

Energy Labeling as an Educational Vehicle

Presented at
CIBSE ASHRAE 40th Anniversary Seminar
UCL, London, England
October 12th 2016



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Creating Our Future

Adapt ASHRAE investments
to energize chapters and
engage members

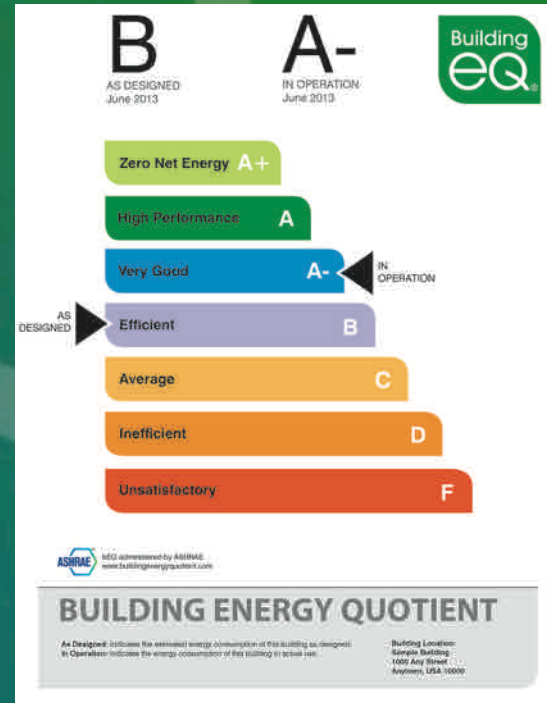


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Creating Our Future

Initiative #3

Adapt Building EQ for use by student branches



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What is Building EQ?

- Energy management tool
 - Rates a building based upon energy use
 - Compares to similar buildings
 - In similar climate zones



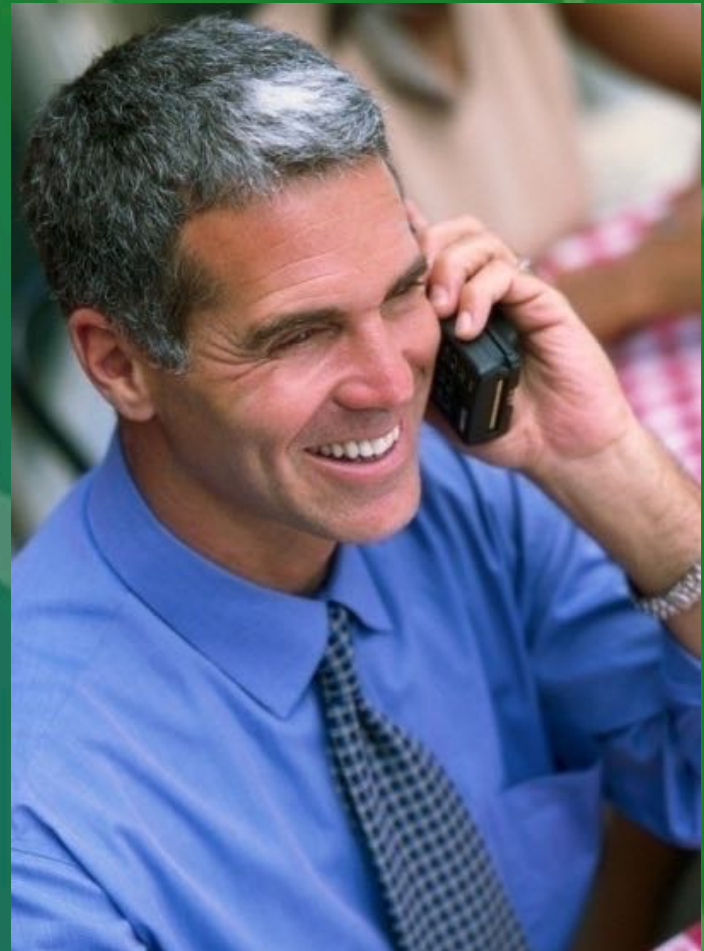
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Why is Building EQ Different?

