Nebraska's Commercial Energy Code:
COMcheck Walk-through

Nebraska Energy Code Training Program

Instructor: Matt Belcher

July 17, 2024: 11:00 a.m. – 1:00 p.m. CDT

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Housekeeping

Attendees are muted upon entry

Questions? Enter them in the chat box, or simply unmute yourself and ask

Webinar is being recorded – slides and recording will be sent to attendees

CEU's will be available upon request (ICC and AIA)

Email: jgossman@mwalliance.org with questions

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About the Nebraska Training Program

Goal: **prepare** the Nebraska workforce for changes in construction best practices

Focused on **providing training** to builders, code officials, design professionals, public officials and students

For more information, visit:

https://www.mwalliance.org/nebraska-energy-codes-training-program

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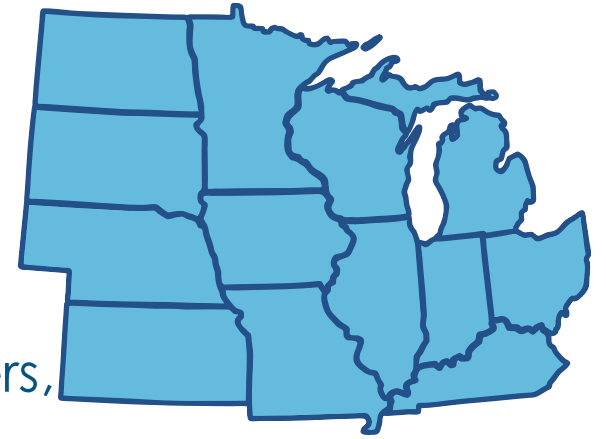
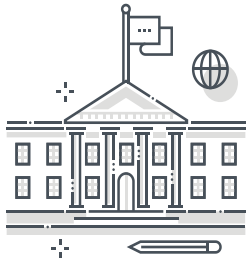
Who We Are

The Midwest Energy Efficiency Alliance (MEEA) is a collaborative network, promoting energy efficiency to optimize energy generation, reduce consumption, create jobs and decrease carbon emissions in all Midwest communities.



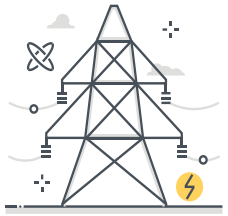
MEEA is a non-profit membership organization with 170+ members, including:

Energy Service Companies & Contractors



State & Local Governments

Academic & Research Institutions



Electric & Gas Utilities

Community-based Organizations

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About Matt/Verdatek Solutions

- 40+ Years in the Building Industry
- Served as a Top Building Codes official in the St. Louis area.
- Director of University of Missouri Columbia High Performance Buildings Research Center. Created and Instructed Curriculum for Students and Industry Professionals.
- Currently Assisting University of Missouri Science & Technology in Building and Energy Code Curriculum and Policy
- ICC Member serving on 2012, 2015, 2018 and 2024 Energy Code Development Committee. 2021 Building Code-General Committee
- NAHB-Approved Instructor for Advanced Building Science and Advanced Business Management

COMcheck Learning Objectives:

Basics of using the COMcheck software, reviewing generated compliance reports and the latest and greatest new features.

1. Obtain an overview of the basic functions and how COMcheck calculates compliance for the building envelope, interior and exterior lighting.
2. Be able to identify the construction specifications needed to complete a compliance calculation in the software.
3. Learn how to enter the building envelope, lighting, and mechanical components into the software.
4. Understand how the compliance reports are created and what they entail.

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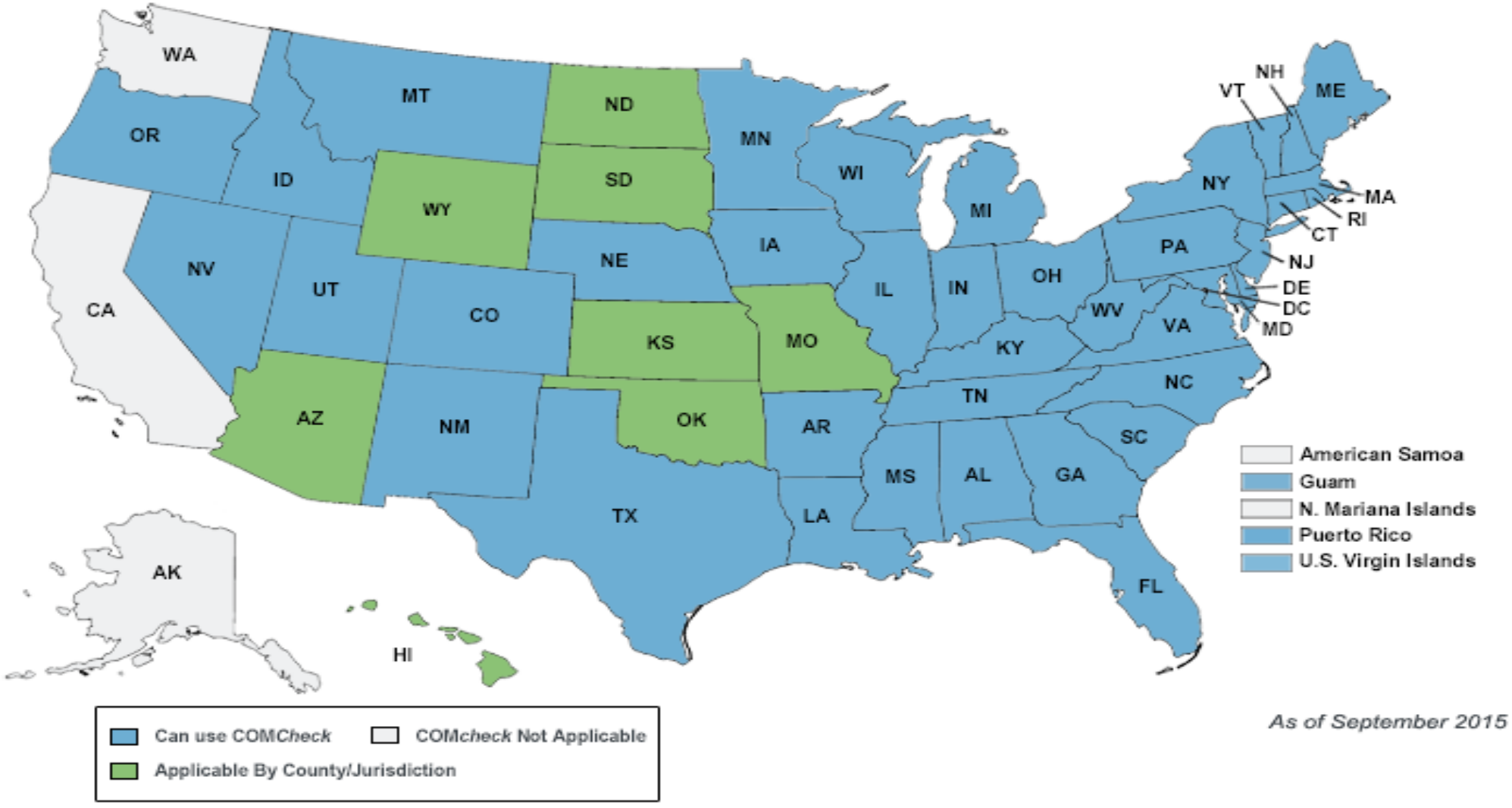
States that allow COMcheck



Commercial Compliance Tools

Desktop Software Tools

COMcheck™

Free

Web-Based Tools

COMcheck•Web™

COMcheck™ Package Generator

Printed Materials

Compliance Guides

Prescriptive Tables

COMcheck-Web simplifies commercial and high-rise residential energy code compliance.

It performs just like **COMcheck**, the desktop version, but you don't need to download or install any software on your computer.

- *Can exchange files between desktop and web*

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COMcheck/COMcheck Web

- The COM*check* software product group makes it easy to determine whether new commercial or high-rise residential buildings, additions and alterations meet the requirements of the IECC and ASHRAE Standard 90.1.

- COM*check* also simplifies compliance for building officials, plan checkers and inspectors by allowing them to quickly determine if a building project meets the code.

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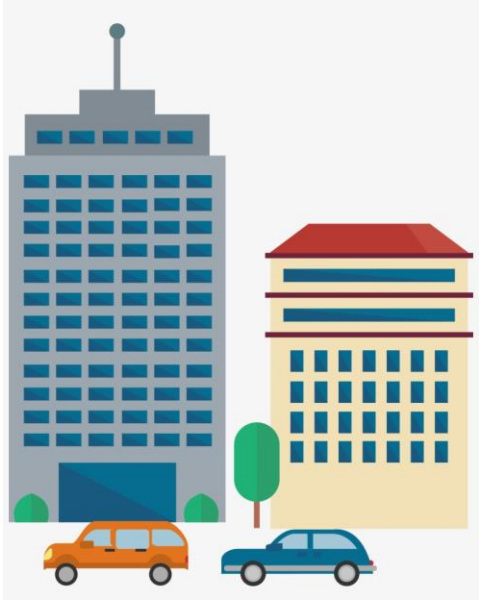
Commercial Buildings in the IECC

Under the Purview of the Commercial Code

- ✓ Buildings with commercial use
- ✓ Multifamily residential buildings four stories or greater in height



Not Under the Purview of the Commercial Code

- × One- and two-family residential
- × R-2, R-3, R-4 three stories or less in height

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What About Mixed Use? – C101.4.1

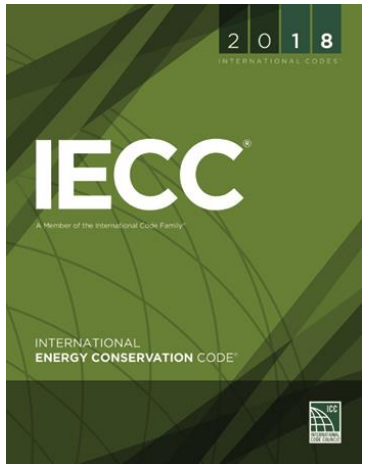
- Treat the residential building portion under the applicable residential code
- Treat the commercial building portion under the commercial code
- Code Official has final authority

Image: agarch.com

Commercial Compliance Options

ASHRAE 90.1-2016

OR



2018 IECC – Prescriptive

- ✓ C402 – Envelope
- ✓ C403 – Mechanical
- ✓ C404 – SWH
- ✓ C405 – Lighting

AND Pick **at Least One C406**:

- ❑ C406.2 – Eff. HVAC Performance
- ❑ C406.3 – Reduced Lighting Power
- ❑ C406.4 – Enhanced Lighting Controls
- ❑ C406.5 – On-site Supply of Renewable Energy
- ❑ C406.6 – Dedicated Outdoor Air System
- ❑ C406.7 – High Eff. Service Water Heating
- ❑ C406.8 – Enhanced Envelope Performance
- ❑ C406.9 – Reduced Air Infiltration

OR

2018 IECC – Performance

- C407 – Total Building Performance
- C402.5 – Air Leakage
- C403– Mandatory Mechanical Provisions
- C404 – SWH
- C405 - Lighting
- Building energy cost to be < 85% of standard reference design building

90.1 Simplified Approach Option for HVAC Systems

The simplified approach is an optional path for buildings that meet these criteria:

- Building is two stories or fewer in height.
- Gross floor area is less than 25,000 sq. ft.
- System serving single HVAC zone
- Each HVAC system in the building must comply with all 19 requirements.

