ENERGY & WATER EFFICIENCY: HOME ASSESSMENTS

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Overview

- Home Energy Efficiency Basics
- Sample Energy Audit Results
- The Professional Energy Audit
Benefits of Energy Efficiency

- U.S. Dept of Energy Study: 33% decrease in heating bills after weatherization
- Eliminate comfort problems
- Healthier air in the home
- 10% Efficiency Improvement eliminates 1400 pounds of emitted CO2
Where Does the Energy Go?

- Largest Waste of Home Energy: duct and house air leaks and insulation problems
- Lighting and refrigerators- large electrical consumption components

Source: U.S. EPA
Impact of Primary Fuel Type

Natural gas house: Colorado Springs

Propane house: Peyton
Don't Forget Water Costs

Annual Utility Costs

- $814 (32%) for Gas-Heating
- $485 (19%) for Water Heat
- $238 (9%) for Elec-Heating
- $166 (6%) for Elec-Cooling
- $781 (30%) for Lights & Appliances
- $70 (3%) for Water-Irrigation
- $17 (1%) for Water-Indoors
• Attics:
  – Penetrations
  – Knee Walls (Vertical Walls)
  – Insulation
  – Ventilation
  – Ducts
  – Hatches
Common Problem Areas 2

- Crawlspace:
  - Venting
  - Moisture control
  - Air sealing and insulation
  - Ducts and plumbing
Common Problem Areas 3

- Air Infiltration
  - Fireplaces
  - Sockets
  - Sill and bottom plates
  - Attic fans
  - Recessed lights
  - …and many more
Hidden Problems

- Air infiltration in stud cavities
- Insufficient insulation
- Leaky cantilever overhangs and window boxes
Furnaces

Direct Vent, Condensing Furnaces also Offer:

- 55% more efficient motors;
- No indoor combustion air;
- Multiple fan and burner stages
• Relatively few cooling days
• Hard to recoup investment in air conditioning replacement or upgrade
• Cool, low humidity evenings create higher efficiency options
  – Evaporative coolers
  – Whole house fans
• Ensure proper attic ventilation and insulation
• Most cost effective option: block summer solar heat gain (windows and skylights)
Lighting: 10 Year Costs

Incandescent Bulbs: 10% Light + 90% Heat
Refrigerator Annual Energy Costs

- ENERGY STAR New: $53
- Avg New: $69
- 20 Yr Old: $170
Typical Breakdown of Heating Energy Consumption

- Walls: 20%
- Windows: 25%
- Doors: 6%
- Attic: 13%
- Attic: 11%
- Foundation: 23%
- Air Leakage: 1%
- Ducts: 6%

[Diagram showing energy consumption breakdown]
<table>
<thead>
<tr>
<th>Measure</th>
<th>Savings ($/Year)</th>
<th>Measure Cost ($)</th>
<th>Energy Savings (KWH)</th>
<th>SIR*</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replace incandescent light bulbs with compact florescent</td>
<td>198</td>
<td>228</td>
<td>1801</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td>Reduce irrigation water consumption by 60% through efficient watering</td>
<td>330</td>
<td>1500</td>
<td>0</td>
<td>4.4</td>
<td>Assumes professional landscaping</td>
</tr>
<tr>
<td>and Xeriscaping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace three highest use 1.6 gallon per flush toilets with WaterSense</td>
<td>12</td>
<td>75</td>
<td>0</td>
<td>3.3</td>
<td>Assumes DIY install and $75 per toilet</td>
</tr>
<tr>
<td>certified 1.28 GPF models</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CSU rebate</td>
</tr>
<tr>
<td>Install WaterSense certified low flow showerheads</td>
<td>15</td>
<td>75</td>
<td>414</td>
<td>2.4</td>
<td>Assumes DIY install</td>
</tr>
<tr>
<td>Insulate exposed hot water pipes</td>
<td>9</td>
<td>45</td>
<td>251</td>
<td>2.1</td>
<td>Assumes DIY install</td>
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<tr>
<td>Air sealing and infiltration reduction (25% reduction)</td>
<td>41</td>
<td>175</td>
<td>1260</td>
<td>2.0</td>
<td>Assumes DIY repairs</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$605</td>
<td>$2,098</td>
<td>3726</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Typical Low Payoff Improvements