- Builds relationships
- Incentivizes behavior



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Meeting Owner's Expectations

- J. P. Kotter & J. L. Heskett, *'Corporate Culture and Performance'*, research sponsored by Harvard Business School
- Revenues increase 4 times faster
- Job creation is 7 times faster
- Owner equity grows 12 times faster
- Profit performance is 750% higher

Businesses that focus obsessively on meeting the needs of clients:



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Course Goals

- Impart the knowledge and skills necessary to conduct an energy audit
- Produce more energy efficient buildings
- Give back to the community
- Build relationship and management skills



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Forging a Partnership

- Students work closely with practicing professionals
- University/Chapter provides target buildings
- Building owner has a clear path to higher energy efficiency
- Students learn by doing – a “hands on” approach



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Provided by Partner

- Portfolio of buildings for students to audit
 - PDF floor plans
 - 1 to 3 years of metered energy consumption
 - Listing of “hot/cold calls”
 - Facility Condition Assessment (FCA) form
 - Maintenance logs



501 Building – The first building audited by the students



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Provided by Partner

- Some test equipment
 - CO₂ meters
 - Infrared camera
 - Infrared thermometer
 - Light meter
 - RH meter
 - Infrared tape measure
- Professional Engineer or ASHRAE BEAP certified



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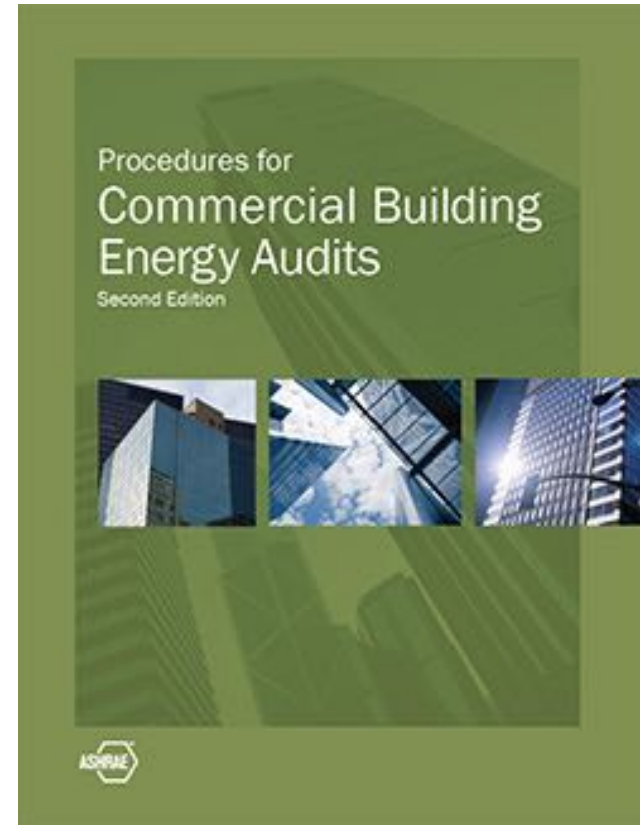
THE DURHAM SCHOOL
Of Architectural Engineering and Construction