COMcheck: Who May Submit?

- The commercial energy code requires that a **registered professional submit compliance documentation** (construction documents and compliance verification).
- In the IECC, Section C103.1 Construction Documents, General, the wording states that construction documentation and other supporting data shall be submitted in one or more sets with each application for a permit.
- The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the code official is authorized to require necessary construction documents to be prepared by a registered design professional.

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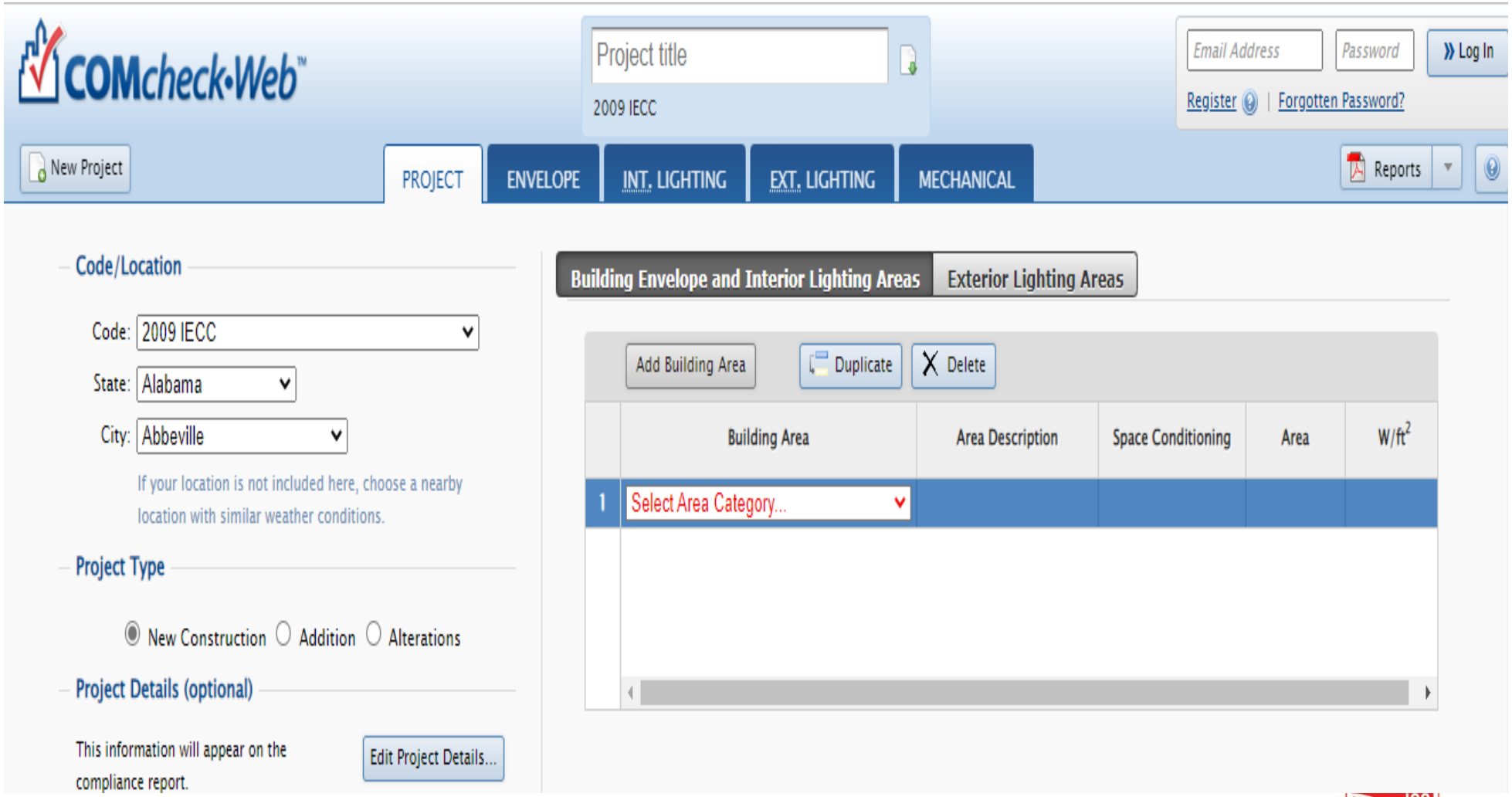
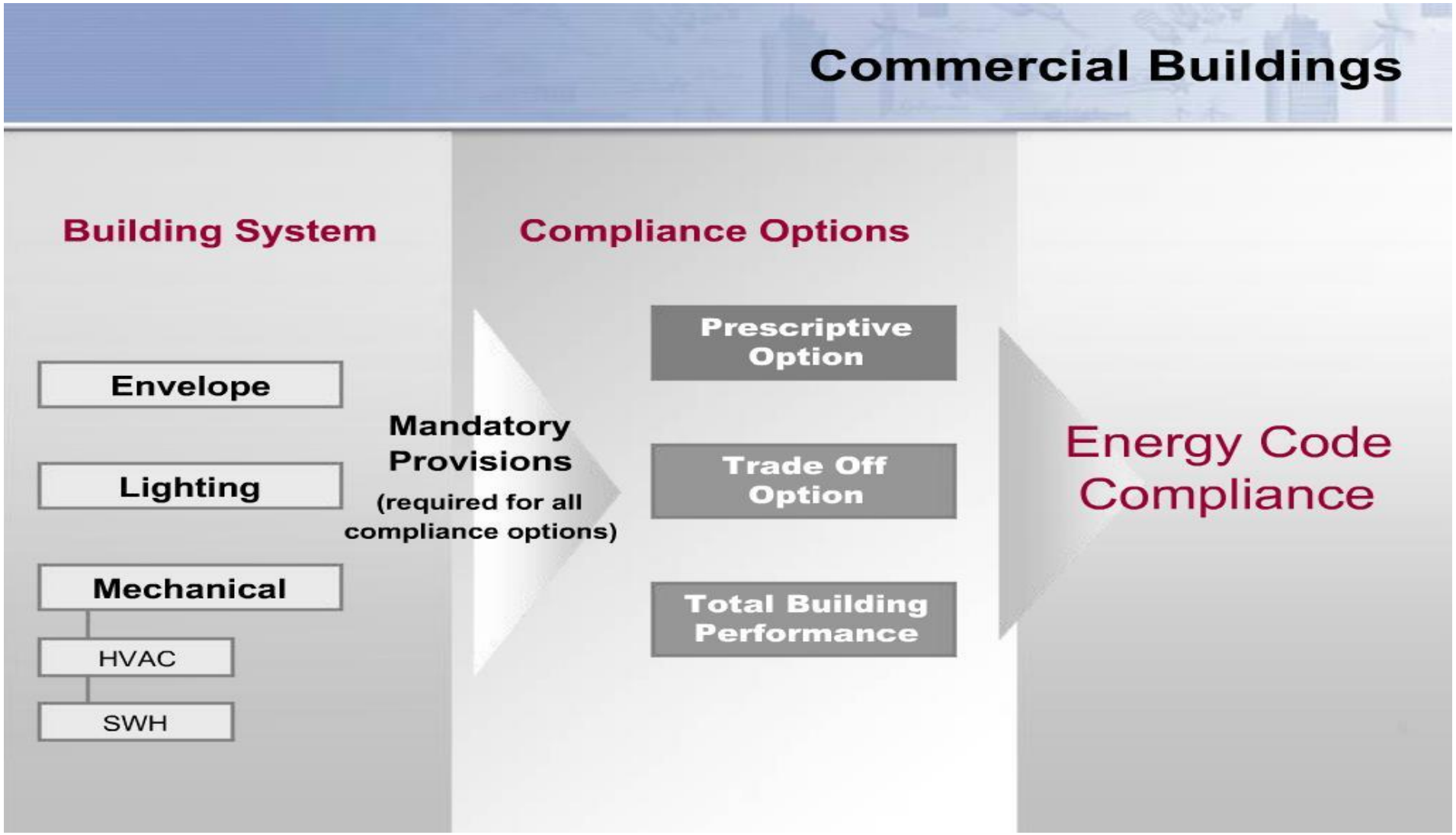
Landing Page




Commercial Buildings
Building System
Compliance Options
Envelope
Lighting
Mechanical
HVAC
SWH
Mandatory Provisions
(required for all compliance options)
Prescriptive Option
Trade Off Option
Total Building Performance
Energy Code Compliance

Mandatory Requirements Include:

- Air Leakage
- Air barriers
- Fenestration air leakage
- Rooms Containing Fuel-burning Appliances
- Air intakes, exhaust openings, stairways and shafts
- Loading dock weather seals
- Vestibules
- Recessed lighting
- Commissioning

What is COM*check*?

- Envelope
  - trade-off calculations are based on envelope loads only
  - defines a proposed design and a budget design
- Lighting
  - Watts/square foot (LPDs)
- Mechanical
  - short wizard to customize a list of requirements applicable to the system identified

Envelope Trade-Off Methods:

- ASHRAE 90.1 (Pre-2013) Normative Appendix C Methodology for Building Envelope Trade-Off Option
  - 90.1-2007/2010
  - 2009/2012 IECC
- ASHRAE 90.1-2013 Appendix C has limited performance method (EnergyPlus) *(New)*
- 2015 IECC Component Performance Alternative (Total UA) *(New)*

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Project Types:

- New Construction: Trade-off compliance method
- Addition Trade-off compliance method
- Alteration Prescriptive compliance

Commercial Building Envelope Requirements

- Mandatory Requirements:
  - Moisture Control
  - Air Leakage
- Climate Specific Requirements:
  - Roof
  - Above Grade Walls
  - Below Grade Walls
  - Floor
  - Slab
  - Skylights, Windows, and Doors

7

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Mechanical and Service Hot Water Requirements

- Efficiency requirements
- Economizer requirements
- Fan Power Limitation
- Mandatory requirements
- No compliance metric available

Lighting Requirements

- Mandatory requirements: Controls, Switching
- Interior/Exterior lighting power requirements

Complies if total connected power <= lighting power allowance

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When do Lighting and Power Requirements Apply?

