



Using ComCheck *and* Advanced Energy Designing and Constructing to 2021 IECC

June 14, 2023



Commercial Energy Code – IECC Session 4 Part 1

Using ComCheck

Session 4 Part 2

Advanced Energy & Business Applications

Instructor: Matt Belcher

Wednesday, June 14th 11:00 AM-12:30 PM



Correlation IECC and 90.1

(IECC Section/90.1 Section)

- Prescriptive and Alternative Envelope and component information/Tables; 402 / Section 5
- ***Mechanical Systems; 403 / Section 6***
- ***Service Water Heating; 404 / Section 7***
- ***Electrical Power and Lighting; 405 / Sections 8,9***
- Additional Energy Efficiency Options: 406 / 11, App G
- Total Building Performance; 407 / Per Section
- Building Maintenance and Commissioning; 408 / Per Section

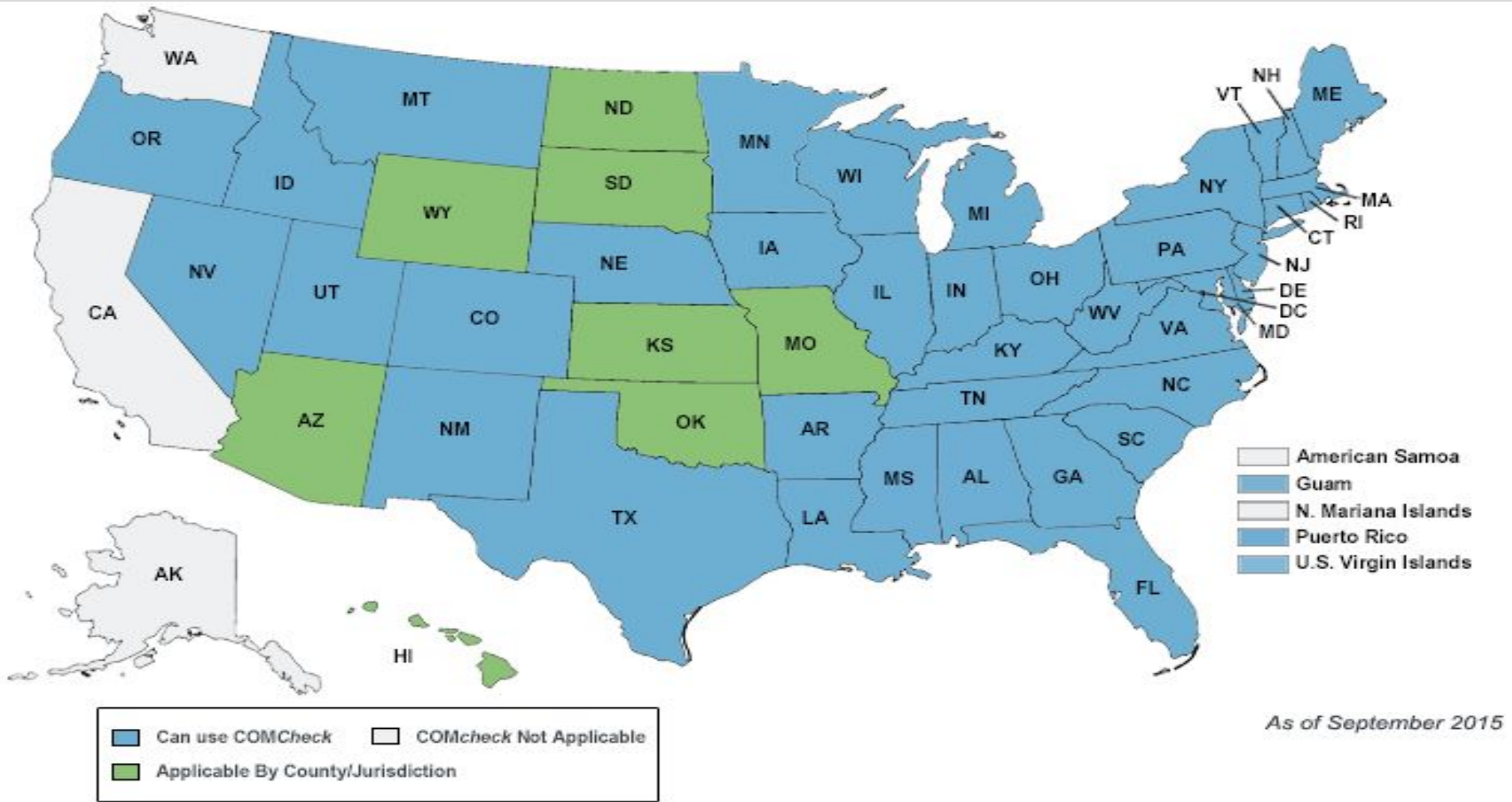
Using COMcheck Learning Objectives:

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.



States that allow COMcheck



Commercial Compliance Tools

Desktop Software Tools



Web-Based Tools



Free

Printed Materials

Compliance Guides

Prescriptive Tables



3

COMcheck/COMcheck Web



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

COMcheck/COMcheck Web

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

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



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

Project Types:

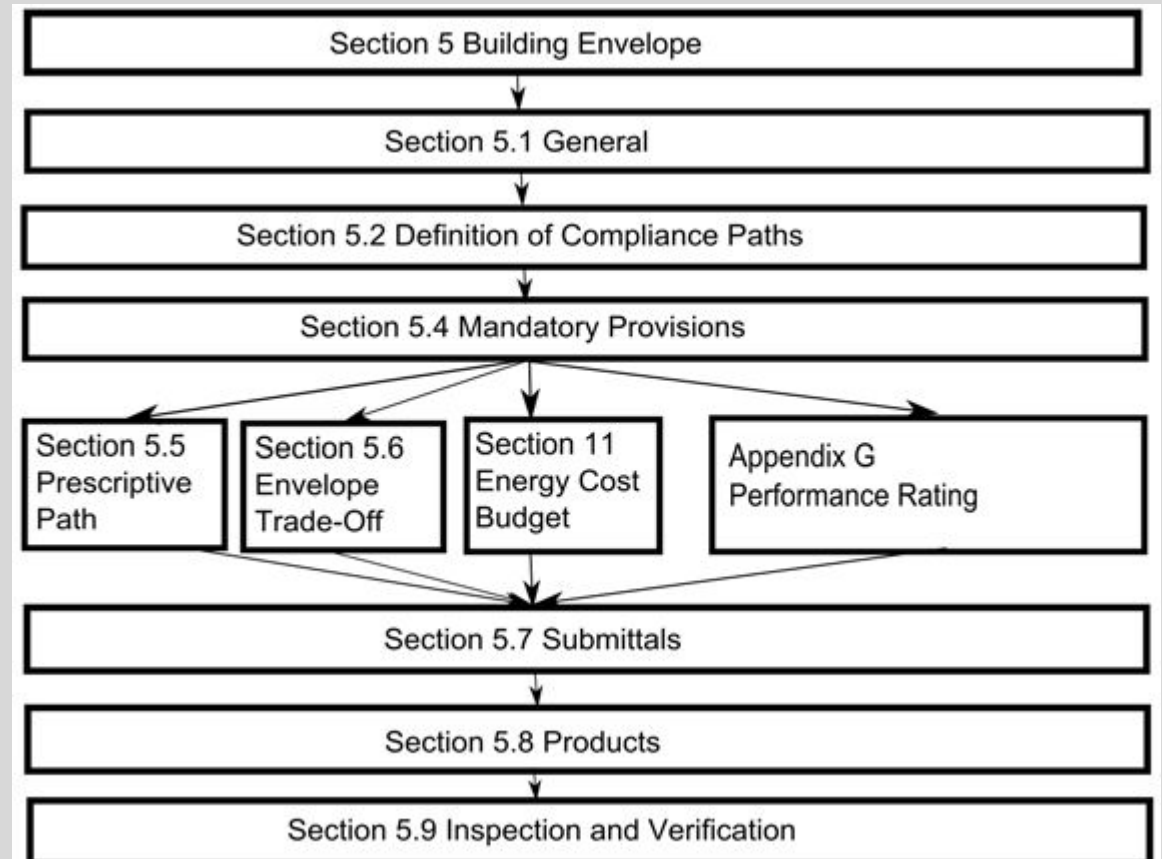
- New Construction: Trade-off compliance method
- Addition Trade-off compliance method
- Alteration Prescriptive compliance

What is COMcheck?

- 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

'21 IECC/ '19 90.1 Compliance Options –

- Building must comply with
 - C402 Envelope
 - C403 Mech
 - C404 SWH
 - C405 Lighting
 - Plus pick one additional efficiency package.



Additional Efficiency Package Options

- One additional efficiency feature must be selected to comply with the IECC
- C406.2 More efficient **HVAC** performance, OR
- C406.3 Reduced **lighting** power density system, OR
- C406.4 Enhanced lighting **controls**, OR
- C406.5 On-site supply of **renewable** energy
- C406.6 Dedicated outdoor air system (**DOAS**), OR
- C406.7 More efficient SWH (**hot water**) OR
- C406.8 Enhanced **envelope** performance OR
- C406.9 Reduced air **infiltration**

U/A Trade off compliance

Compliance: Passes using UA trade-off					
Compliance: 12.2% Better Than Code		Maximum UA: 500	Your UA: 439		
<small>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.</small>					
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.	1200	13.0	5.0		88
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 Conservation 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

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.


Landing Page



Project title 

2009 IECC

[Register](#)  [Forgotten Password?](#)

PROJECT ENVELOPE INT. LIGHTING EXT. LIGHTING MECHANICAL 

Code/Location

Code:

State:

City:

If your location is not included here, choose a nearby location with similar weather conditions.

Project Type

New Construction Addition Alterations

Project Details (optional)

This information will appear on the compliance report.

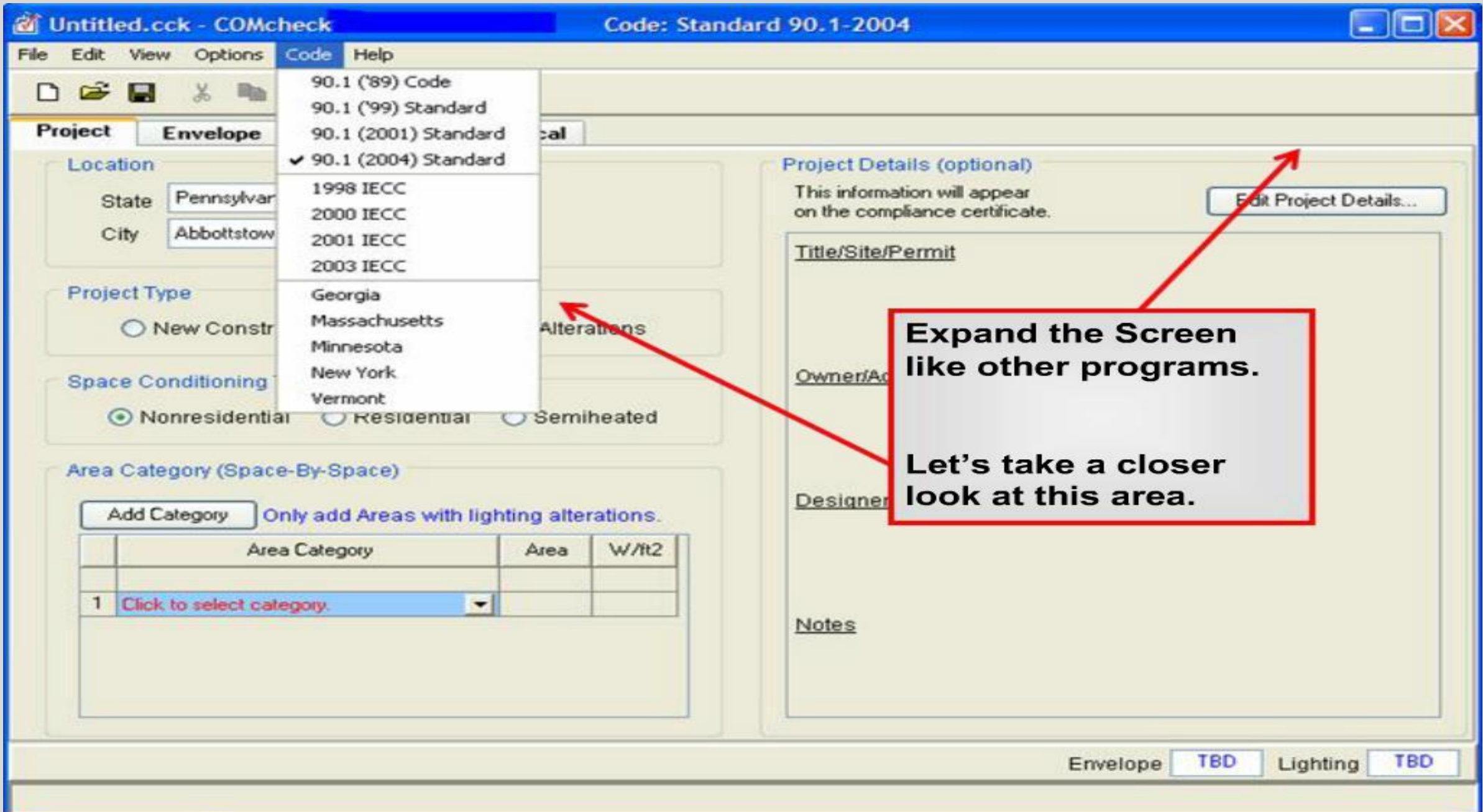
Building Envelope and Interior Lighting Areas Exterior Lighting Areas