- 1. Course Number and Name:**
Number: CNST-498/898
Name: Special Topics in Construction Management – Building Energy Assessment and Rating
- 2. Credits and Contact Hours:**
Credit Hours: 3 hours
Contact Hours: 45 hours
- 3. Instructors:**
 - Tim Wentz, PE – Construction Management Program
 - i. Room 113, Nebraska Hall, twentz1@unl.edu, 402-472-3737
 - Kirk Conger, PE – UNL Facility Management
 - i. Kirk.conger@unl.edu, 402-472-4052
- 4. Text Book and Other Supplementary Materials:**
 - Required Text – ASHRAE Procedures for Commercial Building Energy Audits, 2nd Edition
 - The text is only available from ASHRAE at www.ashrae.org, under the 'Resources and Publications' button, then select 'Bookstore'.
 - Optional resource material:
 - ASHRAE Standard 100-2014
 - ASHRAE bEQ workbooks (most current version)
 - ASHRAE BEAP certification study guide
 - ASHRAE Standard 105
 - ASHRAE Performance Measurement Protocols for Commercial Buildings: Best Practices Guide, 2010
 - ASHRAE Energy Efficiency Guide for Existing Commercial Buildings, 2009
 - ASHRAE Fundamentals of HVAC Control Systems, 2nd Edition, 2011
- 5. Specific Course Information:**
 - Proposed Catalog Description
An introduction and study of commercial existing building energy assessment principles and protocols for the application and submission of a building disclosure, rating, and labeling program, including:
 - Course instruction/lecture
 - Hands-on techniques of measurement and verification
 - IEQ parameter identification and measurement
 - Energy metric comparison/analysis
 - Control system sequence of operation analysis
 - Prerequisite(s) or Co-requisite(s)
Senior standing, graduate standing or permission
 - The course can be used as a CNST technical elective

The Charles W. Durham School of Architectural Engineering and Construction
The Peter Kiewit Institute / 1110 South 67th Street / Omaha, NE 68182-0816 / 402-554-2660 / www.durhamschool.unl.edu

Course Materials

- Based upon an ASHRAE Level 1 energy audit
 - Procedures for Commercial Building Energy Audits, 2nd Edition
- ASHRAE Standards
 - 100 (2015) – Energy Efficiency in Existing Buildings
 - 62.1 (2013) – Ventilation
 - 90.1 (2013) – Energy Efficiency



Text for the course



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Course Materials

- Online quizzes to test comprehension

Begin: Quiz #3 - Preliminary Energy-use Audit (PEA)

Cancel

Begin

INSTRUCTIONS

Description	This quiz covers the material found in Part 1 - 'Levels of Effort', page 3 to 9, and in Part 2 - 'The Energy Audit Process', page 17 to 34, and the material found in the presentation on PEA. The quiz contains 10 true/false and/or multiple choice questions with a timed duration of 15 minutes. You may take the quiz 3 times and the highest grade earned will be recorded as your grade. This quiz is due on Monday, January 26.
Instructions	Please read each question carefully. Each answer may seem correct, but only one answer is more correct than the others.
Timed Test	This test has a time limit of 15 minutes.
Timer Setting	You will be notified when time expires, and you may continue or submit.
Force Completion	Once started, this test must be completed in one sitting. Do not leave the test before clicking Save and Submit .
Multiple Attempts	This test allows multiple attempts.

Click **Begin** to start: Quiz #3 - Preliminary Energy-use Audit (PEA). Click **Cancel** to go back.
You will be previewing this assessment and your results will not be recorded.

Click Begin to start. Click Cancel to quit.

Cancel

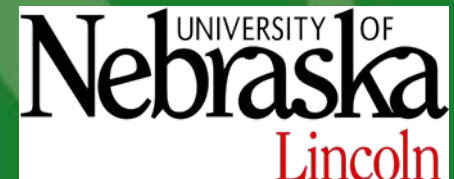
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Course Materials

- Online lectures generated by:
 - Faculty
 - Practicing professionals
 - ASHRAE
 - IAQA
 - Lincoln Electric System
- Allows course to be exported to other universities



