LIVE IN THIS
NOT THAT!
Question:

What new technology will completely change housing?

Hint: It has nothing to do with construction.
Low Cost Infrared Cameras

Your Price: $4,995.00
Four Key Ingredients to Health

Food

- Fat
- Sugar
- Salt
- Chemicals
Status Quo 95+% of Homes: “Houston, We Have a Problem”

Affordable
Comfortable
Healthy
Durable

1. Control Air Flow
2. Control Thermal Flow
3. Control Moisture Flow
4. Control Pollutants
INGREDIENT #1: CONTROL AIR FLOW
TWO CONDITIONS FOR AIR LEAKAGE:

• Holes
• Weather

Weather:
Wind/Heat/Moisture
AIR LEAKAGE CONTROL STRATEGY

1. Can’t control weather
2. So control the holes
3. Since air will take path of least resistance through largest holes...

seal big holes first!

We’re geniuses!
WE KNOW WHERE THE BIG HOLES ARE...

Access Panels
Drywall at Top Plate
Penetrations:
  • Ceiling Fixtures
  • Vents
  • Plumbing

Chases
Cracks:
  • Window Openings
  • Door Openings
  • Sill Plates

Ducts
WHY OLD BUILDINGS LAST SO LONG
NO INSULATION = WARM WALL

Without Insulation:

Outside: 30°F

55°F Cold Surface

Inside: 70°F, 45°F Dew Pt.

No Condensation Problem!

High Bills, Comfort, Health Problems!
WHY NEW HOMES MOISTURE PROBLEMS
INSULATION = COLD WALLS

With Insulation:

Potential Condensation Problem

Inside: 70°F, 45°F Dew Pt.

30°F

34°F Cold Surface
WHY NEW HOMES HAVE MOISTURE PROBLEMS

With Insulation:

Outside: 55°F, Warm
Inside: 30°F, 34°F Cold Surface

70°F, 45°F Dew Pt.

Real Problem

Therefore, must control air leakage!!!
DO ELECTRIC OUTLETS/SWITCHES LEAK?
WHY CONTROL AIR FLOW?

Courtesy of Building Science Corp.
INGREDIENT #2: CONTROL THERMAL FLOW
TWO-PART SOLUTION

- First Control Air Flow
  (see Ingredient #1)
- Then provide an effective ‘Insulation System’!
WHAT IS A COMPLETE INSULATION SYSTEM

1. Proper Amount
2. Complete Air Barriers
3. Proper Installation
4. Minimal Thermal Bridging
WHAT IS PROPER AMOUNT OF INSULATION?

• At least minimum code

• Recommend 50% above minimum code
WHY INSULATION NEEDS AN AIR BARRIER

Resists Heat Flow

Air Flow
INSULATION IS NOT AN AIR BARRIER

Courtesy of Blue Grass Energy
INSULATION IS NOT AN AIR BARRIER
Air Barrier is...

any solid material that blocks air flow...

...including sealing at edges and seams

...on all six sides

...in direct contact with insulation (no air spaces)
BUILDING SCIENCE
WHY COMPLETE AIR BARRIER

Air Barrier Should Be Here
PROPER INSULATION INSTALLATION

Insulation must be installed with no:

- gaps
- voids
- compression
- air spaces
WHAT IS THERMAL BRIDGING
SURFACE TEMPERATURES AND COMFORT

30 °F
SURFACE TEMPERATURES AND COMFORT

If you lose control of surface temperatures, you lose control of comfort!

30 °F
INGREDIENT #3: CONTROL MOISTURE FLOW

MOISTURE COMES IN TWO FORMS

- **Vapor** (humid air); and

- **Bulk** (the wet stuff)
WHY CONTROL MOISTURE FLOW?
CONTROLLING MOISTURE VAPOR: THIS GETS COMPLICATED

• First control air flow (sound familiar...go see Ingredient #1)... yes air flow is really important!

• Remember controlling thermal flow creates cold surfaces... this makes bulk moisture (e.g., water) flow really important... unless you like mold and dry rot.
CONTROLLING BULK MOISTURE:
DRAIN HOMES COMPLETELY

Drain Roofs
Drain Walls
Protect/Select Materials
Drain Foundations
INGREDIENT #4: CONTROL POLLUTANTS

MAJOR POLLUTANTS

• Chemicals (VOC’s/Formaldehyde)  
  [paints, carpets, carpet pads, board products, cabinets, adhesives]

• Moisture  
  [mold, mustiness]

• Biological  
  [dust mites, pests]

• Combustion Gases  
  [gravity exhaust equipment, fireplaces, candles]

• Radon
If That’s Why Homes Work and Fail…

LIVE IN THIS, NOT THAT!
Big Remaining Hole!
Dryer pulling flame out of the heater
COMBUSTION SAFE EQUIPMENT:
Key Ingredient: **Air Flow**
Solution: **Direct Vented Equipment**

LIVE IN THIS

NOT THAT!
COMBUSTION SAFE EQUIPMENT:
Key Ingredient: **Air Flow**
Solution: **Direct Vented Equipment**