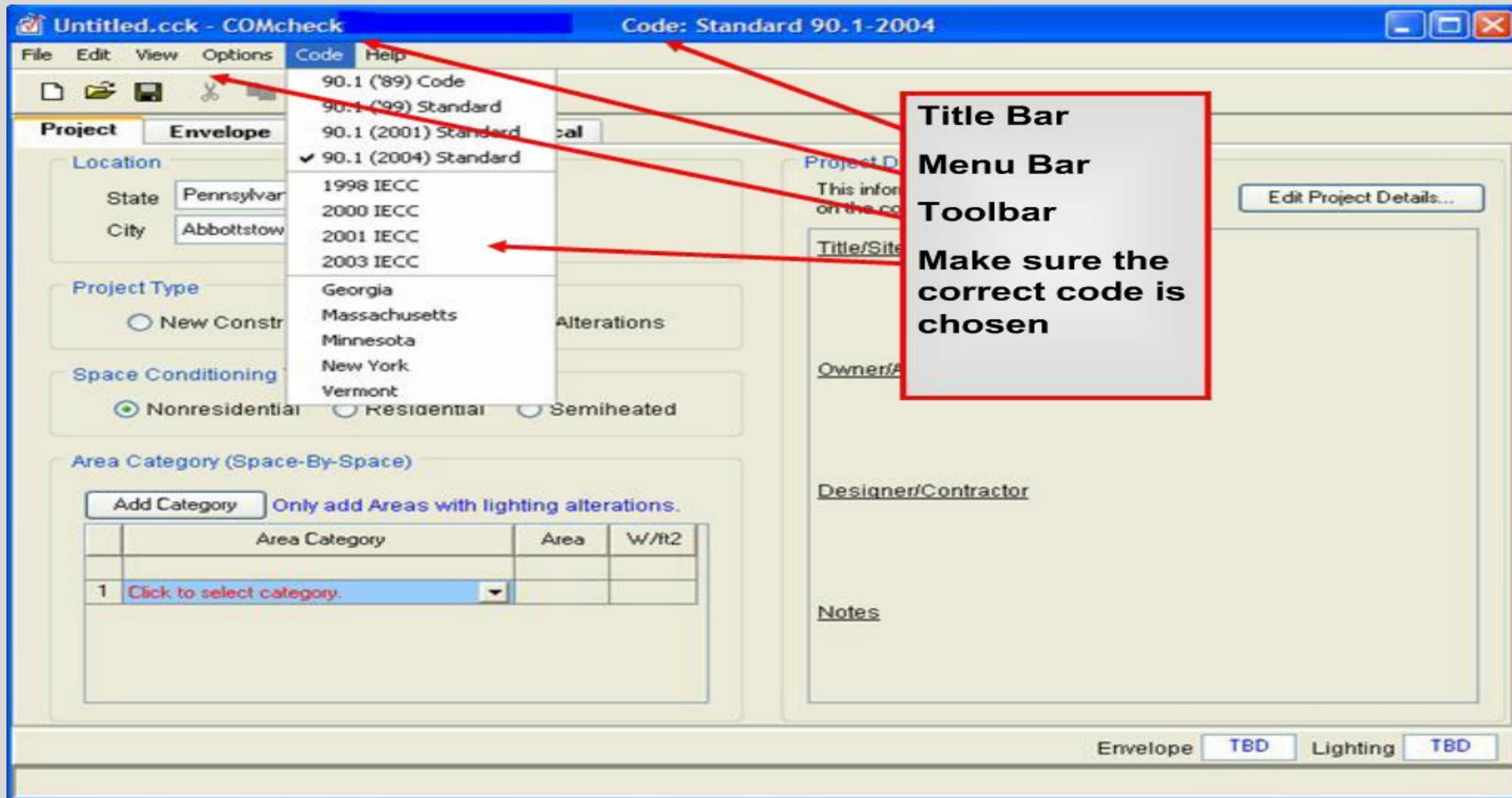
	Building Area	Area Description	Space Conditioning	Area	W/ft ²
1	<input type="text" value="Select Area Category..."/>				

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







Envelope Screen

EZ-Casestudy.cck - COMcheck XXXXXXXXXX Code: 2001 IECC

File Edit View Options Code Help

File Edit View Options Code Help

Project Envelope Lighting Mechanical

Roof Skylight Ext. Wall Int. Wall Window Door Basement Floor

	Component	Assembly	Construction Details	Gross Area		Cavity Insulation R-Value	
	Building						
1	Roof 1	Non-Wood Joist/Rafter/Tr...		20532	ft2	19.0	

Building Components are added by clicking on these.