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Course Outline

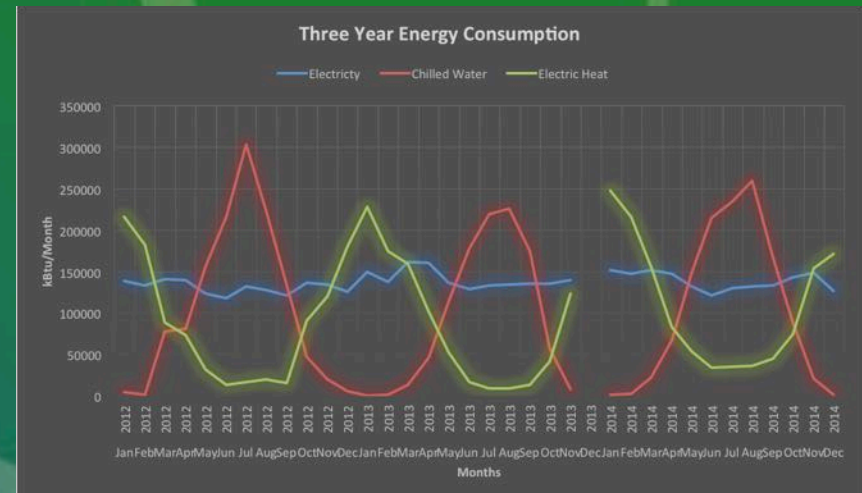
- Produce a Space Function Analysis
- Perform a Preliminary Energy Audit (PEA)
- Conduct pre-site visit interviews
- Perform an ASHRAE Level 1 site visit audit
- Conduct a post-site visit interview
- Write an ASHRAE Level 1 energy audit report
- Apply for an ASHRAE Building EQ label



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Course Assignments

- Preliminary Energy Assessment
- Space Function Analysis



Name of Space	Space Use Type*	Gross Floor Area	Weekly Operating Hours	Weeks/Year	# Occupants	# PCs	Principal Lighting Type	Principal HVAC Type	% of Spaces Heated	% of Spaces Cooled
Basement										
Electrical	Utility	375	16/7/365	52	0	0	Fluorescent	VAV	100	100
Mechanical	Utility	2720	16/7/365	52	0	0	Fluorescent	VAV	100	100
Elevator Equipment	Utility	125	16/7/365	52	0	0	Fluorescent	VAV	100	100
Other	Utility	275	16/7/365	52	0	0	Fluorescent	VAV	100	100
First Floor										
100/101	Vestibule	220	16/7/365	52	Variable	0	Fluorescent	VAV	100	100
102	Office	175	16/7/365	52	1	1	Fluorescent	VAV	100	100
103	Office	120	16/7/365	52	1	1	Fluorescent	VAV	100	100

Course Assignments

- Conduct a pre-site visit interview (relationship building)
 - Equipment condition
 - Maintenance protocols
 - O & M issues
 - Planned improvements
 - Maintenance obstacles
 - Indoor Air Quality problems
 - Persistent comfort problems
 - Excessive maintenance items



Students conducting a pre-site visit interview with Facility Management professionals



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Course Assignments

- Perform an ASHRAE Level 1 site visit audit
 - Energy Efficiency Measures
 - Changes from plans
 - Repurposed space
 - Indoor Environmental Quality



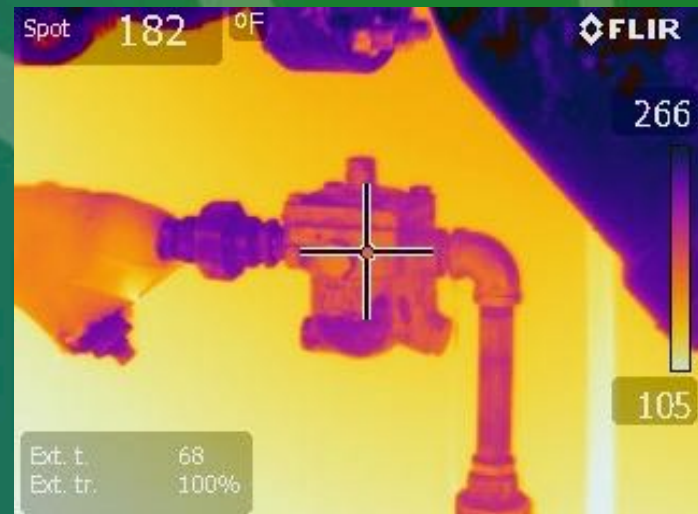
A student audit team conducting a site survey at Ross – Van Brunt Visitor Center