LIVE IN
THIS

NOT
THAT!
DROPPED CEILING:
Key Ingredient: Air, Thermal, and Moisture Flow
Solution: Air Barrier

LIVE IN THIS

NOT THAT!
DROPPED CEILING:
Key Ingredient: **Air, Thermal, and Moisture Flow**
Solution: **Air Barrier**

LIVE IN THIS

NOT THAT!
A CHANGING WORLD
DEFECTS NO LONGER HIDDEN
ATTIC KNEE WALL:
Key Ingredient: Air, Thermal, and Moisture Flow
Solution: Air Barrier

LIVE IN
THIS

NOT
THAT!
ATTIC KNEE WALL:
Key Ingredient: Air, Thermal, and Moisture Flow
Solution: Air Barrier

LIVE IN THIS

NOT THAT!
INSET STAPLING = AIR SPACES
WALL INSULATION:
Key Ingredient: **Thermal Flow**
Solution: **Insulation Proper Installation**

LIVE IN
THIS

NOT
THAT!
WALL INSTALLATION:
Key Ingredient: Thermal Flow
Solution: Insulation Proper Installation

LIVE IN THIS

NOT THAT!
WALL INSTALLATION:
Key Ingredient: Thermal Flow
Solution: Insulation Proper Installation

LIVE IN THIS

NOT THAT!
OUTLET/SWITCHES WALL PENETRATIONS:
Key Ingredient: **Air Flow**
Solution: **Air Sealing**

LIVE IN THIS

NOT THAT!
SILL PLATES:
Key Ingredient: Air Flow
Solution: Air Sealing, Foam Sill Sealer

LIVE IN THIS

NOT THAT!
WINDOW/DOOR OPENINGS:
Key Ingredient: Air Flow
Solution: Non-Expanding Foam Seal

LIVE IN
THIS

NOT
THAT!
PLUMBING PENETRATIONS:
Key Ingredient: **Air Flow**
Solution: **Foam/Flashing as Required**

LIVE IN THIS

NOT THAT!
DUCT SHAFTS:
Key Ingredient: **Air Flow**
Solution: **Air Barriers and Sealing**

**LIVE IN THIS**

Use caulk or mastic to seal the penetrations

**NOT THAT!**
DRYWALL AT TOP PLATE BELOW ATTIC:
Key Ingredient: **Air Flow**
Solution: **Air Sealing**

LIVE IN **THIS**

NOT **THAT**!
DRYWALL AT TOP PLATE BELOW ATTIC:
Key Ingredient: **Air Flow**
Solution: **Air Sealing**

**LIVE IN THIS**

**NOT THAT!**
AIR ACCESS PANEL:
Key Ingredient: Air and Thermal Flow
Solution: Insulation and Gaskets

LIVE IN THIS

NOT THAT!
ATTIC KNEE WALL ACCESS DOOR:
Key Ingredient: **Air and Thermal Flow**
Solution: **Insulated Door and Gasket**

LIVE IN THIS

NOT THAT!
ATTIC EAVE WIND WASHING
Solution?
Space age material

Perimeter radiant heating?
No, wind intrusion.
INSULATION AT ATTIC EAVE:
Key Ingredient: Air and Thermal Flow
Solution: Wind Baffles

LIVE IN THIS

NOT THAT!
QUESTION: HOW WILL BUILDER INSULATE AND INSTALL AIR BARRIER BEHIND THIS TUB?
TUBS/SHOWERS AT EXTERIOR WALLS:
Key Ingredient: *Air, Thermal, and Moisture Flow*
Solution: *Air Barrier*

**LIVE IN THIS**

**NOT THAT!**
FIREPLACE INSERTS AT EXTERIOR WALLS:
Key Ingredient: **Air, Thermal, and Moisture Flow**
Solution: **Air Barrier**

LIVE IN THIS

NOT THAT!
GRAVITY MAKES THINGS FALL…
WHO KNEW?
GARAGE/CANTILEVER FLOOR

Conditioned Room

Garage Ceiling

Winter
GARAGE/CANTILEVER FLOOR

Conditioned Room

Garage Ceiling

Summer
INSULATED FLOOR AT GARAGE/CANTILEVER:
Key Ingredient: **Thermal Flow**
Solution: **Insulation Proper Installation**

**LIVE IN THIS**

**NOT THAT!**
INSULATED FLOOR AT GARAGE/CANTILEVER:
Key Ingredient: Thermal Flow
Solution: Insulation Proper Installation

LIVE IN THIS

NOT THAT!
Gap

Will be there for the life of the building!
WALL INSTALLATION:
Key Ingredient: Thermal Flow
Solution: Insulation Proper Insulation

LIVE IN
THIS

NOT
THAT!
WALL CORNERS:
Key Ingredient: Thermal Flow
Solution: Two-Stud Corners

LIVE IN
THIS

NOT
THAT!
EXTERIOR/INTERIOR WALL INTERSECTIONS:
Key Ingredient: **Thermal Flow**
Solution: **Lattice Framing**

LIVE IN THIS

NOT THAT!
WALL THERMAL BRIDGING:
Key Ingredient: Thermal Flow
Solution: Advanced Framing

