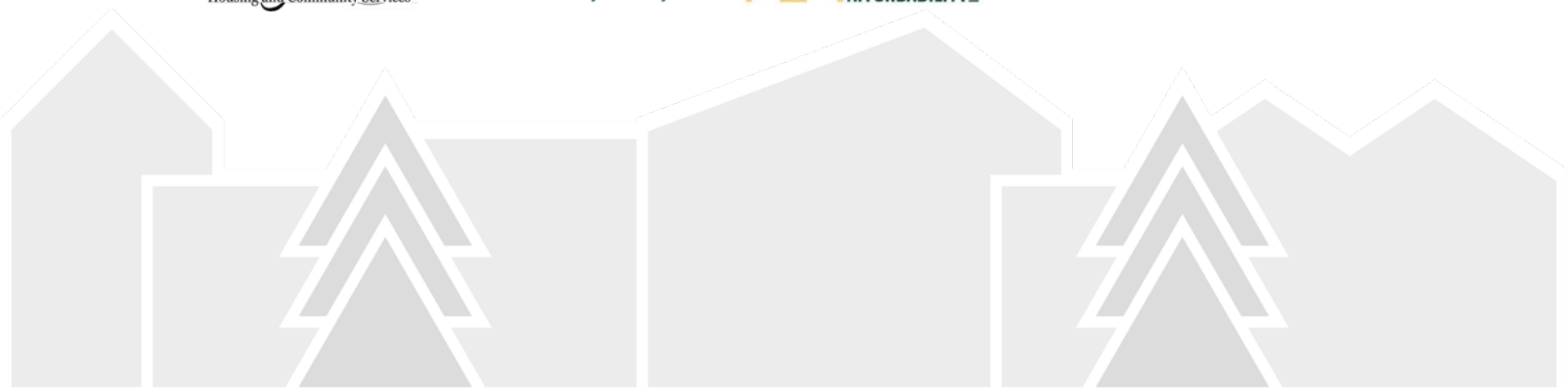


OREGON HOUSING & COMMUNITY SERVICES Multifamily Energy Program

Energy Efficient Multifamily Building Operations

Date: October 11, 2018

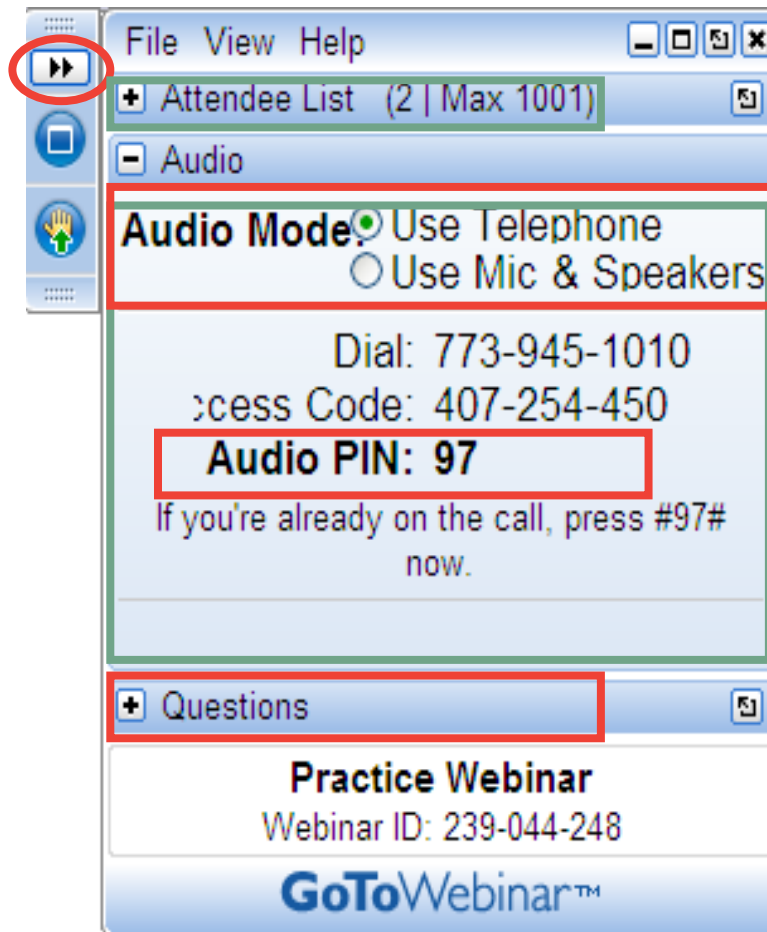
Presenter: Nick Young – AEA, Inc.