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Course Assignments

- Identify EEMs that provide direct, immediate benefit (relationship building)
 - Piping not insulated
 - Holes in ductwork
 - Equipment not balanced
 - Dampers not working
 - Improper set points



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Course Assignments

- Low Cost – No Cost Energy Efficiency Methods (EEMs)
 - Easy solutions with a quick payback
 - Problems the owner wasn't aware of
 - Potential areas of risk in relationship building



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Course Assignments

- Recommend no cost/low cost Energy Efficiency Measures (EEMs)
- Estimate likely payback on EEMs
- Identify potential capital projects

Suggested Energy Savings Measures by Category:		
Envelope Suggestions	Cost Range	Payback
1A. Replace single pane windows throughout	\$10,000-30,000	5-10yrs
2A. Caulk windows to stop leaks where needed	\$0-500	1-4yrs
3A. Add weather stripping to doors in which it is missing	\$0-500	5-10yrs
4A. Replace window frames and thresholds that have rot	\$3,000 - \$8,000	1-4yrs
5A. Implement a building envelope commissioning program	\$1,000 - \$2,000	5-10yrs
6A. Consider installing a high-albedo roof when roof needs to be replaced	\$2,000 - \$4,000	1-4yrs
7A. Install solar reduction film on East/West facing windows	\$1,000-\$1,500	1-4yrs
8A.		



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Course Assignments

- Site visit
 - Addressing IAQ and human comfort issues
 - Ventilation rates
 - Water damage



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Course Assignments

- Conduct a post-survey interview
 - More relationship building



Post-survey interview with client. Students were able to hone their interview and relationship-building skills as a part of the audit.



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Course Assignments

- Write an ASHRAE Level 1 audit report

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501 Building Energy Audit

ASHRAE Level 1

CNST498/898 BUILDING ENERGY ASSESSMENT AND RATING
3/30/2015



An ASHRAE Level 1 Energy Audit performed by CNST498/898

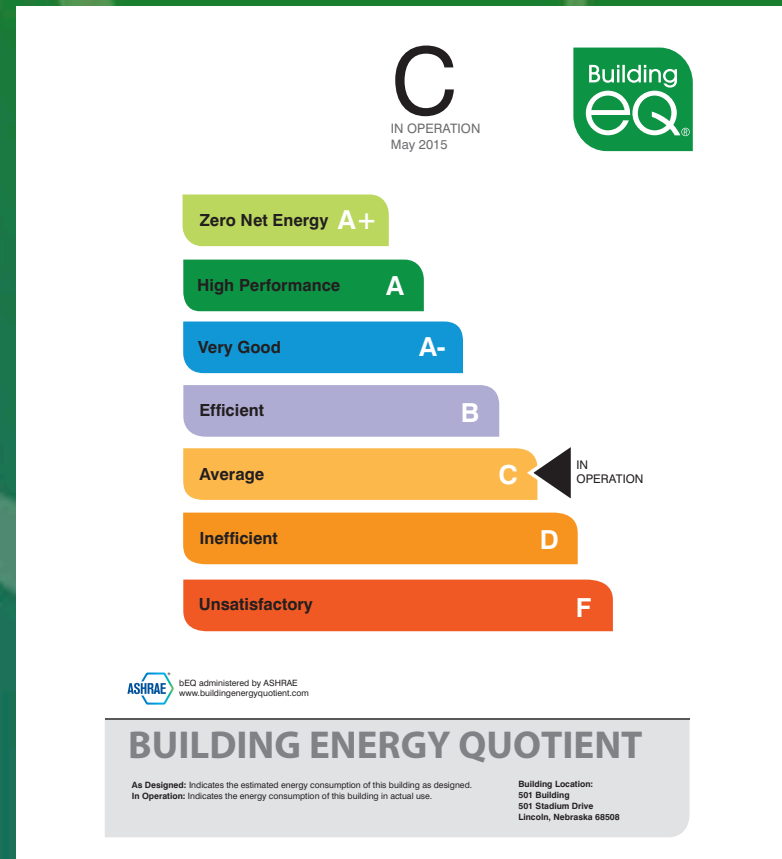
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Course Assignments