Commercial Buildings

Building System

Envelope

Lighting

Mechanical

HVAC

SWH

Mandatory Provisions
(required for all compliance options)

Compliance Options

Prescriptive Option

Trade Off Option

Total Building Performance

Energy Code 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



Envelope Requirements

Sample.cck - CONcheck 3.9.0 Code: 2009 IECC

Project Envelope Interior Lighting Exterior Lighting Mechanical

Roof Skylight Ext. Wall Window Door Basement Floor

Component	Assembly	Concrete Density	Construction Details	Gross Area or Slab Perimeter	Cavity Insulation R-Value	Continuous Insulation R-Value	U-Factor	SHGC	Projection Factor
Building									
1	Roof 1	Insulation Entirely Ab...		138319 ft2		25.0	0.039		
2	Exterior Wall 1	Concrete Block: 12", ...	Media...	38130 ft2		0.0	0.280		
3	Window 1	Wood-Framed, 16" o.c.	Glazing: ...	152 ft2			0.550	0.35	1.45
4	Window 2	Wood-Framed, 24" o.c.	Glazing: ...	532 ft2			0.190	0.25	0.60
5	Window 3	Steel-Framed, 16" o.c.	Glazing: ...	207 ft2			0.550	0.35	1.45
6	Door 1	Steel-Framed, 24" o.c.	Swinging	378 ft2			0.100		
7	Door 2	Metal Building Wall	Non-Swi...	162 ft2			0.130		
8	Door 3	Solid Concrete					0.130		
9	Floor 1	Concrete Block							

Envelope PASSES: Design 1X better than Code

Envelope +1% Interior Lighting TRD Exterior Lighting TRD

Mandatory Requirements Include:

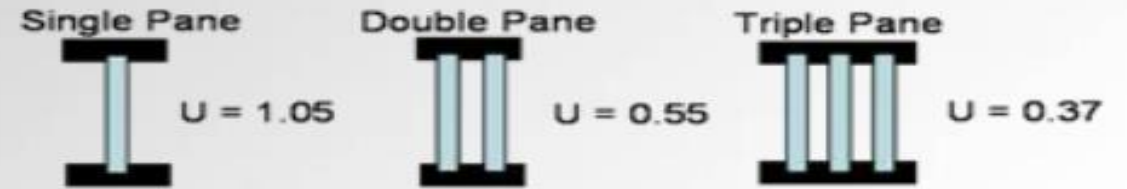
- Air Leakage
- Air barriers
- Fenestration air leakage
- Rooms Containing Fuel-burning Appliances
- Air intakes, exhaust openings, stairways and shafts
- Loading dock weatherseals
- Vestibules
- Recessed lighting
- Commissioning



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)		
Fixed	1.08	0.65
Garden Window	1.07	0.63
Curtain Wall	1.11	0.68
Skylight	1.89	1.11
Site-assembled Sloped/overhead glazing	1.25	0.70
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

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)*

Lighting Requirements

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

Complies if total connected power \leq lighting power allowance



Adding Lighting

EZ-Casestudy.cck - COMcheck Code: 2001 IECC

File Edit View Options Code Help

Project Envelope **Lighting** Mechanical

T8/T12 Fluorescent Compact Fluorescent HID Incandescent Add Space

Component	Fixture ID	Fixture Description	Lamp Description/ Wattage Per Lamp	Ballast	Lamps Per Fixture	Number of Fixtures	Fixture Wattage
Building							
Space 1							
2		Recessed Troffer	48" T12 40W	Magnetic	4	174	139
3		Recessed Troffer	48" T12 40W	Magnetic	2	31	70
4		Recessed Troffer	48" T12 40W	Magnetic	2	5	70
5		2 x 2 Prismatic Troffer	24" T12U 40W	Magnetic	2	53	70
6		2 x 4 Prismatic Troffer	48" T12 40W	Magnetic			

Lighting components are added by clicking on these

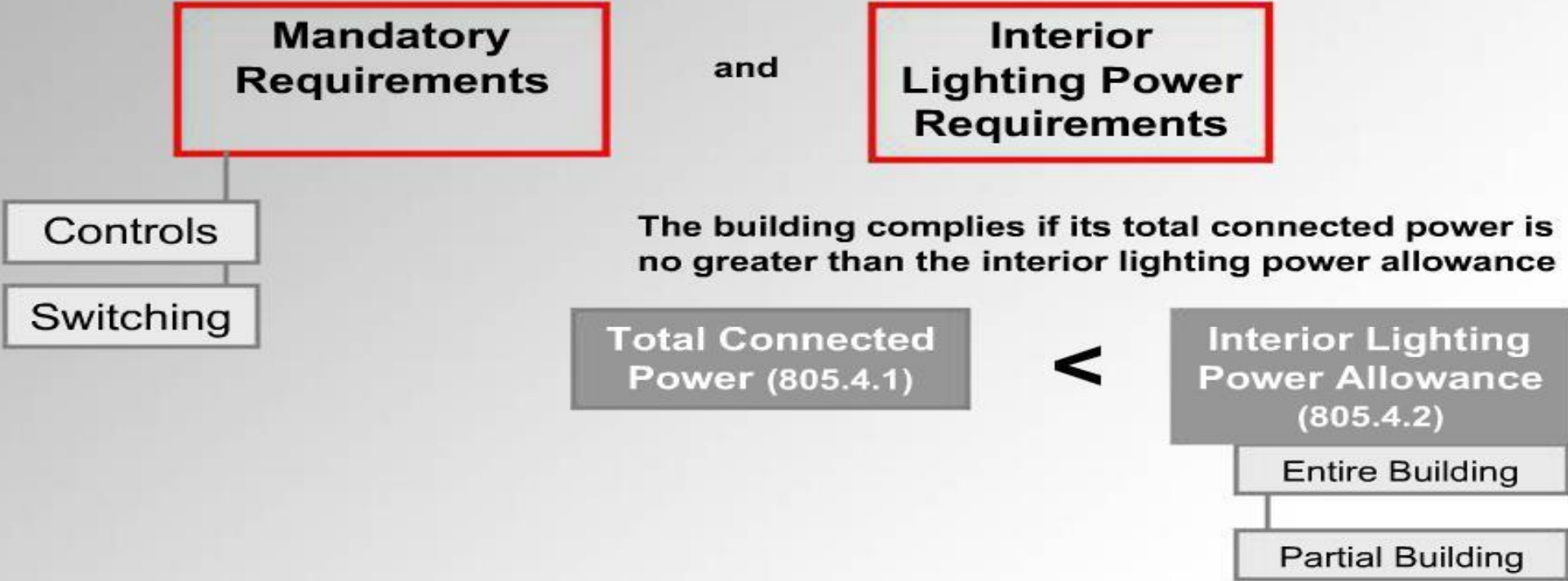
Lighting Results

Allowed Wattage 28295 Proposed Wattage 31186

Envelope TBD Lighting **-10%**

Use the Options Menu to Arrange Lighting Fixtures by Spaces.