- Original Installed Lighting System in a New Building, Addition, or Tenant Build-out
- Existing Lighting System that is Altered
- Change in Occupancy that Increases Energy
- Change in Occupancy that requires less LPD as shown in the LPD tables

Exceptions:

- Alterations where less than 10% of the luminaires in a space are replaced and installed interior power lighting is not increased
- Lighting within dwelling units
  - Where ≥ 75% of permanently installed fixtures (except low-voltage) are fitted for and include high-efficacy lamps

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Electrical Lighting and Power Systems Requirements

- Mandatory Interior Lighting requirements
  - Required Controls
  - Wattage/Efficiency Limits
- Interior Lighting Power Allowances (watts/ft^2)
- Exterior Lighting Controls
  - Required Controls
  - Lamp Efficiency
- Exterior Lighting Power Allowances (watts/ft^2)
- Dwelling Electric Meters
- Electrical Transformers and Motors
- Vertical and Horizontal Transportation Systems and Equipment

Image: U.S. Dept of Energy

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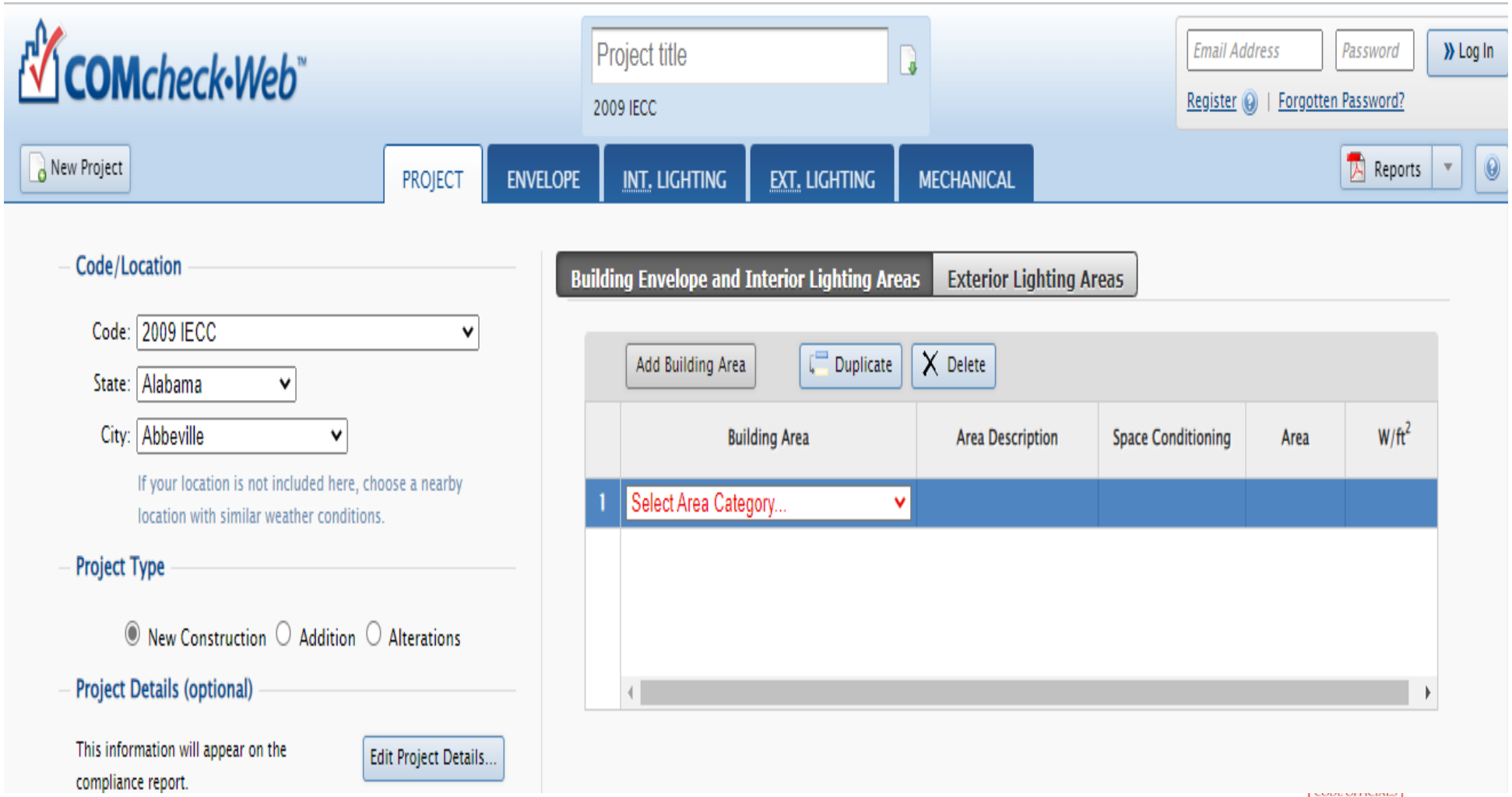
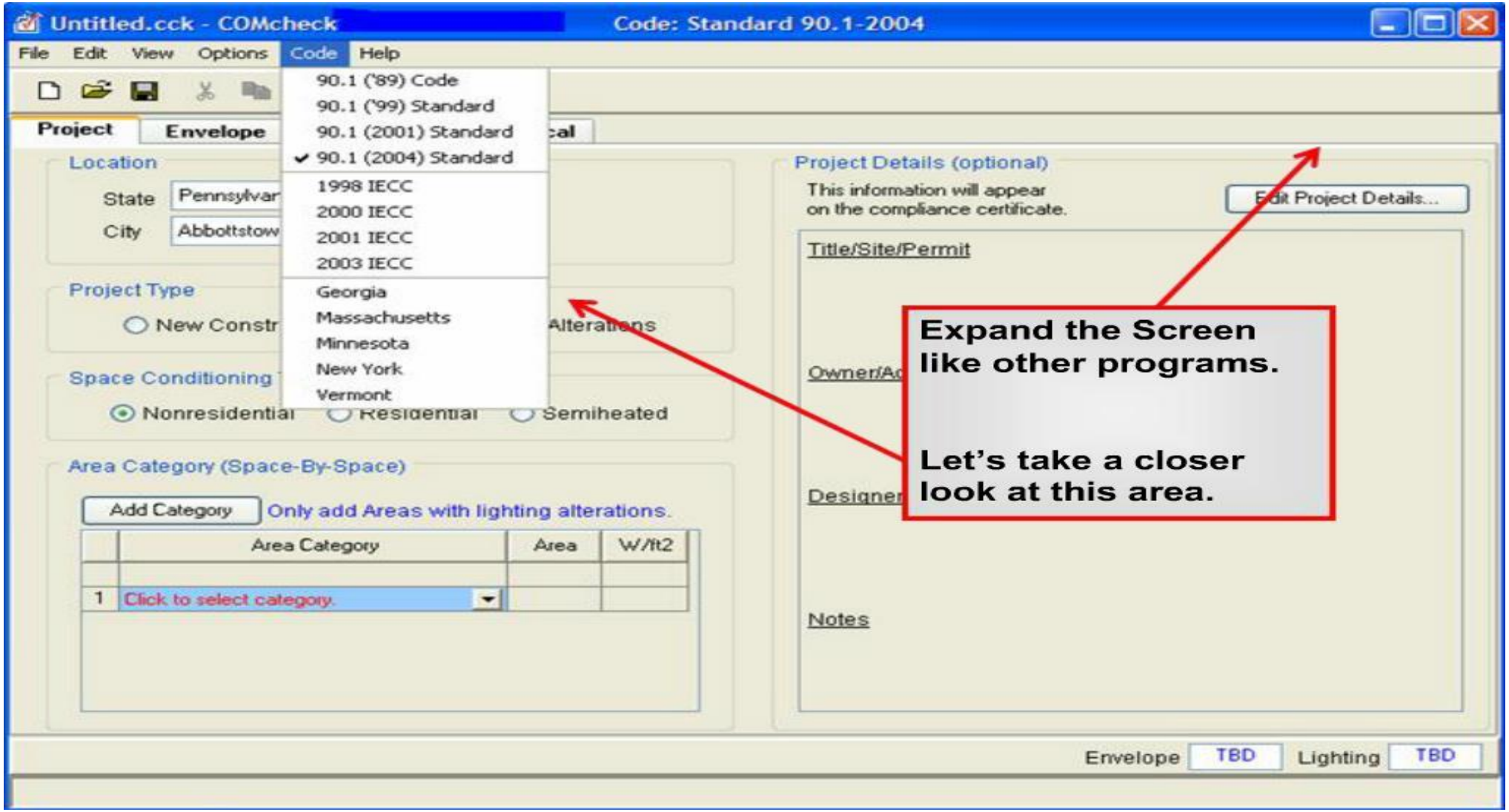
Landing Page

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90.1 (2001) Standard
90.1 (2004) Standard
1998 IECC
2000 IECC
2001 IECC
2003 IECC
Georgia
Massachusetts
Minnesota
New York
Vermont
Project
Envelope
Location
State
City
Project Type
New Constr
Alterations
Space Conditioning
Nonresidential
Residential
Semiheated
Area Category (Space-By-Space)
Add Category
Only add Areas with lighting alterations.
Area Category
Area
W/ft2
1
Click to select category.
Project Details (optional)
This information will appear on the compliance certificate.
Edit Project Details...
Title/Site/Permit
Owner/Ac
Designer
Notes
Expand the Screen like other programs.
Let's take a closer look at this area.
Envelope TBD
Lighting TBD

COMcheck Basics

- COMcheck is a reflection of the difference between a 'design' building energy performance factor (EPF) and a 'code' or budget building EPF.

- The methodology used to determine EPF is provided in ASHRAE 90.1 Normative Appendix C: Methodology for Building Envelope Trade-off Option.