- Submit documentation for an ASHRAE 'In Operation' energy label



bEQ Label for the 501 Building



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Increasing Motivation

- You are given \$50 and must decide between two options:
 - Option #1 – All or nothing gamble – 40% chance you keep \$50 and 60% chance you will lose everything
 - Option #2 – You keep \$20
- You are given \$50 and must decide between two options:
 - Option #1 – All or nothing gamble – 40% chance you keep \$50 and 60% chance you will lose everything
 - Option #2 – You lose \$30



Experiment conducted by Bernedetto de Martino

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Increasing Motivation

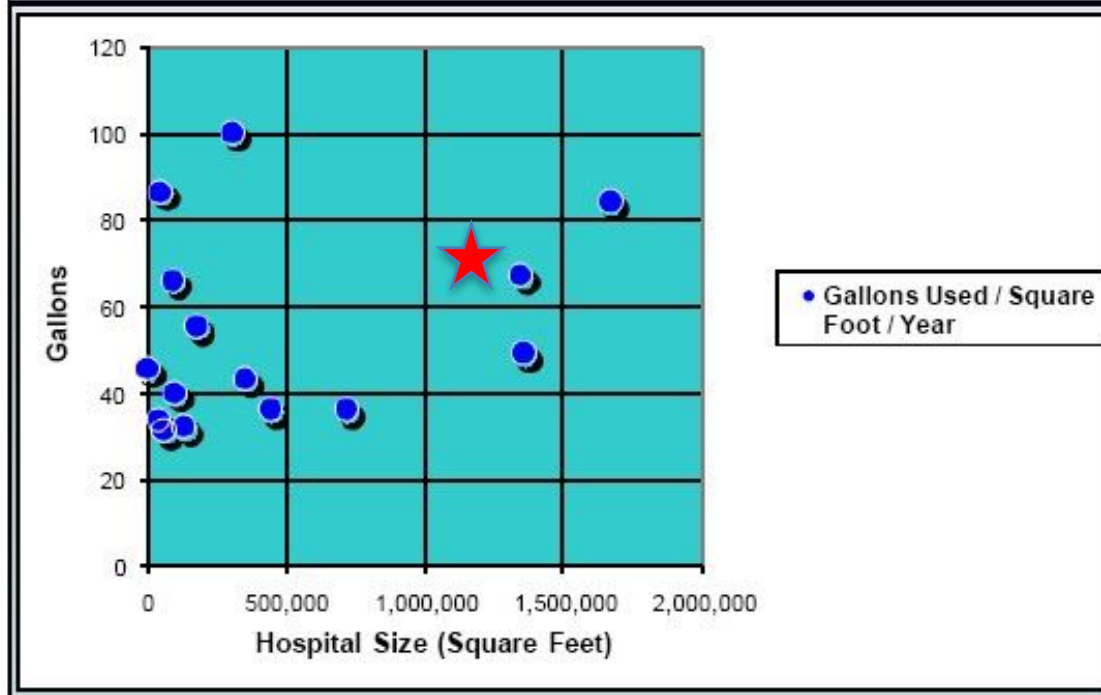
- Humans are wired to “herd” together



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Increasing Motivation

Benchmarking



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Course Outcomes

- Client has a path towards higher energy efficiency
- Students and staff learn the fundamentals of energy audits
- Client has more money to spend on their mission
- Students learn relationship building skills



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TWENTY QUESTIONS



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