Interior Lighting Compliance



When do the 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 $\geq 75\%$ of permanently installed fixtures (except low-voltage) are fitted for and include high-efficacy lamps

Electrical Lighting and Power Systems Requirements

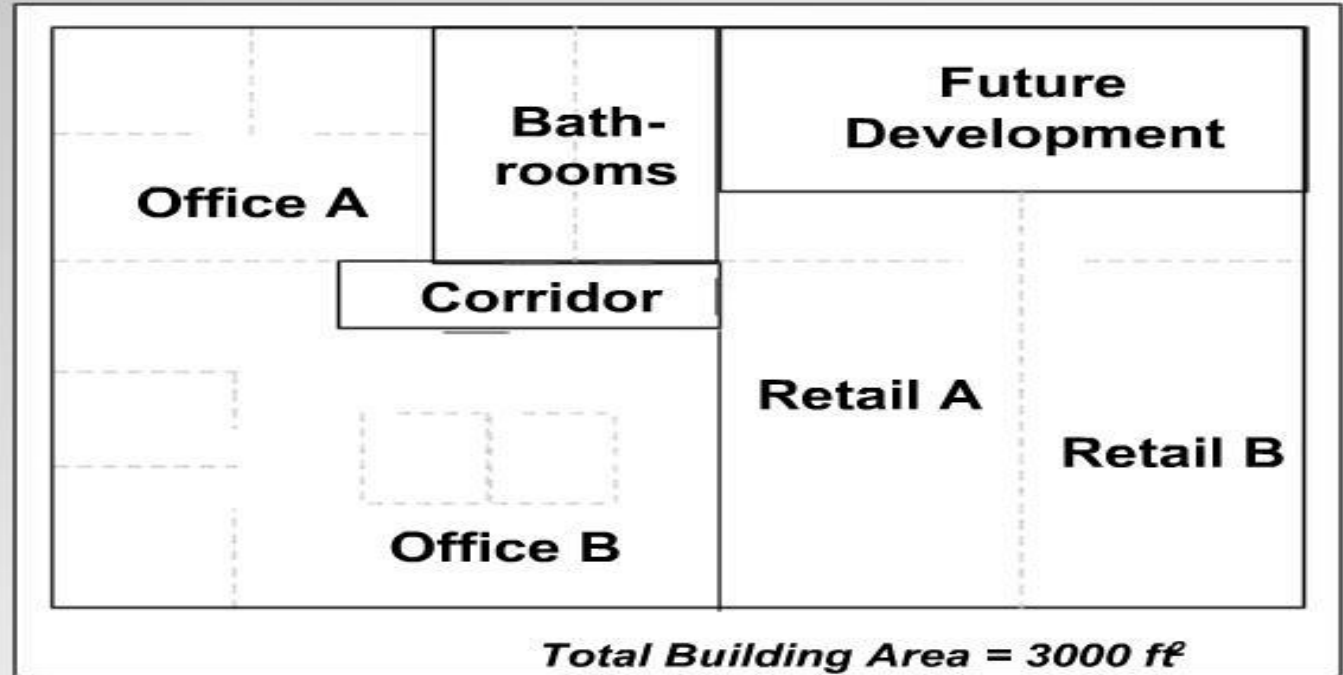
- Mandatory Interior Lighting requirements
 - Required Controls
 - Wattage/Efficiency Limits
- Interior Lighting Power Allowances (watts/ft²)
- Exterior Lighting Controls
 - Required Controls
 - Lamp Efficiency
- Exterior Lighting Power Allowances (watts/ft²)
- Dwelling Electric Meters
- Electrical Transformers and Motors
- Vertical and Horizontal Transportation Systems and Equipment



Image: U.S. Dept of Energy

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/Service Hot Water Requirements

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

Mechanical

EZ-Casestudy.cck - COMcheck 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		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.

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
 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

COMcheck Project Specification Steps

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



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

Commercial Energy & Building Codes Updates and Applications;

**Wednesday, July 19, 10 a.m. – 12 p.m. CDT: COMcheck
“Live” Walk-through**

Nebraska Energy Code: COMcheck Walk-through Tickets, Wed, Jul 19,
2023 at 10:00 AM | Eventbrite