<table>
<thead>
<tr>
<th>Measure</th>
<th>Savings ($/Year)</th>
<th>Measure Cost ($)</th>
<th>Energy Savings (KWH)</th>
<th>SIR</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replace north windows with ENERGY STAR – rated units (U= 0.30)</td>
<td>66</td>
<td>3503</td>
<td>1535</td>
<td>0.3</td>
<td>Large energy savings is overwhelmed by replacement cost</td>
</tr>
<tr>
<td>Replace furnace with 95% efficient, ENERGY STAR model</td>
<td>84</td>
<td>4200</td>
<td>2344</td>
<td>0.3</td>
<td>Data for one furnace</td>
</tr>
<tr>
<td>Increase attic insulation from R-36 to R-49</td>
<td>26</td>
<td>2132</td>
<td>638</td>
<td>0.2</td>
<td></td>
</tr>
</tbody>
</table>
The Home Energy Audit

Diagnostic Testing:
- Blower Door (air leakage)
- Duct Blower (duct leakage)
- Thermal imaging
- Combustion gas analysis
- Natural gas leak detection
- Indoor air quality

- Inspections:
  - Insulation
  - Heater, A/C, ventilation
  - Moisture Issues
  - Attic, basement, crawl space

- Electrical, Gas and Water Consumption Analysis
- Modeling and Analysis
Home Energy Rating System (HERS)

- Like “EPA Mileage Sticker” for home efficiency
- Independent, third party tested (certified rater)
- Score of 100 = efficiency of 2006 energy code reference
  - Each point below 100 is 1% more efficient
- Average existing U.S. Home: HERS 130
- Compensates for climate
- Independent of homeowner behavior or family size
Conclusion

• Energy efficiency returns on investment not always obvious
• Must consider relationship between efficiency, safety and comfort when performing upgrades
Resources

- Appliance, Furnace, Air Conditioning, Fans Search: www.energystar.gov
- Light bulb and appliance review: www.consumerreports.org
- WaterSense Product Search: www.epa.gov/WaterSense/product_search.html
QUESTIONS?

Link to slides:  secres.org/taming

Upcoming Sessions:

• **November 14th**: Incentives and financing for efficiency upgrades
• **December 12th**: Renewable energy basics for homes and small businesses
Backup
Energy Myths vs. Building Science

• Myth: “Replace your windows and save 40% on your heating bills.” (Radio ad)

• Reality:
  – Even with single panes, heat loss through windows is 12% to 30% of total heating bill
  – Standard uncoated double pane vs. ENERGY STAR windows: R-2.2 vs. R-3.3
  – Old wood single pane vs. ENERGY STAR: R-1.0 vs. R-3.3
Energy Myths vs. Building Science

• Myth: Save energy by turning down the thermostat and turning on gas fireplace

• Reality:
  – Typical furnace: 80% efficient
  – Typical gas fireplace: 15% to 35% efficient
  – Conventional wood fireplace: <5% efficient

• Fireplace pilot lights consume $12 to $20 per month. Turn them off in summer!
Energy Myths vs. Building Science

• Myth: Always start in attic when adding new insulation
• Reality:
  – Typically, uninsulated basement or crawl space walls wastes 5 times more energy than an under-insulated attic
  – Know the payback time when considering additional attic insulation
Energy Myths vs. Building Science

• Myth: Can't seal a house too much...a house needs to breathe.

• Reality:
  – A house can never be too tight...but it can be under-ventilated
  – Best to “Make it tight and ventilate right” using efficient, controlled ventilation
Energy Myths vs. Building Science

• Myth: Add more insulation to stop air leaks into attic.
• Reality:
  – Fiberglass and cellulose are not air barriers
  – Air leakage typically wastes more energy than insufficient insulation
Energy Myths vs. Building Science

• Myth: Spray-in exterior wall foam is cost effective (in finished wall)

• Reality:
  – Sometimes true in 80 year old home with zero insulation
  – In typical 3000 sq ft house, cost > $1.70 per sqft, savings < $0.07 per sqft