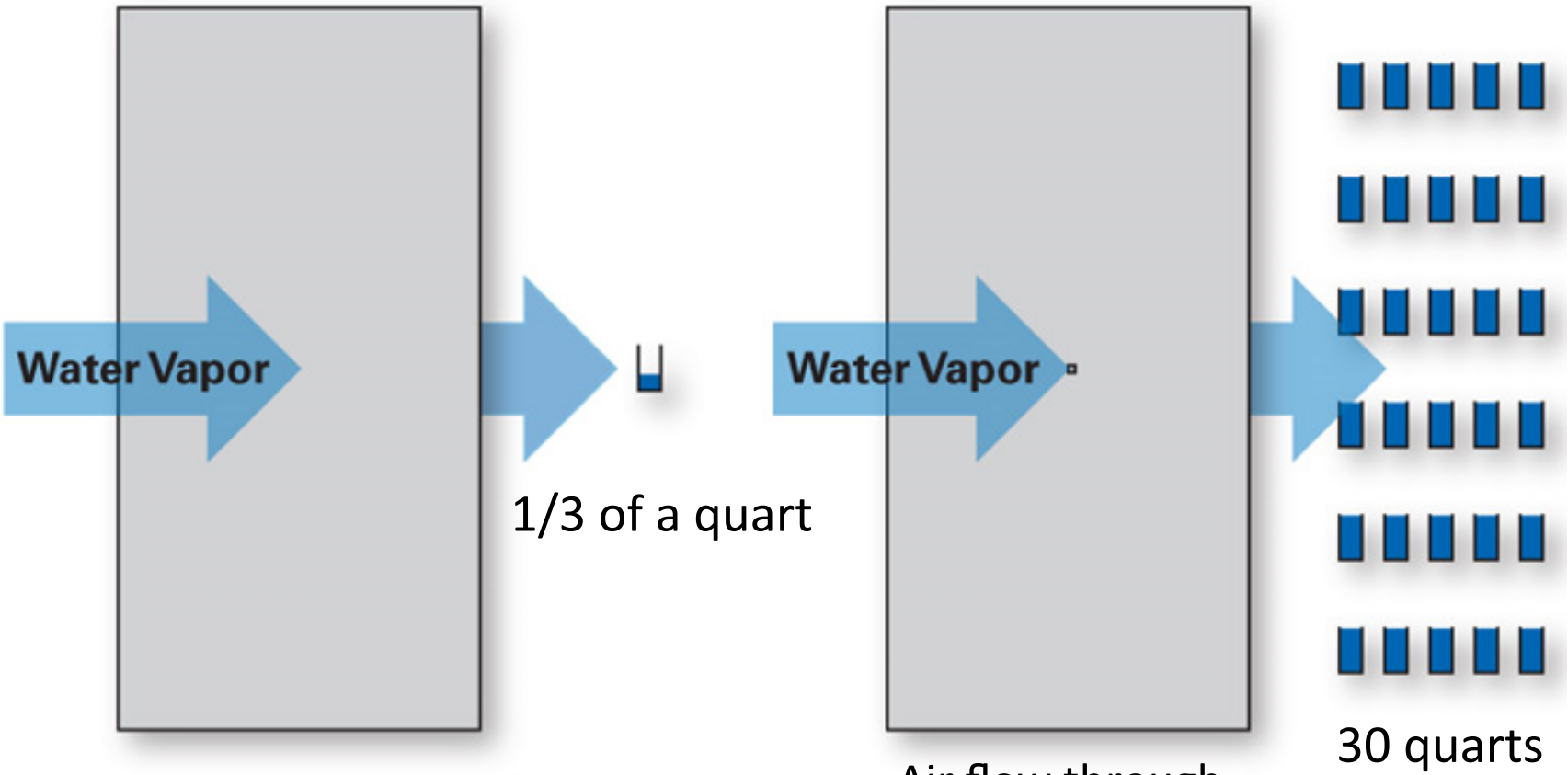
» Air flows and pressures
  - Often unplanned, unintentional, and unmanaged
  - Primary cause of performance failures.
  - Can carry with it a great deal of heat and moisture
  - Air pressures can easily compromise mechanical systems
  - Air management is critical for comfort, energy efficiency, durability, and indoor air quality

» But the greatest challenge is airflow control

Building Science Basics - Water

» Water movement – driving forces
  - Gravity - bulk water
  - Capillarity
  - Diffusion through materials
  - With air currents