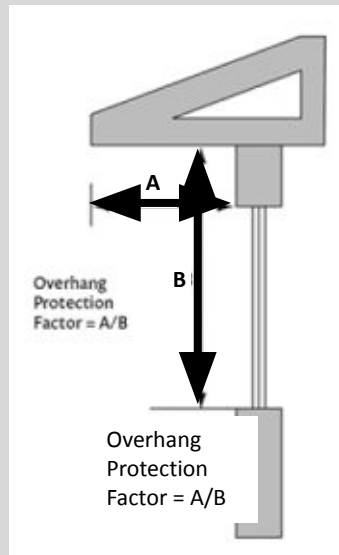


Advanced Technologies

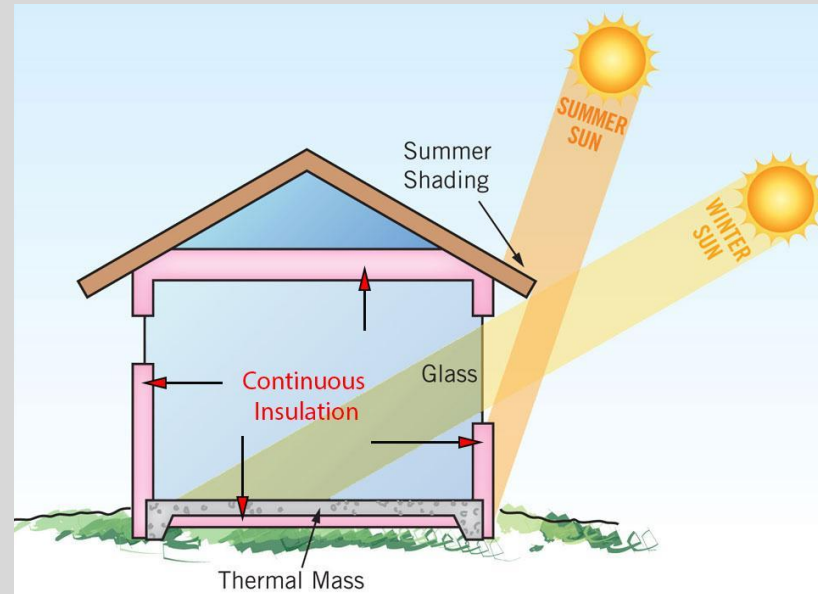
- Advanced Insulation/Building Envelope
- Phase Change Materials
- Systemic Approach to Building
- Advanced Fenestration
- Advanced HVAC Equipment
- Smart Technology
- Electric Vehicles (EV Charging)
- Grid-Integrated Efficient Buildings (GEB)
- Carbon Defined

Building Envelope

- Sometimes you **can** get a free lunch! FREE ENERGY starts with good, thoughtful design!



Projection Factor



Solar Angle

Continuous Insulation - Advanced Framing

- Double stud wall allows for continuous insulation to be placed between interior and exterior studs
- Can accommodate various types of insulation, or even mixed types of insulation