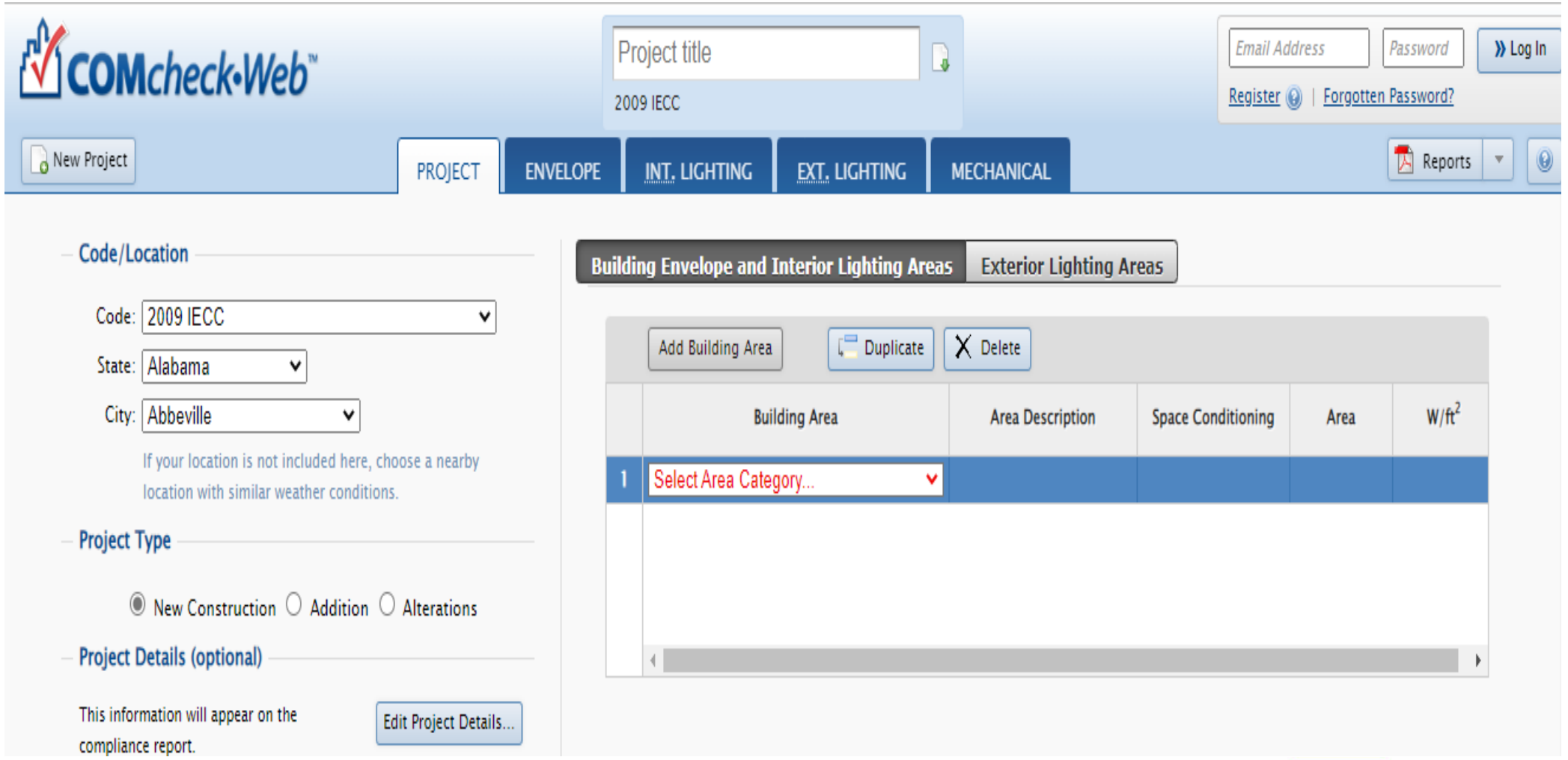
COMcheck Project Specification Steps

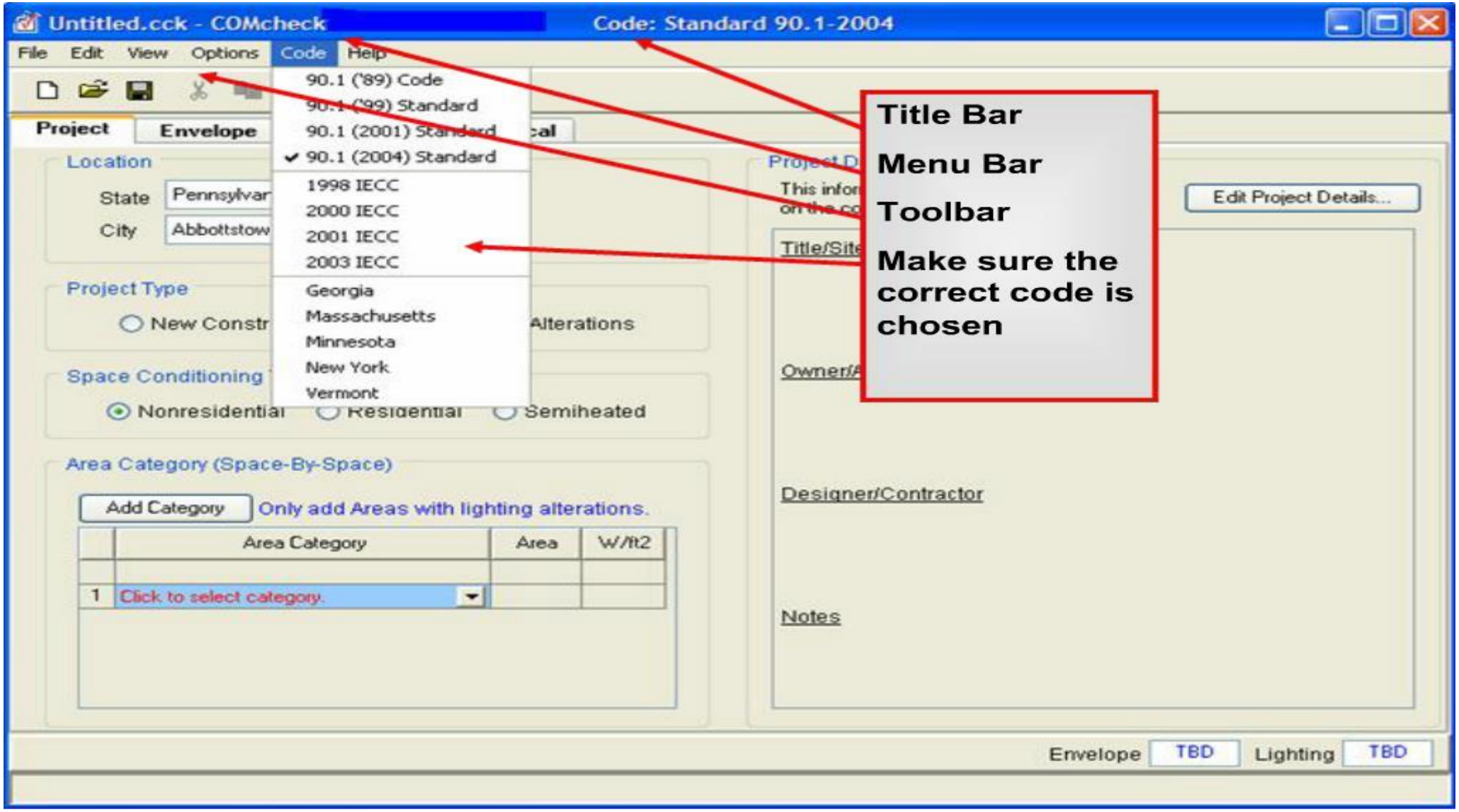
- Project
- Building Envelope Components
- Lighting
- Mechanical
- Requirements/ View/Print/ Save

Information You will need:

- Energy Code
- Builder and project location
- Area take-offs for envelope assemblies
- Insulation R-values, fenestration performance data
- Lighting fixture details
- Heating and cooling system details
- Service water heating details

Landing Page

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90.1 ('99) Standard
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1998 IECC
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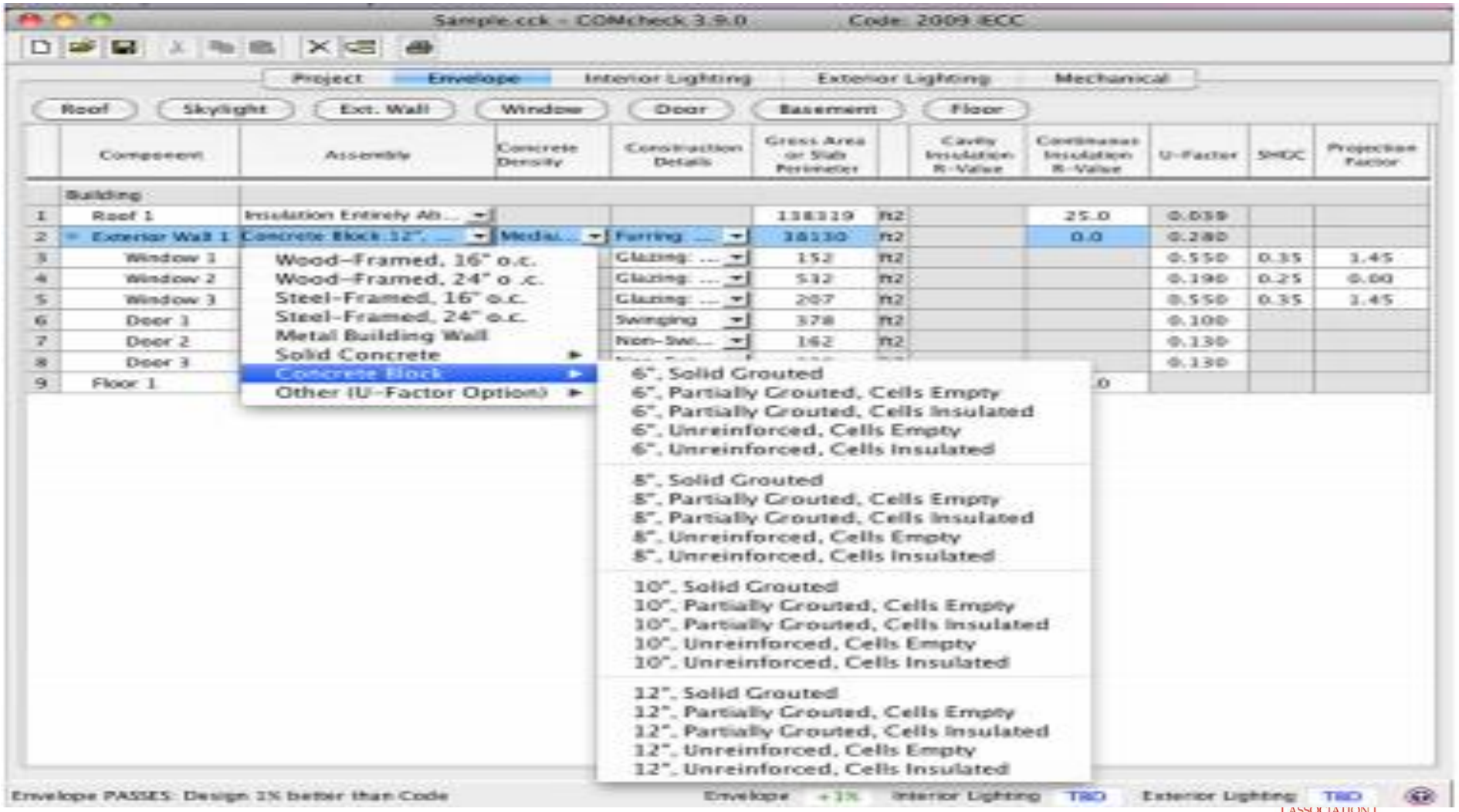
2001 IECC
2003 IECC
Georgia
Massachusetts
Minnesota
New York
Vermont
Project
Envelope
Location
State
City
Project Type
New Constr
Alterations
Space Conditioning
Nonresidential
Residential
Semiheated
Area Category (Space-By-Space)
Add Category
Only add Areas with lighting alterations.
Area Category
Area
W/ft2
1
Click to select category.
Edit Project Details...
Title/Site
Owner/A
Designer/Contractor
Notes
Envelope
TBD
Lighting
TBD
Title Bar
Menu Bar
Toolbar
Make sure the correct code is chosen