USING GOTOWEBINAR

Open and close
your **control panel**

Questions will be
taken
at the end of the
presentation.



Choose **audio mode**

Enter your **audio pin**

Type **questions** in the chat box

REGISTER FOR UPCOMING TRAININGS

- ◆ Thursday, October 25, 2018, 12pm:
Health & Safety in Multifamily Buildings | [REGISTER NOW](#)

REGISTER

for the monthly newsletter
to stay updated on future
trainings!



OREGON HOUSING & COMMUNITY SERVICES
Multifamily Energy Program

June Is National Healthy Homes Month!



To celebrate [National Healthy Homes Month](#), an initiative by HUD's Office of Lead Hazard Control and Healthy Homes, we've put together some tips and resources to encourage safe, healthy, and supportive environments.

Read the full list in [News & Resources](#) on the OR-MEP website!

[Read More](#)

AGENDA

- ◆ Operations & Maintenance
- ◆ Energy Management
- ◆ Building Science
- ◆ Energy Systems

OPERATIONS & MAINTENANCE



ENERGY EFFICIENT OPERATIONS

Existing buildings → limited options

- You may want your wall to be better insulated, but may not have that luxury – you have what you have and may not be able to improve it much.

Key here is to control or reduce waste.

Different than using less

Partnerships

- Owner/Manager | Maintenance Staff | Building Occupants
- Importance of education

BENEFITS OF EFFICIENT OPERATIONS

**Substantial
energy savings**



**Lower
operating costs**



**No sacrifice of
comfort or
productivity**



**Better
information for
making capital
improvement
decisions**



TYPES OF MAINTENANCE

Reactive

- Run till fail
- *Why is this popular?*



Preventative

- Scheduled, time or run-time based
- *Ex: Pump lubrication*



Predictive

- May require instrumentation
- *Ex: Infrared thermography, data loggers, etc.*



MAINTENANCE PLAN

☐ Master Equipment List

- Name plate information, location, service it provides, operation and maintenance manuals

☐ Preventative Maintenance (PM) Chart

- From the manuals – what maintenance is required and how frequently
- Daily, weekly, bi-weekly, monthly, semi-annually, annually

☐ PM Work Order Process

- Task, skill and tools requirement, estimated hours

PROCUREMENT POLICIES



?

What is on hand for as-needed replacement or repairs?



?

What is the standard practice for unit turnover?

ENERGY MANAGEMENT



ENERGY ACCOUNTING

To control energy cost, start by identifying:

?

What are we paying for?

Electricity, fossil fuels, water, other (grounds keeping, etc.)

?

How much are we consuming?

Utility bills

Comprehensive utility benchmarking

?

What is our realistic savings opportunity?



BASELOAD & BENCHMARKING

Baseload Disaggregation

- *Baseload*: Energy usage that does not vary by season, such as ventilation, domestic hot water, lighting, cooking etc.
- *Seasonal*: Energy usage that varies by season – heating and cooling.

Benchmarking

- Tool-based tracking of energy usage across multiple years or an entire portfolio.
- Enables evidence-based targeting of buildings with largest savings opportunities or O&M challenges.



**QUESTION
BREAK**

BUILDING SCIENCE



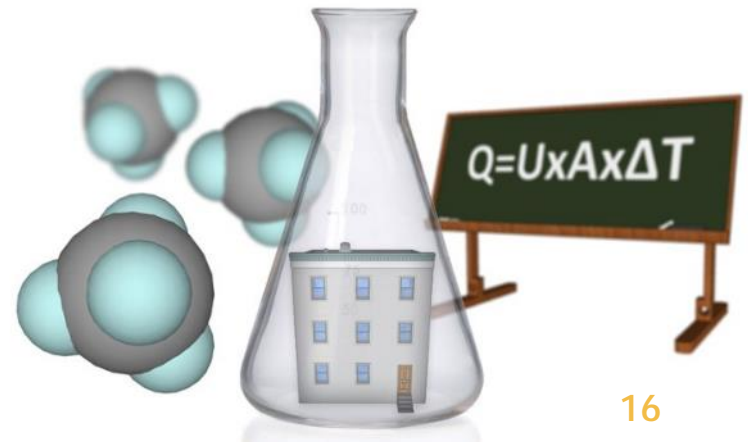
WHAT IS BUILDING SCIENCE?