Building Science Basics - Water



Diffusion through a
4x8 sheet of sheetrock

Air flow through
1 inch² hole

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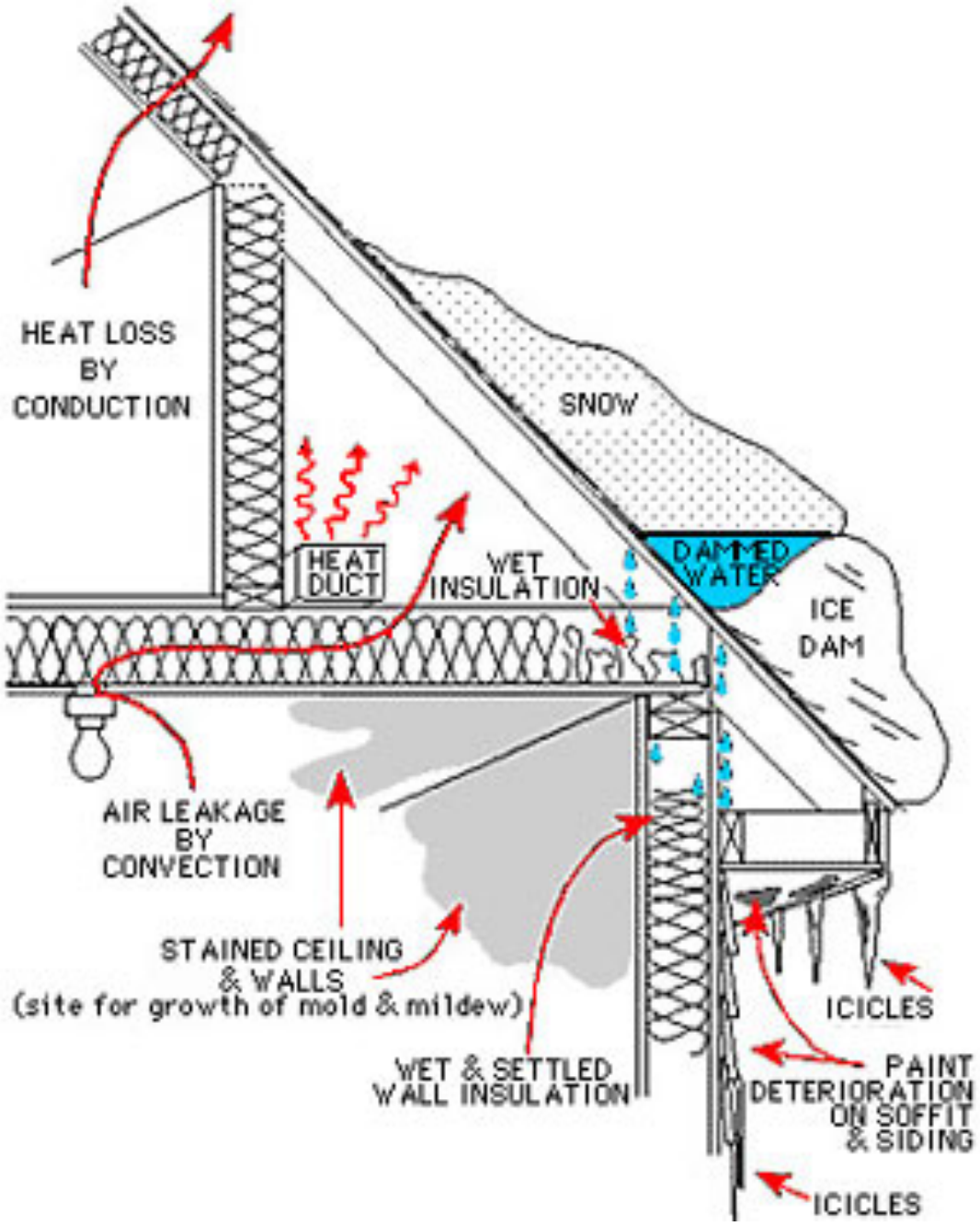
Building Science Basics - Heat

- Comfort and efficiency
- Wall and attic insulation
- Deliver heat where it is needed
  - Longest heat run
  - Ducts through an attached garage
  - BTUs = 1.07 x CFM x ΔTemperature



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The process

- Homeowner interview
- Formulate hypotheses
- Test in
- Develop a plan
- Field inspections during construction
- Test out
- Feedback