Envelope Requirements



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U/A Trade-Off Compliance

Compliance: Passes using UA trade-off

Compliance: 12.2% Better Than Code Maximum UA: **500** Your UA: **439**

The % Better or Worse Than Code Index reflects how close to compliance the house is based on code trade-off rules.
It DOES NOT provide an estimate of energy use or cost relative to a minimum-code home.

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Exterior Wall Type A: Steel Frame, 16" o.c.	1260	13.0	5.0		68
Window 2: Wood Frame:Double Pane with Low-E	75			0.330	25
Door B: Solid	41			0.420	17
Exterior Wall Type B: Steel Frame, 16" o.c.	2513	13.0	5.0		173
Window 1: Wood Frame:Double Pane with Low-E	210			0.330	69
Window 2: Wood Frame:Double Pane with Low-E	30			0.330	10
Window 3: Wood Frame:Double Pane with Low-E	5			0.330	2
Door A: Glass	24			0.310	7
Roof Type 1: Steel Joist/Rafter, 16" o.c.:2x10	823	0.0	35.0		21
Window 4 - Skylight: Metal Frame with Thermal Break:Triple Pane	32			0.700	22
Window 5 - Skylight: Other	9			0.540	5

Compliance Statement: The proposed building design described here is consistent with the building plans, specifications, and other calculations submitted with the permit application. The proposed building has been designed to meet the 2010 New York Energy Conservati Construction Code requirements in REScheck Version 4.4.1 and to comply with the mandatory requirements listed in the REScheck Inspect Checklist.

Name - Title | Signature | Date

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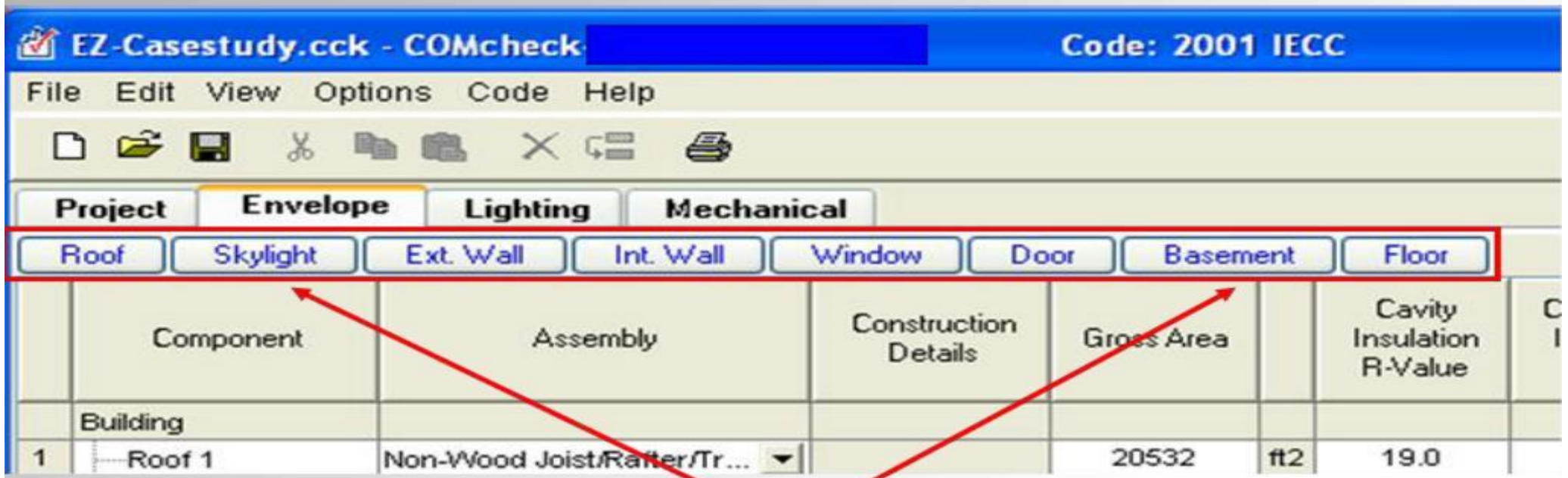
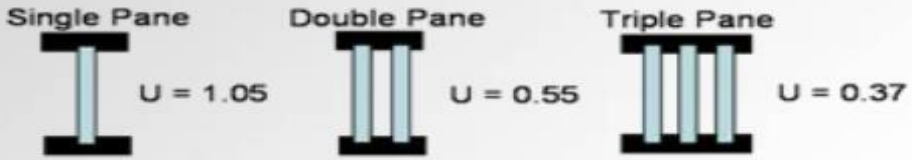
Envelope Screen



Windows – U-Factors

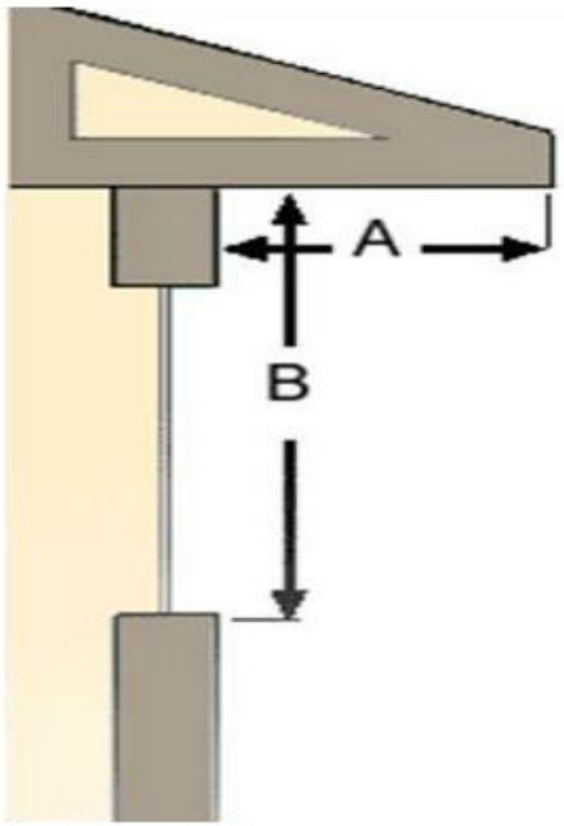
Table 102.3(1)
U-Value Default For Windows
Glazed Doors and Skylights

Frame Material and Product Type	Single Glazed	Double Glazed
Metal without thermal break		
Operable (including Sliding and swinging glass door)	1.27	0.87
Fixed	1.13	0.69
Garden Window	2.60	1.81
Curtain Wall	1.22	0.79
Skylight	1.98	1.31
Site-assembled Sloped/overhead glazing	1.36	0.82
Metal with thermal break		
Operable (including Sliding and swinging glass door)	1.08	0.65
Fixed	1.07	0.63
Garden Window	1.11	0.68
Curtain Wall	1.89	1.11
Skylight	1.25	0.70
Site-assembled Sloped/overhead glazing		
Reinforced vinyl/metal clad wood		
Operable (including sliding and swinging glass doors)	0.90	0.57
Fixed	0.98	0.56
Skylights	1.75	1.05
Wood/vinyl/fiberglass		
Operable (including sliding and swinging glass doors)	0.89	0.55
Fixed	0.98	0.56
Garden Window	2.31	1.61
Skylight	1.47	0.84



- NFRC tested and certified or default window U-value range
- Use assembly U-value
- All windows must meet or exceed

Overhang/Projection Factor (PF)