*The study of the **interaction** between the various **materials**, **products** and **systems** used in building construction, the **occupants** of these buildings, and the **environments** in which they are located.*

- Building Science Corporation

Applies physics to:

- Understand how buildings operate
- Solve building failures

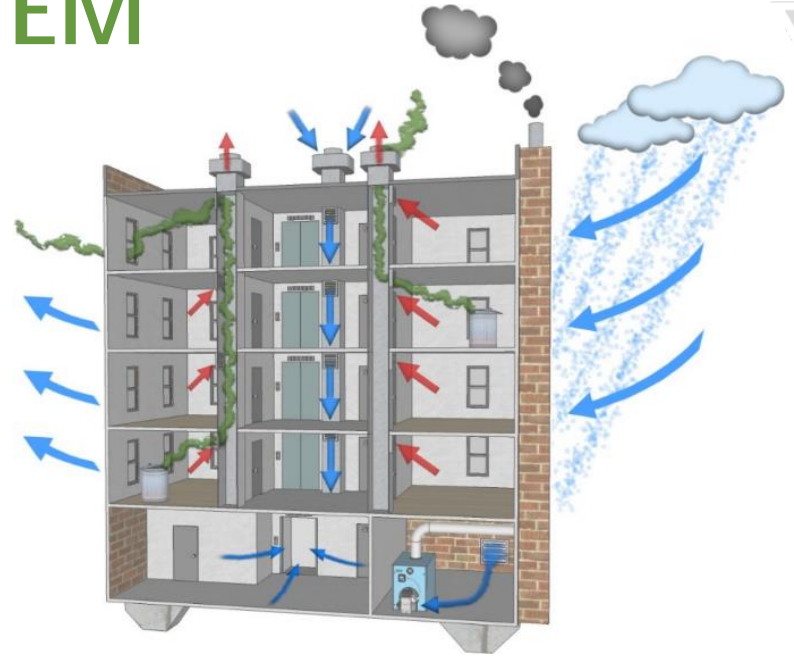




FUNDAMENTALS OF BUILDING SCIENCE

- ◆ Heat travels from high temperature (**HOT**) to low temperature (**COLD**).
- ◆ The greater the temperature difference, the higher the rate of heat transfer.
- ◆ Insulation reduces the rate of heat transfer.
- ◆ Air travels from **HIGH** pressure to LOW pressure.
- ◆ Hot air rises. ↑
- ◆ Water goes from **WET** to **DRY**.
- ◆ Flow seeks the path of least resistance.

BUILDING AS A SYSTEM

- ◆ Buildings have many **connecting** components:
 - structural systems
 - mechanical systems
 - materials and assemblies
 - even occupants!
- ◆ Components that are sometimes far away from each other can **interact**.
- ◆ Minor changes in one area of a building can lead to **major consequences** in another area.





**QUESTION
BREAK**

ENERGY SYSTEMS AND O&M OPPORTUNITIES



Building Envelope



Domestic Hot Water



Ventilation



Lighting



Heating



Appliances



Cooling



Water Conservation



BUILDING ENVELOPE



Air Sealing



Insulation



Windows



BUILDING ENVELOPE – AIR SEALING



Seal the top of the building

- ☐ Bulkhead doors
- ☐ Gaps around plumbing or flue chases
- ☐ Recessed lighting fixtures
- ☐ Roof-wall junctions
- ☐ Attic and utility accesses











BUILDING ENVELOPE – AIR SEALING



Seal the top of the building

- ☐ Bulkhead doors
- ☐ Gaps around plumbing or flue chases
- ☐ Recessed lighting fixtures
- ☐ Roof-wall junctions
- ☐ Attic and utility accesses



BUILDING ENVELOPE – AIR SEALING



Seal the bottom of the building

- ☐ Pipe, cable and other services penetrations
- ☐ Seal core wall to floor slab
- ☐ Crawlspace
- ☐ Exterior doors



BUILDING ENVELOPE – AIR SEALING



Seal vertical shafts

- ☐ Stairways
- ☐ Fire hose cabinets
- ☐ Plumbing chases
- ☐ Trash chutes (doors and floor to floor)



BUILDING ENVELOPE – AIR SEALING



Seal outside walls and openings

- ☐ Weather strip all windows and doors
- ☐ All service penetrations
- ☐ Electric receptacles