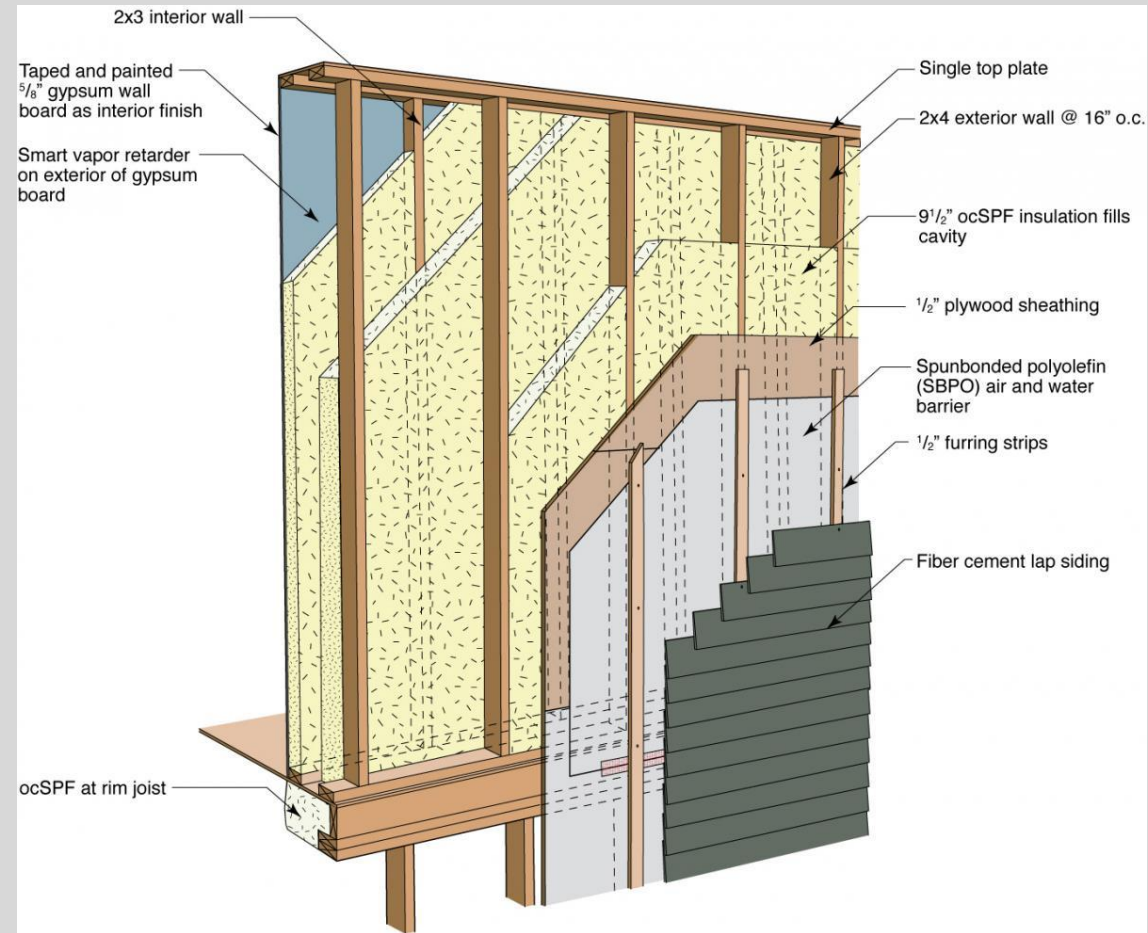


Image: basc.pnnl.gov

3 Main Types of Rigid Insulation



Image: finehomebuilding.com

Expanded Polystyrene – EPS

- Least expensive
- Most vapor permeable
- R-value: 3.6 to 4.2 per inch

Extruded Polystyrene – XPS

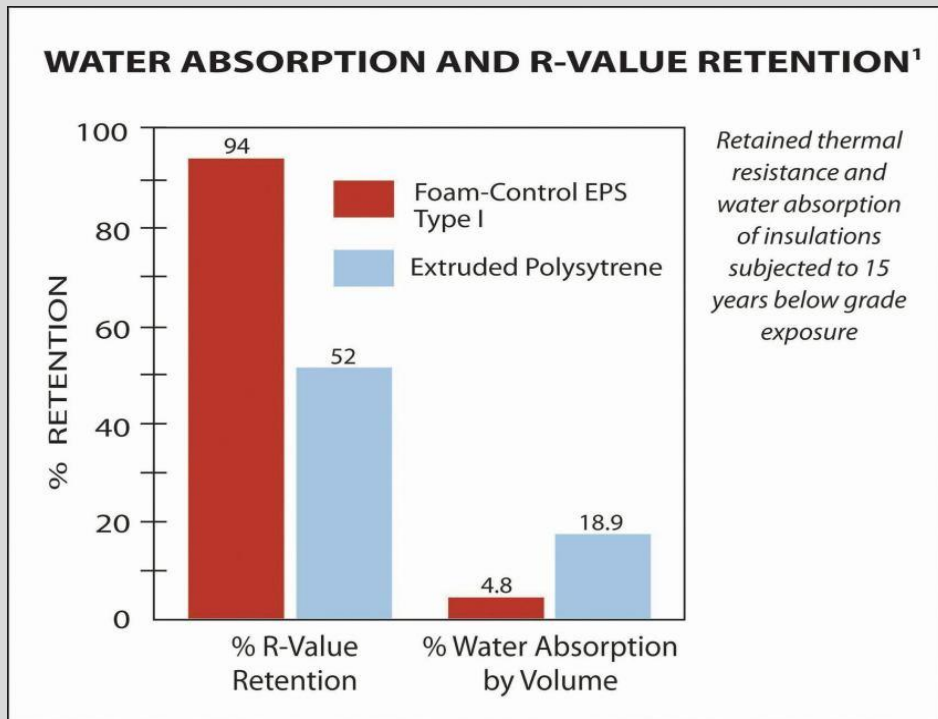
- High compressive strength
- High initial water resistance
- R-value: 5 per inch

Polyisocyanurate - Polyiso

- No ozone depleting blowing agent
- Absorbs water/ requires facing
- R-value: 6 to 6.5 per inch

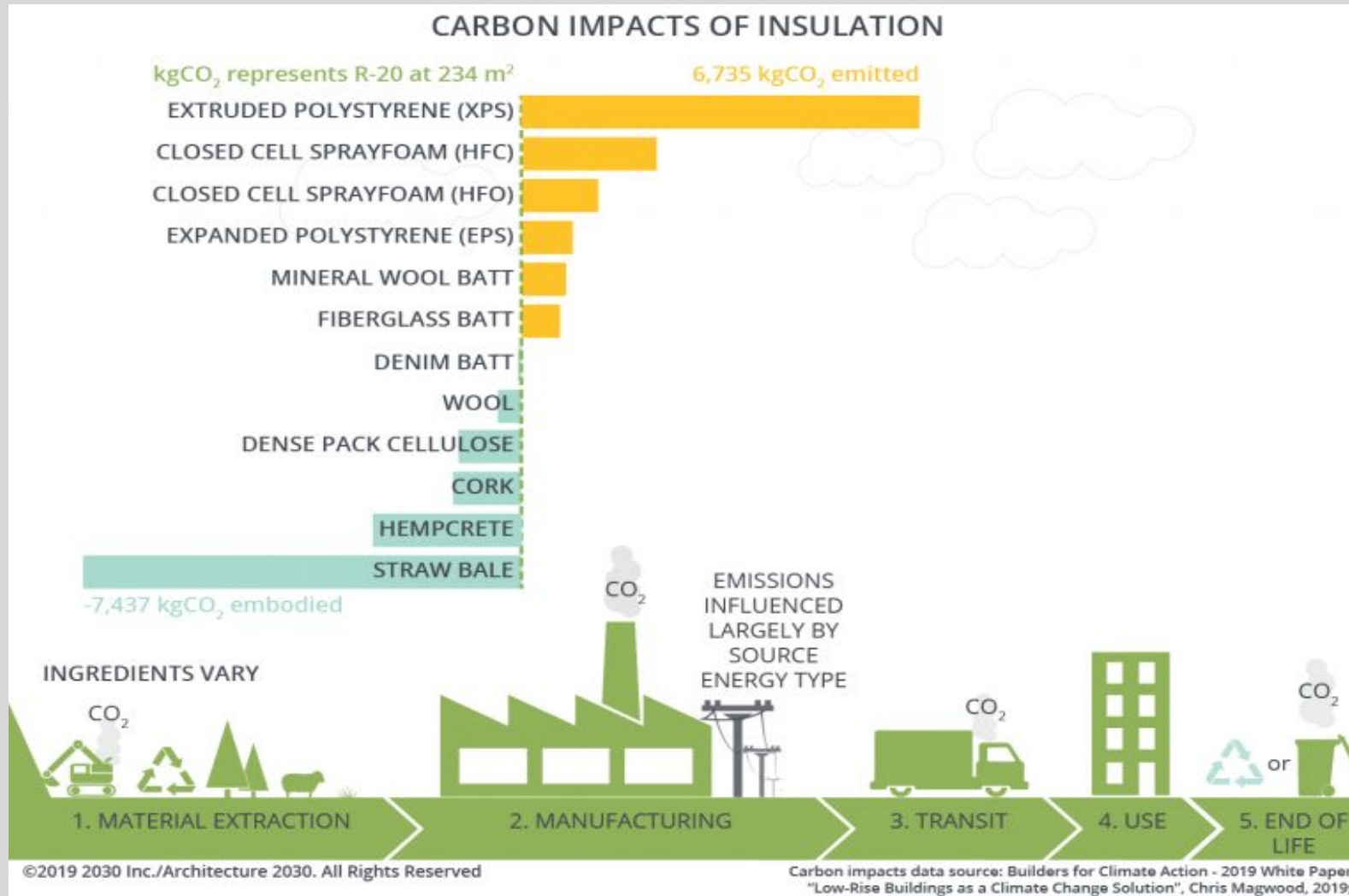
Comparing EPS and XPS

- Standardized tests show XPS has much lower water absorption, but one study of a below grade installation showed a different result. The takeaway – ***carefully research before selecting materials.***