LIVE IN THIS

NOT THAT!
WALL THERMAL BRIDGING:
Key Ingredient: Thermal Flow
Solution: Rigid Insulation Sheathing

LIVE IN THIS

NOT THAT!
BAND JOISTS:
Key Ingredient: **Thermal Flow**
Solution: **Insulation Proper Installation**

**LIVE IN** THIS

**NOT** THAT!
LIVE IN THIS NOT THAT
ADVANCED INSULATION VALUE QUESTIONS

How many **quality defects** do you want?
Would you pay less for more **comfort & health**?
Which house would you rather **resell**?
HVAC SYSTEM QUALITY INSTALLATION

Field Adjusted SEER vs Rated SEER

Typical Installation

Courtesy of Advanced Energy Corp.
HVAC SYSTEM QUALITY INSTALLATION

Rated SEER

Typical Installation

Sized Right .75

Airtight Ducts 2.0

Correct Flow 0.5

Proper Charge 1.5

Field Adjusted SEER

Rated SEER

6 7 8 9 10

11 12 13 14 15

Courtesy of Advanced Energy Corp.
HVAC SYSTEM QUALITY INSTALLATION

Field Adjusted SEER

Rated SEER

Typical Installation

Airtight Ducts 2.0

Sized Right .75

Proper Charge 1.5

Correct Flow 0.5

Courtesy of Advanced Energy Corp.
COMFORT SYSTEM:
Key Ingredient: **Air and Moisture Flow**
Solution: **HVAC Quality Installation**

LIVE IN THIS

NOT THAT!
PRESSURE BALANCED HVAC SYSTEM:
Key Ingredient: Air and Moisture Flow
Solution: Jump Ducts

LIVE IN THIS

NOT THAT!
PRESSURE BALANCED HVAC SYSTEM

Key Ingredient: Air and Moisture Flow

Solution: Transfer Grills

LIVE IN THIS

NOT THAT!
DILUTION OF POLLUTANTS:
Key Ingredient: Air and Moisture Flow
Solution: Fresh Air System

LIVE IN THIS

NOT THAT!
FILTRATION OF POLLUTANTS:
Key Ingredient: **Air and Moisture Flow**
Solution: **Effective Filter**

LIVE IN THIS

NOT THAT!
LIVE IN THIS NOT THAT
QUALITY INSTALLED HVAC VALUE QUESTIONS

• How much energy do you want to waste?
• Which part of comfort is not important...
  - Thermal Control
  - Humidity Control
  - Noise Control
• Do you want fresh, filtered air?
WATER PROTECTION SYSTEM:
Key Ingredient: **Moisture Flow**
Solution: **Heavy Membrane Roof Valley Flashing**

LIVE IN THIS

NOT THAT!
WATER PROTECTION SYSTEM:
Key Ingredient: **Moisture Flow**
Solution: **Kick-Out Flashing**

**LIVE IN THIS**

**NOT THAT!**
WATER PROTECTION SYSTEM:
Key Ingredient: **Moisture Flow**
Solution: **Kick-Out Flashing**

LIVE IN **THIS**

NOT **THAT**!
WINDOW FLASHING PROBLEM REVEALED
WATER PROTECTION SYSTEM:
Key Ingredient: Moisture Flow
Solution: Window/Door Pan Flashing

LIVE IN THIS

NOT THAT!
WATER PROTECTION SYSTEM:
Key Ingredient: Moisture Flow
Solution: Foundation Capillary Break

LIVE IN THIS
NOT THAT!
LIVE IN THIS NOT THAT WATER MANAGEMENT VALUE QUESTIONS

What parts of your home do you want greater risk of moisture and mold problems?

Do you want more or less maintenance?

Do you want more or less assurance of a healthy home?
LIVE IN THIS NOT THAT
SUMMARY VALUE QUESTION

How much more risk do you want?
Why Homes That Work Have More Value
## LOWER OWNERSHIP COST

<table>
<thead>
<tr>
<th></th>
<th>Monthly</th>
<th>Annual</th>
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</thead>
<tbody>
<tr>
<td>Utility Savings</td>
<td>$45</td>
<td>$540</td>
</tr>
<tr>
<td>Added Mortgage</td>
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= $1,000’s for typical ownership period
BETTER PERFORMANCE

- **Comfort**
  room-by-room, no drafts, noise

- **Health**
  less moisture, dust, pollen, pests

- **Durability**
  better protection, long-lived equipment, less moisture damage
BETTER RESALE VALUE

- track record of low bills
- reduced obsolescence
- perceptible comfort advantage
FEELS GOOD TO OWN

Less Energy Used = < Pollution
> National Security
How to Recognize New Homes That Work
HOW CAN I LIVE IN A HOME THAT WORKS?

- **Existing Homes**
  - Home Performance Upgrade
    [look for Home Performance w/ENERGY STAR and DOE Better Buildings Program]
  - Energy Efficient Remodel
  - Energy Efficient Component Replacement

- **New Homes**
  - ENERGY STAR Qualified Homes
  - DOE/EPA Builders Challenge Homes
HOW TO GET MORE INFORMATION

On the Web at:
http://www.eere.energy.gov