BUILDING ENVELOPE – INSULATION

Insulation Materials

Fiberglass



Cellulose



Rockwool



Polystyrene Board



Polyurethane Spray Foam



Aerogel



BUILDING ENVELOPE – INSULATION

Major Insulation Opportunities

- ☐ Attics
- ☐ Crawlspace
- ☐ Garage Ceilings
- ☐ Exterior Walls



VENTILATION

Multifamily buildings are...

under ventilated

OVER VENTILATED

EraDiCaLy ventilated

Intermittently ventilated

Upside down, sideways, backwards...they don't work.



VENTILATION

Air Sealing + Controlled Ventilation

- ✓ **Build tight, ventilate right**
- ✓ Reduce uncontrolled infiltration and exfiltration (leakage)
- ✓ Use ventilation system to bring in the right amount of air and remove the right amount of air
- ✓ **Uniform & balanced flows** from apartment to apartment typically allow you to **decrease overall flows.**



VENTILATION

Causes of Imbalance:

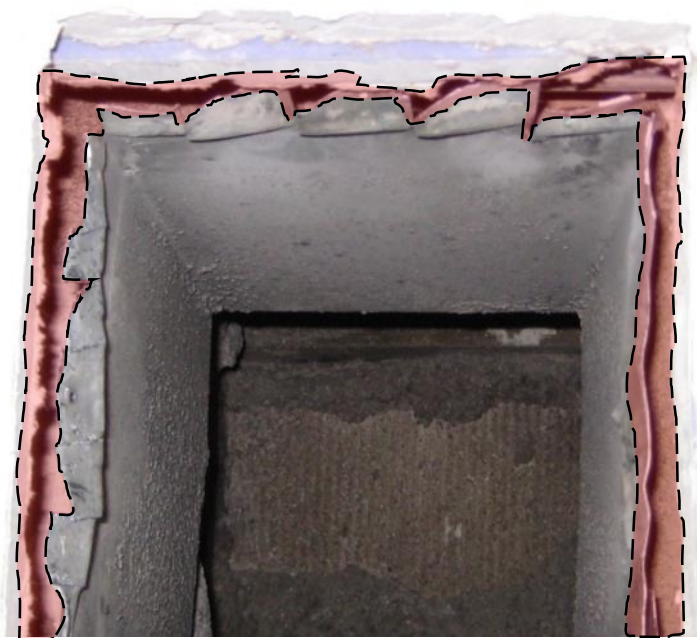
- Taped up grilles due to smell transmissions from other apartments or bugs!
- Grilles covered by furniture
- Duct leakage
- Dirty grilles





VENTILATION – ADDRESSING DUCT LEAKAGE

Termination point between horizontal
runout of exhaust duct and sheetrock.



Where vertical riser meets the roof.



May represent up to 50% leakage in duct system.



HEATING

Electric Baseboard

Not much O&M

Ducted Systems

Duct sealing,
cleaning, and
insulation

Gas or Propane Systems

Combustion
safety measures

Central Steam & Hydronic Systems

Lots of O&M
opportunities
around pumps,
air vents, steam
traps, outdoor
reset controls,
etc.



COMBUSTION SAFETY

- ◆ Should test all combustion appliances based on applicable standards (NFPA, BPI, etc.)
- ◆ Verify carbon monoxide (CO) detectors installed per code
- ◆ Can include testing for gas leaks, spillage, CO, combustion efficiency, and draft





COOLING

System Types

- ◆ Ducted vs ductless
- ◆ Room-by room vs. central
- ◆ Refrigerant vs. chilled water





COOLING O&M OPPORTUNITIES

- ◆ Refrigerant charge & leakage
- ◆ Air flow (ducted systems)
- ◆ Proper sizing
- ◆ Condensate drain maintenance
- ◆ Condenser cleaning
- ◆ Filter replacement
- ◆ Ductwork evaluation
- ◆ Thermostat calibration





DOMESTIC HOT WATER SYSTEM TYPES

Gas



Electric Resistance



Electric Heat Pump





DOMESTIC HOT WATER O&M OPPORTUNITIES

◆ All System Types

- Insulate pipes & tanks
- Lower delivery temp ($\leq 120^{\circ}\text{F}$)
- Low flow fixtures
- Repair leaks
- Verify control set points, recirculation controls
- Tank descaling & anode rods
- Don't store corrosives nearby