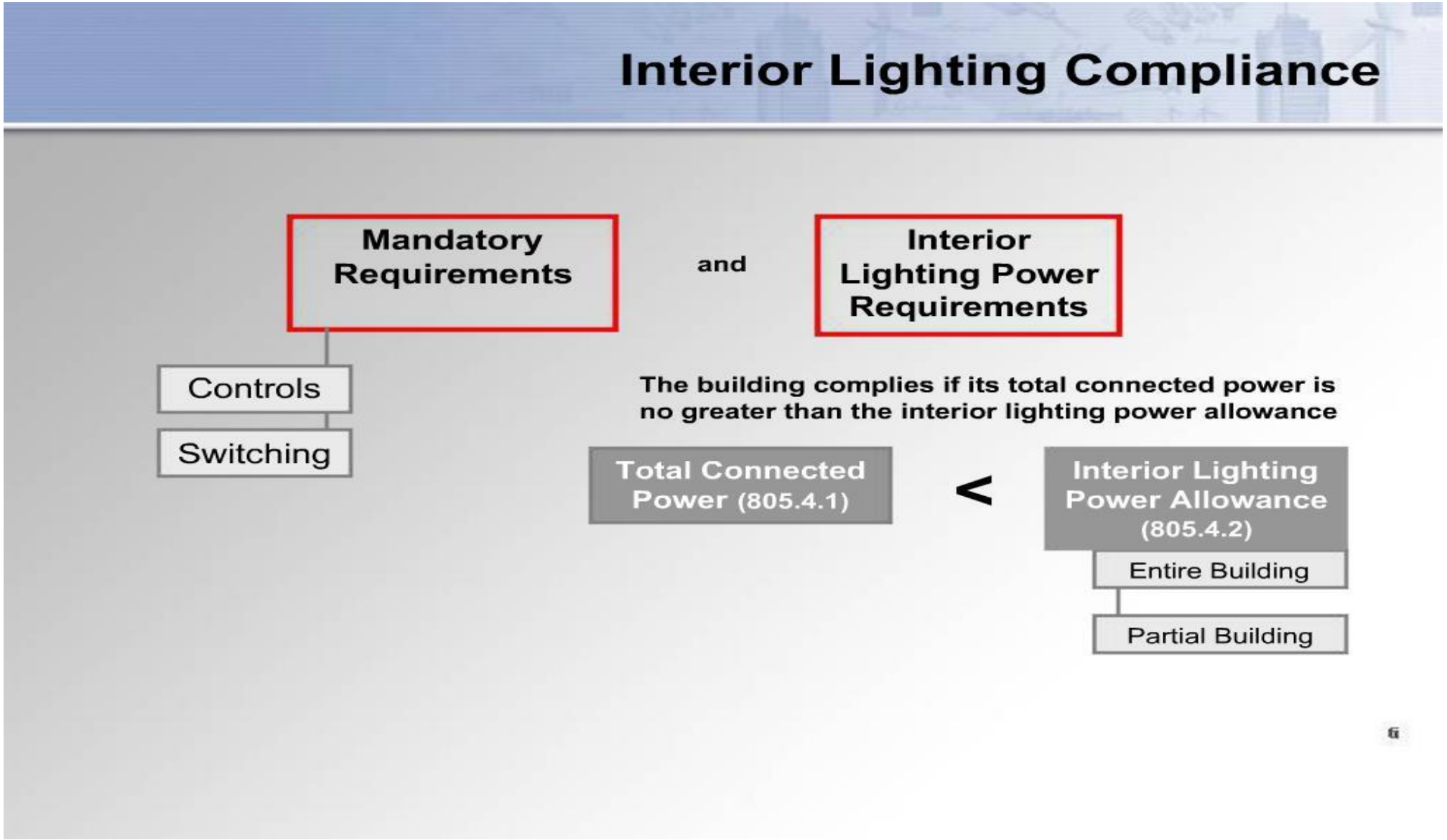
PF= A/B

PF=0.5

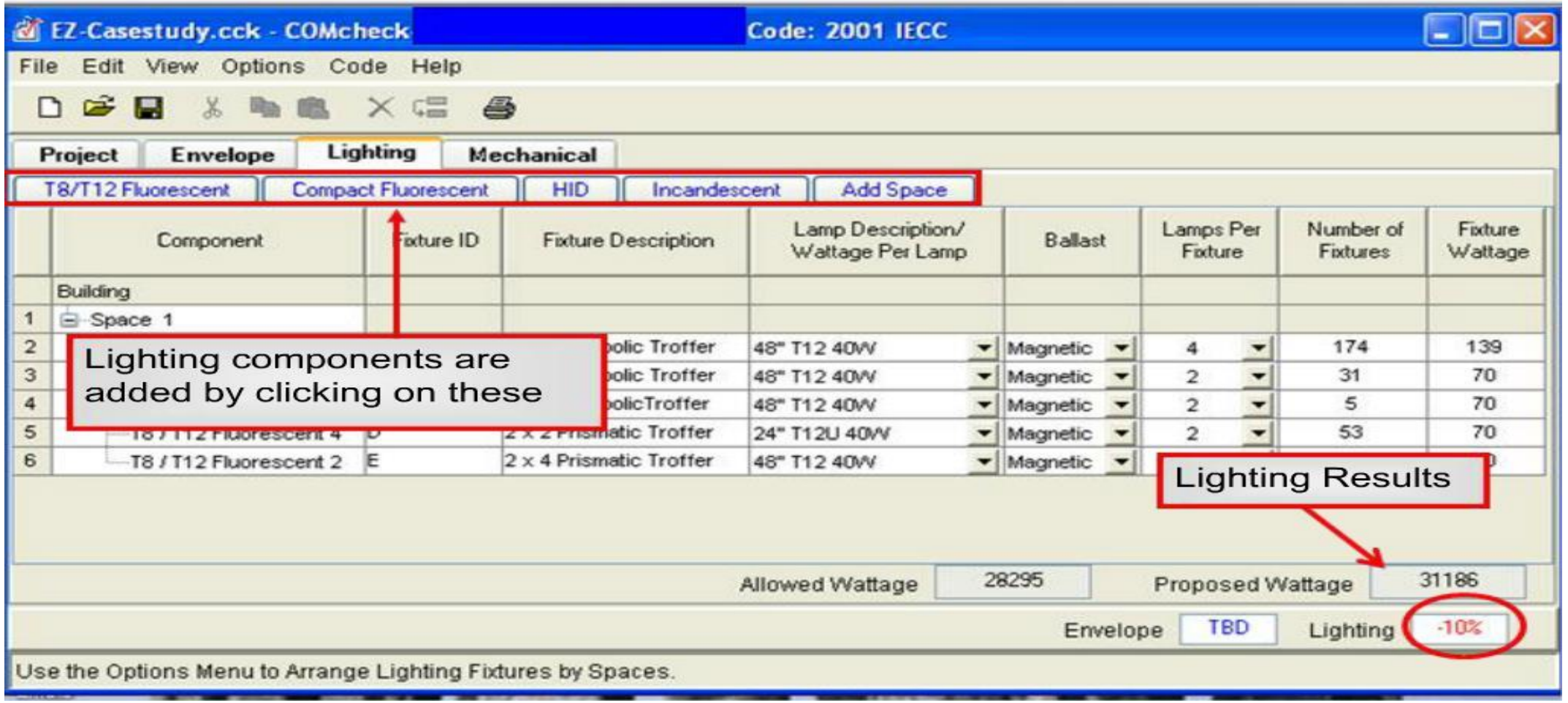
Questions so far?

Please type in chat or unmute

Interior Lighting Compliance



Adding Lighting



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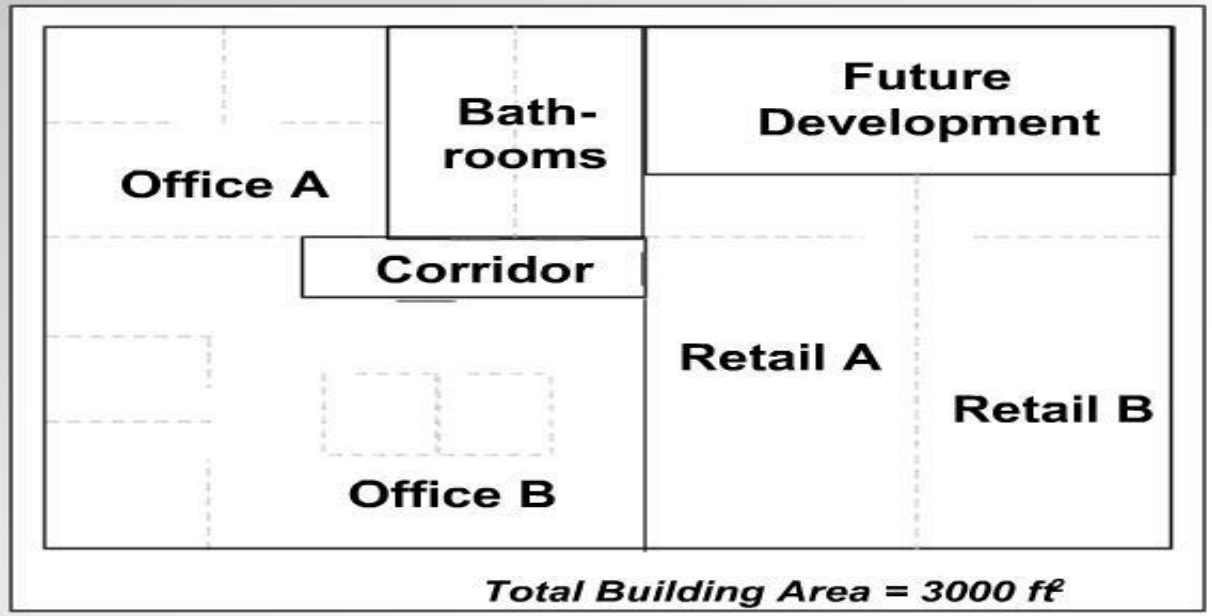
Functional Testing of Lighting Controls
Section C408.3.1

- Prior to passing final inspection, registered design professional to provide evidence that lighting control systems have been tested to ensure that control hardware and software are calibrated, adjusted, programmed and in proper working order per construction documents and manufacturer's installation instructions.

