Weatherization/Home Performance

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Learning Objectives

- Discuss the importance of energy use
- Explain why existing buildings matter for energy and other issues
- Discuss the "house as a system" approach to retrofits
- List major retrofit energy efficiency measures
- Identify technology used for assessing energy performance of buildings
- Describe energy efficiency career opportunities



Energy Use in the U.S.

Buildings use about 40% of all energy in the United States

Split about evenly between residential and commercial

The rest is industrial, transportation, and electricity generation





Energy Use in Residential Buildings



Source: U.S. Energy Information Agency: Residential Energy Consumption Survey (RECS) 2015



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Residential Buildings

Over 120 million residences in the U.S.

- About 100 million single-family homes
- We only build about 1.5 million homes a year
- About 90% of homes we'll have in 2030 are already built!
- Reducing energy use and emissions requires that we consider existing homes while ALSO doing better in new construction





The Environmental Need for Efficiency

Buildings also account for about 40% of greenhouse gas emissions

Energy sources are not infinite

Reducing energy use reduces emissions, helping to limit the worst effects of climate change



The Economic Need for Efficiency

- Energy prices can vary widely
- Many families have difficulty absorbing price changes
- Reducing energy burden improves resiliency of families and leaves more money for other things





The Political Need for Efficiency

- Responds to public demand
- Reduces competition for limited resources







Types of Improved Residential Building Initiatives

Weatherization/home performance (existing building improvements)

- Green Construction (new construction and remodeling; considers quality and source of materials)
- Net-Zero (new construction)
- Passive House (new construction)





Commercial?

Small commercial buildings can have a lot of similarities to residential. Key differences:

- Time of use
- Cooking
- Bathing
- HVAC type



Weatherization/Home Performance

What is it?

- Improvement of existing buildings for efficiency, comfort, and health
- Consider building "as a system" different components impact one another
- Insulation, air sealing, lighting, refrigeration, HVAC, etc.
- Consider health & safety
- Generally achieves about 20% savings
 - Deep energy retrofits would target 50% or more savings



Weatherization/Home Performance

Four major measures

- Air sealing
- Attic insulation
- Wall insulation
- Efficient space conditioning
- Duct leakage can also be major can be the largest energy penalty in the home!





Air Sealing Materials

- Air barrier materials (solid) for large openings
 rigid foam board insulation
 - o scrap drywall or plywood
- Caulk (for openings less than ½")

 type of materials to be caulked
 amount of joint movement expected
 weather and temperature conditions
- Spray foams
 - 1-part spray foam
 - o 2-part spray foam







1-part spray foam

Air Sealing

Seal the big holes first!











Insulation

- Attics blown cellulose
- Walls dense-pack cellulose
 - Need to be careful if walls are weak
- Foundation walls spray foam or faced batts















Efficient space conditioning

High-efficiency furnaces

High-efficiency heat pumps





Heat pumps – do it right!

- Can be important toward meeting electrification and climate goals
 - Not always cheaper to operate with current pricing can be an issue for low-income families unless supports are provided
- Can be severely impacted by duct losses need to QA/QC ducts!
- Installers need to install properly to maximize benefit of compressor
- Option while we transition: heat pump with gas backup to reduce costs and get much of the heat pump benefit



Duct sealing

- As with other air sealing, use rigid materials to bridge large gaps
- Use mechanical fasteners, not duct tape!
- Then use mastic







Moisture management

Gutters

Grading – may require perimeter drains

Well-installed ground covers









Other common measures?

- Water heater replacement, potentially tankless
- Faucet aerators
- Replace old refrigerators
- New windows and doors (often not cost-effective)
- Efficient lighting (LEDs)





Advanced cooling load management

Cool roofs, e.g. light colored shingles or membranes

Strategically planted trees





National trend toward weatherization

Numerous programs, for example:

- DOE low-income weatherization assistance program (WAP)
- Utility programs
- Home Performance with Energy Star (HPwES)
- Other state and local programs
- Funding for these has continued to increase!!!

Intended to address deficiencies in a way that lasts





Customer Benefits

- Reduced utility bills
- Improved comfort
- Can address health & safety problems
- Many measures pay for themselves multiple times over their lifetime



Career Pathways





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Career Pathways

- Building/Home Performance Contractor
- Big HVAC Contractor with heat pump design experience
- Energy Efficiency Program Director
- Residential Building Code Official (with green building experience)
- Multifamily Quality Control Inspector
- Quality Control Inspector
- Multifamily Energy Auditor
- Healthy Home Evaluator
- Building Performance Crew Leader
- Residential Energy Auditor
- Energy Efficiency Sales Representative
- Energy Efficiency Technician (residential)
- Energy Efficiency Program Assistant
- Building Performance Installer



Certifications

- Many from Building Performance Institute
 - Home Energy Professional Series
 - Energy Auditor -> Quality Control Inspector
 - Retrofit Installer -> Crew Leader
 - Building Analyst
 - Healthy Home Evaluator
 - Air Leakage Control Installer
 - Infiltration/Duct Leakage
 - ...and more!







Business Opportunities

- Business owner Builder, Remodeler, HVACR, Insulation etc.
- Contractor firm
- Referral system
- Efficiency division
- Program implementer
- All need field staff, office staff





Business Opportunities

Employer	Sector
State/Federal Agencies	Government
CAA (Community Action Agencies)	Private/County Non-Profit
Utilities	Private
Utility Implementers	Private
Contractors	Private/Non-Profit
Advocacy	Private/Non-Profit



COOL TOOLS™ used in building performance

- Blower Door
- Infrared Camera
- Smoke Pens
- Borescope
- Combustion Analyzer
- Gas Leak Detector
- IAQ Monitors
- Energy Monitors
- Smart Home Tech

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Blower Door

Large calibrated fan that depressurizes building

- 50 Pa = ~20 MPH wind
- Inflated basketball = 55,000 Pa
- Used with manometers
- <u>Amount of air through fan == bui</u>



How Energy Audits Work

Doorway

Calibrated Blower Door Test

Infrared (IR) Cameras

- IR is part of the electromagnetic spectrum
- Some animals can see in IR
 - Goldfish are special
- Cameras allow you to see heat
 - Building airflow,

Electrical issues





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Energy Monitors

- Power consumption
- Single device or whole house
- Helps focus on problematic or high-consumption devices







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Smart Home Tech

Developing tech with huge potential ?

2012

- Automate HVAC, lights, appliances, door locks
- Set complicate









Summary

- Buildings are very important for energy and other considerations
- There are many opportunities in the building performance industry
- There are several important measures that drive energy savings
- Technology is a key component of energy retrofits