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Step 1. Test In

- Homeowner interview
  - What works
  - What does not work
- Identify pre-existing conditions
- Formulate hypotheses
- Test in
- Results are basis for a scopes of work
- Also, baseline for evaluating work
  - Combustion Safety
  - Mechanical Ventilation
  - Insulation, air sealing, duct sealing

Step 2: Develop Plan

- Develop a Customized Rehab Plan
- Existing conditions
- Desired outcomes
  - Each action will have different interactions
- Use the “test in” data to guide the work plan
  - Develop clear work scopes, specs, and expectations
  - Prioritize
    - Combustion safety and Ventilation - people first, then buildings

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Step 3: Field Inspection during construction

- Verify Compliance in the Field
  - May require some testing
- Proper materials/equipment
  - Is the right stuff on the job site?
- Proper means and methods
  - Are they following the plan
  - Sequence issues
  - Hand-off between multiple contractors
- Properly document the end product

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Step 4. Test Out

- Not Done Until You “Test Out”
  - Compare results to the initial baseline
  - Compare results to established guidelines
- Criteria set in rehab plan
  - Were expectaions met?

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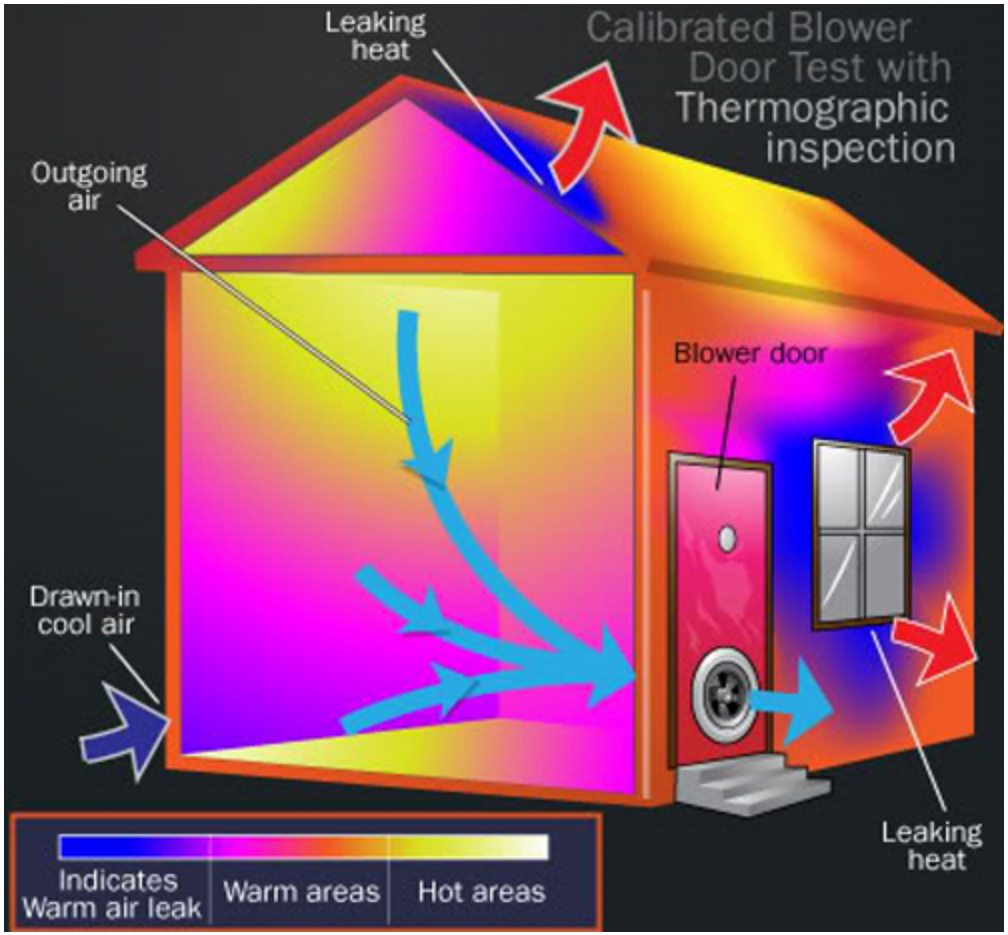
Step 4. Test Out

Step 4. Test Out



Step 5. Feedback

- Monitor Performance
  - Feedback is a required component for continuous improvement.
    - Were comfort expectations met
  - This is especially critical when we are trying to get maximum results with minimum dollars.
  - It is the only way to increase our effectiveness and efficiency over time.

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Questions?

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Thank you

Paul Morin
pmorin@energyconservatory.com
612-254-2162

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