Lighting Using Space-by-Space

Office A:	400 ft²
Office B:	850 ft²
Bathrooms:	350 ft²
Corridor:	50 ft²
Retail A:	500 ft²
Retail B:	500 ft²
Future:	350 ft²



Mechanical Systems and SWH Commissioning
Section C408.2

- Prior to the final mechanical and plumbing sections, the registered design professional or approved agency shall provide evidence of mechanical systems commissioning and completion in accordance with section C408.2
- Mechanical Systems exempt from commissioning requirements (all other systems must comply)
  - In buildings where total mechanical equipment capacity is < 480,000 Btu/h (40 tons) cooling capacity **and** < 600,000 Btu/h combined service water heating and space-heating capacity
  - Included in Section C403.3 that serve individual dwelling units and sleeping units

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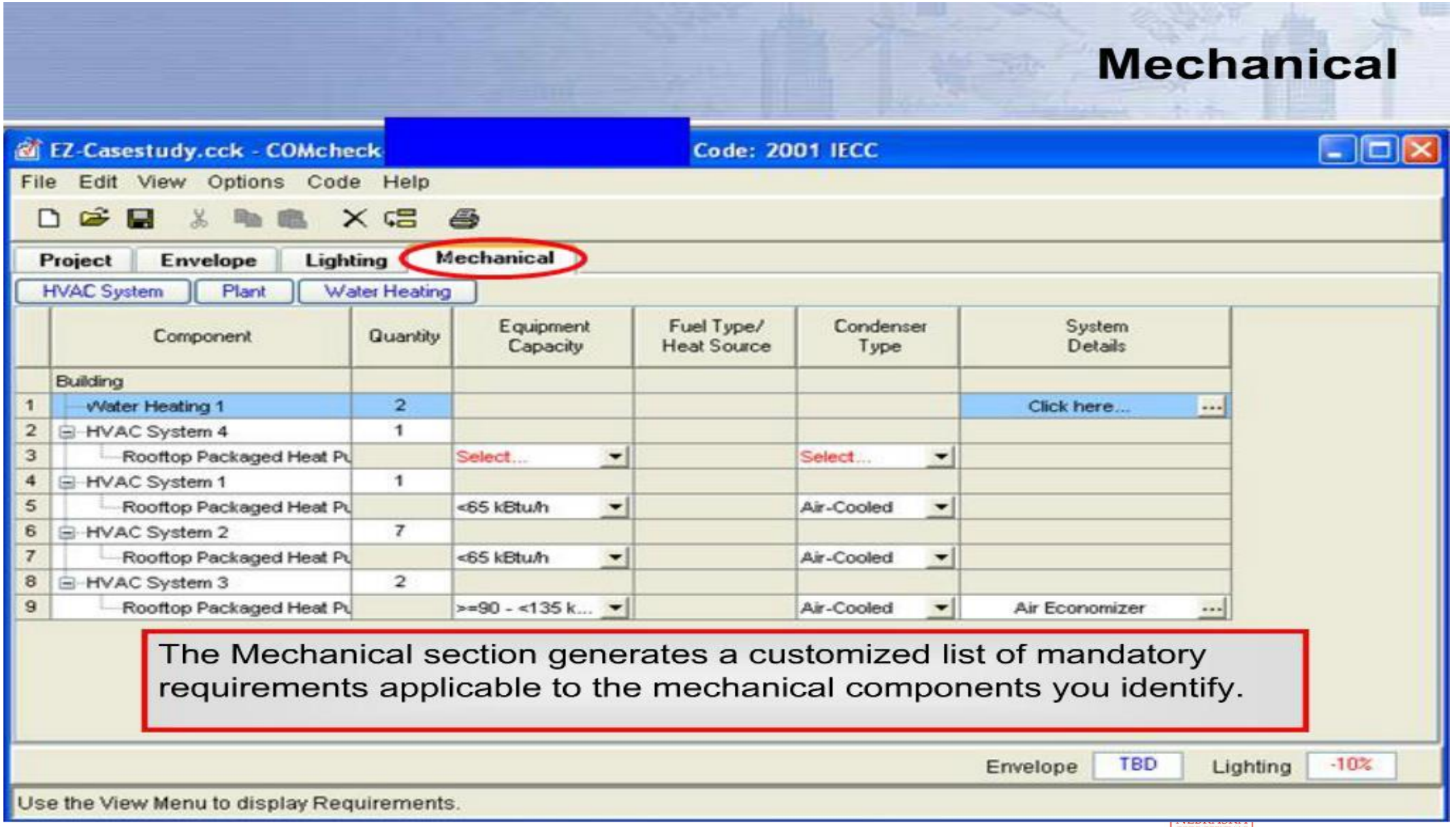
Mechanical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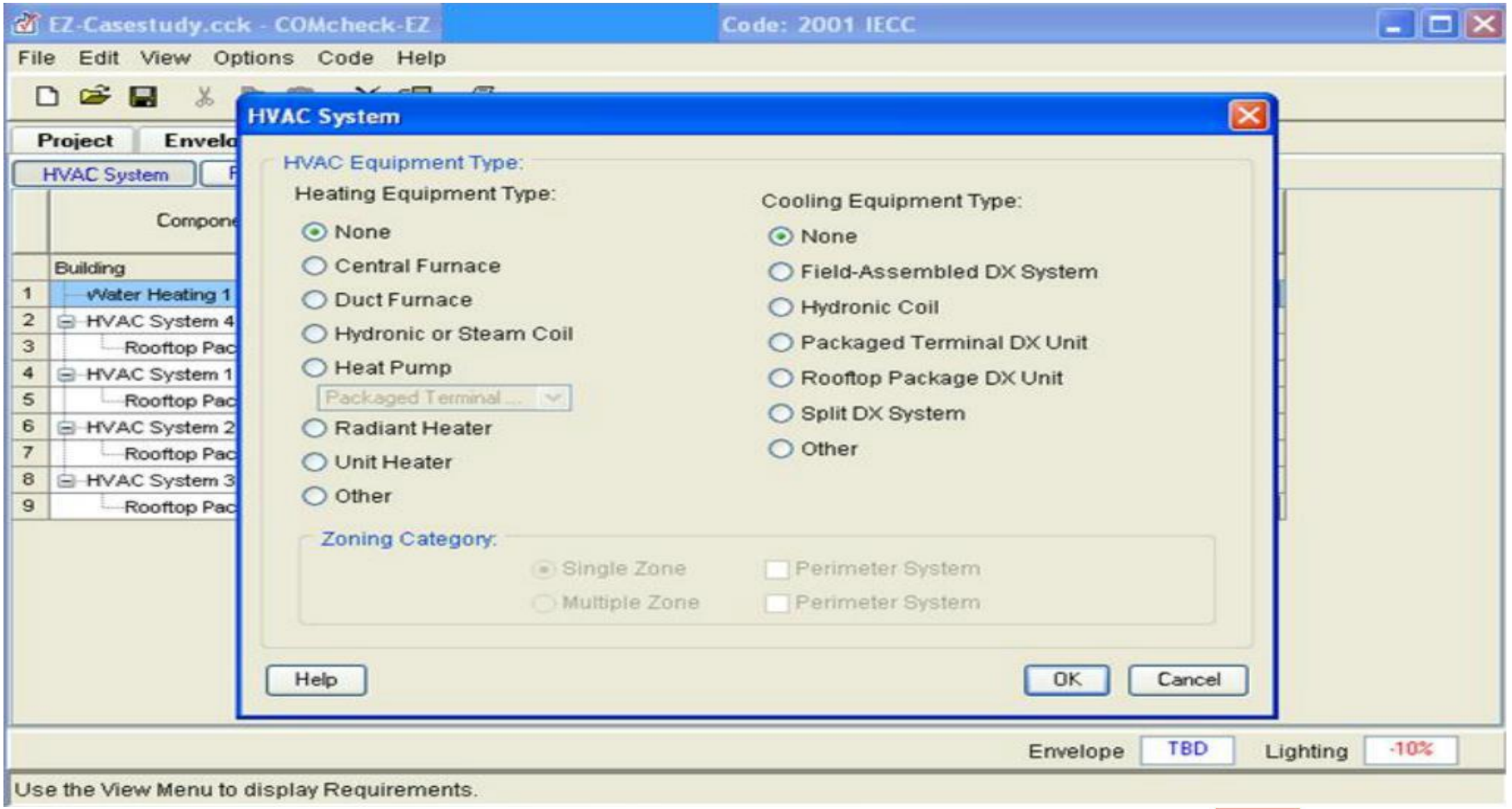
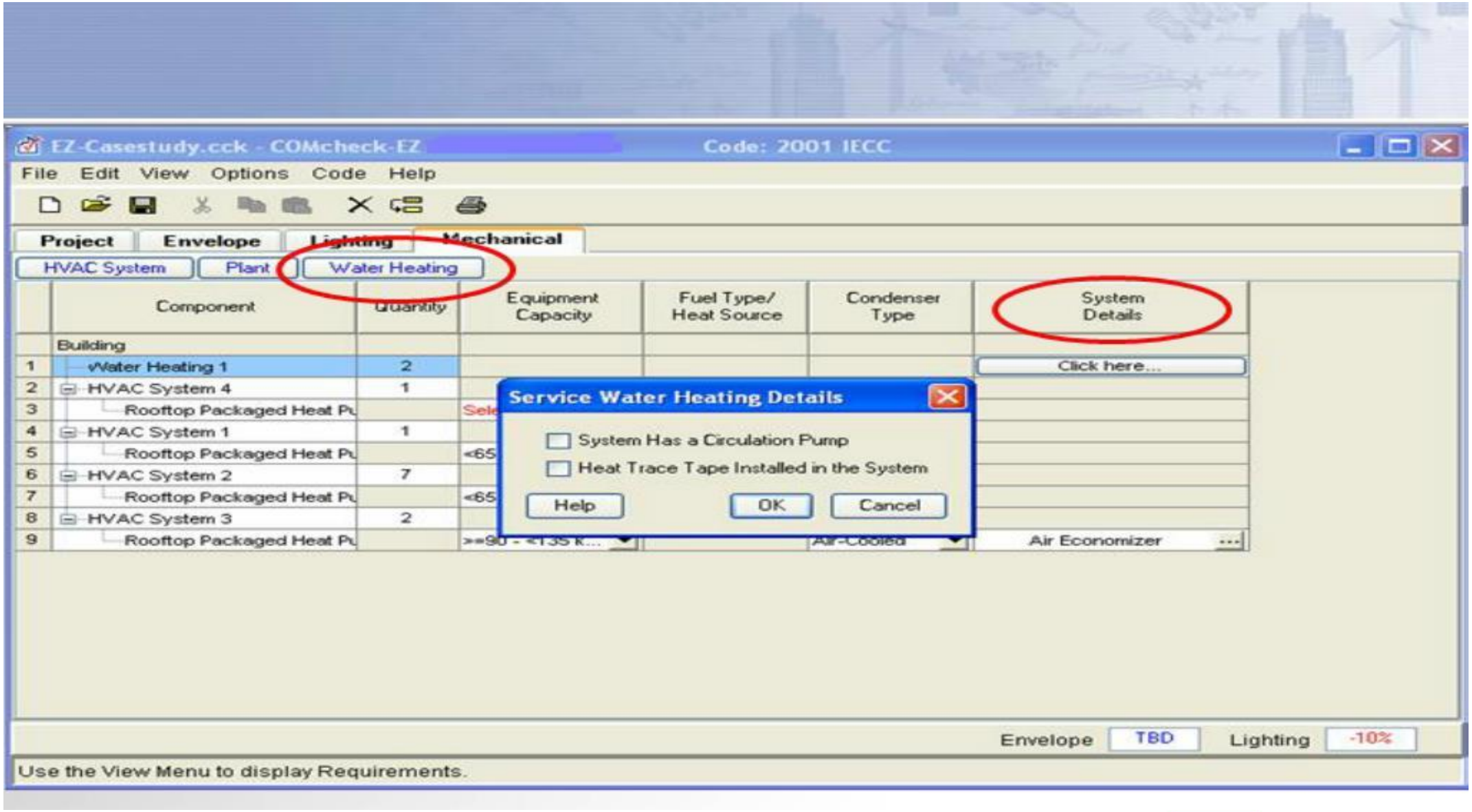
File Edit View Options Code Help
Project Envelope Lighting Mechanical
HVAC System Plant Water Heating
Component | Quantity | Equipment Capacity | Fuel Type/ Heat Source | Condenser Type | System Details
Building
1 Water Heating 1 | 2 | Click here...
2 HVAC System 4 | 1
3 Rooftop Packaged Heat Pu | Select... | Select...
4 HVAC System 1 | 1
5 Rooftop Packaged Heat Pu | <65 kBtu/h | Air-Cooled
6 HVAC System 2 | 7
7 Rooftop Packaged Heat Pu | <65 kBtu/h | Air-Cooled
8 HVAC System 3 | 2
9 Rooftop Packaged Heat Pu | >=90 - <135 k... | Air-Cooled | Air Economizer
The Mechanical section generates a customized list of mandatory requirements applicable to the mechanical components you identify.
Envelope TBD Lighting -10%
Use the View Menu to display Requirements.