◆ Gas Systems

- Combustion safety
- Motorized dampers

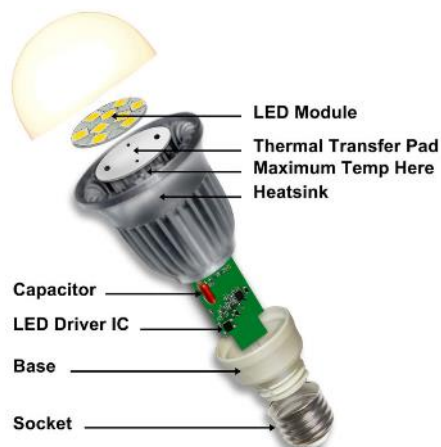
◆ Electric Heat Pump

- Clean evaporator coil, if accessible
- Service compressor, when needed



LIGHTING TECHNOLOGIES

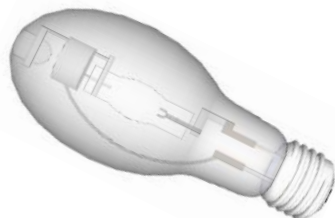
LED



Fluorescent



High Intensity Discharge



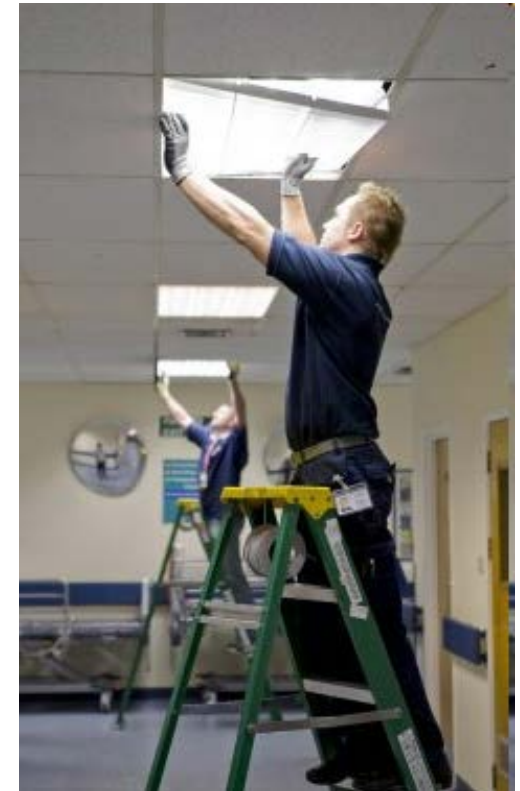
Incandescent





LIGHTING O&M OPPORTUNITIES

- ◆ Upgrade to LED
 - Bulbs & fixtures
- ◆ Shutoff Controls
 - Vacancy sensors
 - Time clock
 - Photocell
- ◆ Other Controls
 - Occupancy-based dimming
 - Daylight controls
- ◆ Other
 - Tenant Education
 - Reduce over-lighting





APPLIANCES O&M OPPORTUNITIES

- ◆ Upgrade
 - To ENERGY STAR units
- ◆ Refrigerators
 - Clean coils
 - Keep freezers full
 - Maintain gaskets
 - Defrost freezer
- ◆ Vending Machines
 - Occupancy sensors
- ◆ Water Coolers
 - Basic timer
- ◆ Clothes Washers
 - Front-loaders
- ◆ Recycling
 - Ensure all removed appliances are recycled





WATER CONSERVATION O&M OPPORTUNITIES

◆ Leaks – Fix Them!

- Toilets
- Shower diverter valves
- Landscape
- Anywhere else

◆ Low Flow Fixtures

- Showerheads
- Aerators
- Toilets
- Dishwashers & laundry

◆ Landscape

- Low-water or native landscaping
- Smart irrigation controls
- Rainwater capture

◆ Water Reuse

- Rainwater
- Greywater
- Laundry-to-landscape

CONCLUSION

Energy efficient operations and maintenance can help:

- Lower operational costs and extend equipment life
- Improve tenant comfort and reduce complaints

Maintenance practices should be:

- Preventative, rather than reactive

Energy efficiency most effective when:

- Personnel is trained and understands how systems work
- Organization commits to ongoing training of building operations staff

THANK YOU FOR ATTENDING

Oregon Housing and Community
Services Multifamily Energy Program

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