EZ-Casestudy.cck - COMcheck-EZ
Code: 2001 IECC
File Edit View Options Code Help
Project
HVAC System
Building
1 Water Heating 1
2 HVAC System 4
3 Rooftop Pac
4 HVAC System 1
5 Rooftop Pac
6 HVAC System 2
7 Rooftop Pac
8 HVAC System 3
9 Rooftop Pac
HVAC System
HVAC Equipment Type:
Heating Equipment Type:
None
Central Furnace
Duct Furnace
Hydronic or Steam Coil
Heat Pump
Packaged Terminal ...
Radiant Heater
Unit Heater
Other
Cooling Equipment Type:
None
Field-Assembled DX System
Hydronic Coil
Packaged Terminal DX Unit
Rooftop Package DX Unit
Split DX System
Other
Zoning Category:
Single Zone
Multiple Zone
Perimeter System
Perimeter System
Help
OK
Cancel
Envelope TBD
Lighting -10%
Use the View Menu to display Requirements.


EZ-Casestudy.cck - COMcheck-EZ
Code: 2001 IECC
File Edit View Options Code Help
Project Envelope Lighting Mechanical
HVAC System Plant Water Heating
Component
Quantity
Equipment Capacity
Fuel Type/ Heat Source
Condenser Type
System Details
Building
1 Water Heating 1 2 Click here...
2 HVAC System 4 1
3 Rooftop Packaged Heat Pu
4 HVAC System 1 1
5 Rooftop Packaged Heat Pu
6 HVAC System 2 7
7 Rooftop Packaged Heat Pu
8 HVAC System 3 2
9 Rooftop Packaged Heat Pu
Air-Cooled
Air Economizer
Service Water Heating Details
System Has a Circulation Pump
Heat Trace Tape Installed in the System
Help
OK
Cancel
Envelope TBD Lighting -10%
Use the View Menu to display Requirements.

Alteration Type Project:

- Projects involve changes to or replacement of
  - Existing building components that are part of building envelope
  - Lighting, heating, ventilating, air conditioning, and water-heating equipment
- Specify only those envelope components, lighting fixtures, or mechanical systems/equipment that will exist upon completion of the project
- Alteration detail dialogs
  - Specify exemptions if applicable
  - Additional qualifications may be required (e.g., Window/wall ratio)
- Compliance shown as Pass/Fail for Envelope and Lighting

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Existing Buildings
Section C503 - Alterations

- Code applies to any new construction
  - Additions or new work in existing structures
- Unaltered portion(s) may not need to comply
- When complying via ASHRAE 90.1-2016, alterations do not need to comply with C402-C405
- Where existing building exceeds fenestration area limitations of Section C402.4.1 prior to alteration, building is exempt from C402.4.1 provided there is no increase in fenestration area

Image: montgomerycountymd.gov

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Existing Buildings
Section C503 - Alterations

- Heating and Cooling
  - New HVAC systems and duct systems that are part of the alteration to comply with Section C403
- Service hot water systems
  - New SWH systems that are part of the alteration to comply with C404
- Lighting Systems
  - New Lighting systems that are part of the alteration to comply with C405
    - **Exception** – alteration that replace <10% of the luminaires in a space provided such alteration does not increase the installed interior lighting power

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Existing Buildings - Lighting Power and Systems Section C502.2.6

New lighting systems installed as part of an addition to comply with C405

- Total interior lighting power to comply C405.3.2
  - Stand alone addition
  - Addition + existing building as a single building
- Total exterior lighting power to comply C405.4.2
  - Stand alone addition
  - Addition + existing building as a single building
- Repairs – C504.2
  - Repairs exempt where only the bulb, ballast or both within the existing luminaires in a space are replaced, provided that the replacement does not increase the installed interior lighting power

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Building Controls are Complicated

- Since 2004, about 30% of all new requirements have been related to building controls
- Control requirements can be difficult to implement and verification is beyond the expertise of most building code officials
- Assumption is that they are implemented and working correctly

Source: https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-26348.pdf

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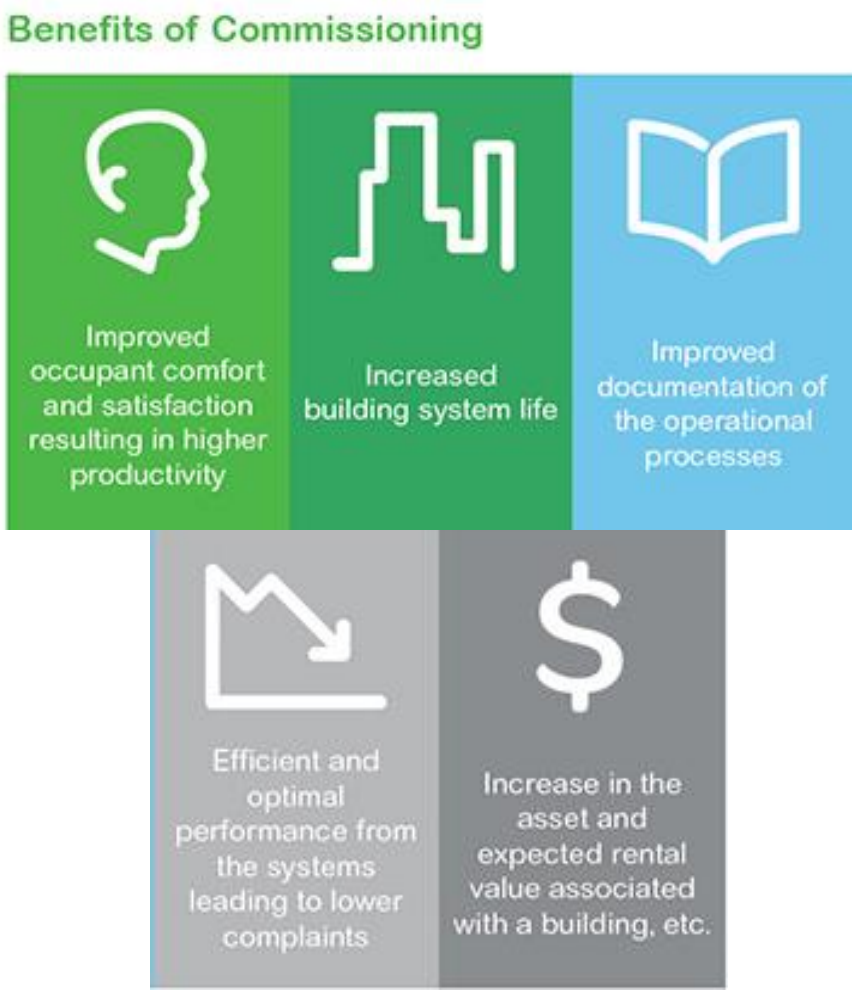
Mandatory Requirements in COM*check* Software

- Requirements Checklist generated automatically based on input
  - applicable code
  - building location

Systems Commissioning and Completion Requirements

Section C408

- Commissioning is critical to ensure that buildings are **working as designed**
- Preliminary and final reports required
- Mechanical and lighting commissioning detailed in section C408



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Functional Testing of Lighting Controls
Section C408.3.1

- Prior to passing final inspection, registered design professional to provide evidence that lighting control systems have been tested to ensure that control hardware and software are calibrated, adjusted, programmed and in proper working order per construction documents and manufacturer's installation instructions

Compliance Certificate for Permit

COMcheck

COMcheck Software Version COMcheck-Web

Envelope Compliance Certificate

Project Information

Energy Code:	2012 Ontario Building Code and Chapter 2 of Division 3 of SB-10(2017)
Project Title:	OAA Festival Project 44%
Location:	Toronto / Downtown, Ontario
Climate Zone:	5a
Project Type:	New Construction
Vertical Glazing / Wall Area:	43%
Performance Sim. Specs:	EnergyPlus 8.1.0.009 (EPW: CAN_ON_Toronto.716240_CWEC.epw)

Construction Site:
666 Park AVe.
Toronto, Ontario M4M 4M4

Owner/Agent:
Ima Driven
CanDo Developments
666 Park Ave
Toronto, Ontario M4M 4M4
6136015689
Ima.Driven@CanDo.ca

Designer/Contractor:
Gerry Conway
Conway Architect Inc
185 Mafeking Ave
Ottawa K1K2V4
6136015689
ConwayArchitect@gmail.com

Building Area	Floor Area
1-Gnd Fl. Retail (Retail) : Nonresidential	10000
2-2nd - 10th (Office) : Nonresidential	90000
3-Bsmt. (Warehouse) : Nonresidential	10000

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Upcoming Trainings

- Late August (Exact date TBD) – In-person training in the Grand Island area, stay tuned.
- Would you like an in-person training in your area? Let us know!

Thank You! Questions?

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John Gossman, MEEA
jgossman@mwalliance.org

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