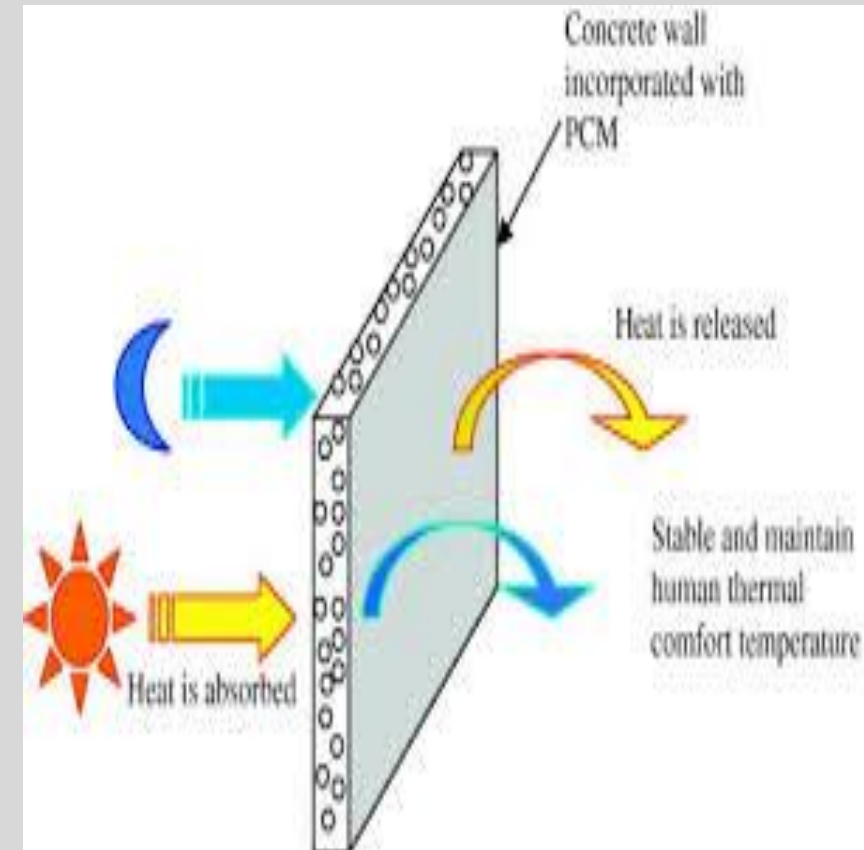
3/4" EXPANDED POLYSTYRENE (EPS)			
Property	Units	ASTM Test	Type I
Density	pcf, minimum	C303	.90
Thermal Resistance Value (R)	per 3/4" thickness @ 75°F (23.9°C)	C518	2.7
Compressive Resistance 10% Deformation	psi, minimum	D1621	10
Water Vapor Permeance	perm-in; maximum	E96	5.0
Water Absorption	% by volume max	C272	4.0
3/4" STYROFOAM EXTRUDED POLYSTYRENE (XPS)			
Property	Units	ASTM Test	Type I
Density	pcf, minimum	C303	1.6
Thermal Resistance Value (R)	per 3/4" thickness @ 75°F (23.9°C)	C518	3.8
Compressive Resistance 10% Deformation	psi, minimum	D1621	25
Water Vapor Permeance	perm-in; maximum	E96	1.1
Water Absorption	% by volume max	C272	.1

Carbon



Phase Change Materials

- Phase Change Materials (PCMs)
- Ability to store heat gains then release stored energy at appropriate time
- PCMs can
 - Reduce energy usage
 - Increase thermal comfort
 - Smooth out temperature fluctuations throughout the day and night
 - Help reduce and/or shift in peak loads



Systems Built Components: Reimagining the Process

- Time!
- Engineered or “Manufactured” *Off-Site Construction*
- Local Labor/Trades/Material Suppliers
- Local Trade School Engagement
- Potential of Utilizing Local Facilities
 - Allows for expansion of market
 - Local lenders/appraisers
- Prefab/Modular Largest growth segment in housing market
- New Codes: ICC/MBI 1200, 1205, 1210

Modular/Volumetric

- Gaining single family market share
- *REALLY* gaining multi-family market share.
- High Rise Construction.



Window Technologies – Dynamic Glazing

- Any fenestration product that has the fully reversible ability to change its performance properties, including U-factor, solar heat gain coefficient (SHGC), or visible transmittance (VT)



Image: dwmmag.com

High Performance HVAC

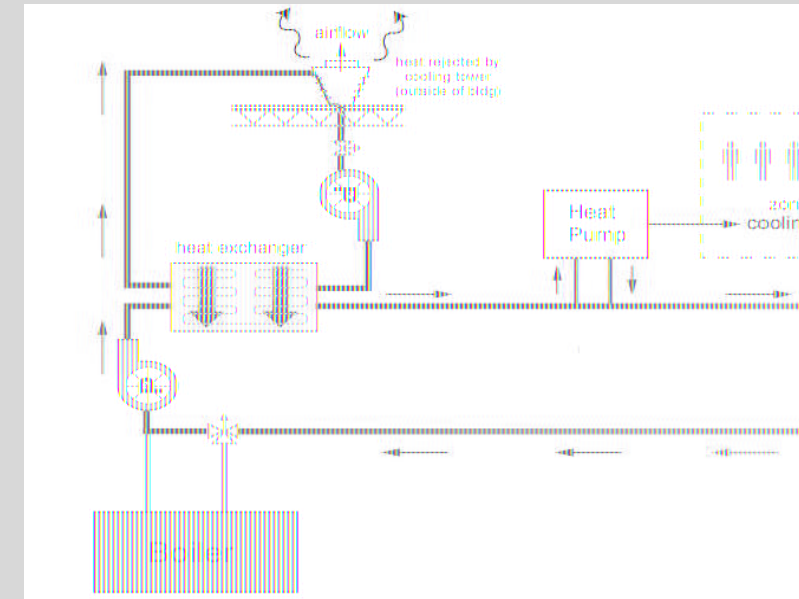
- High Efficiency Furnace
 - 98 AFUE
 - Variable Speed Motors
- Heat Pumps
 - As much as 400% efficient
 - Cold Climate Heat Pumps
 - Mini-Splits
 - Geothermal Heat Pump
 - Even window units!
- DOAS



Image: 604goodguy.com



Image: catamountsolar.com



Hydronic (Water Loop) Heat Pump Systems



Dedicated Outdoor Air*
(ISMRE, IS COP)

High Performance Air Conditioning

- Condensing Unit
 - Variable speed
- Performance Levels
 - 14 SEER required by code
 - Units over **20 SEER** are available
 - Tighter envelope increases efficiency
- Advancements in Technology
 - National Renewable Energy Lab (NREL) is developing an air conditioner with integral phase change materials!



Images: bobmims.com

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



EV Ready and EV Capable

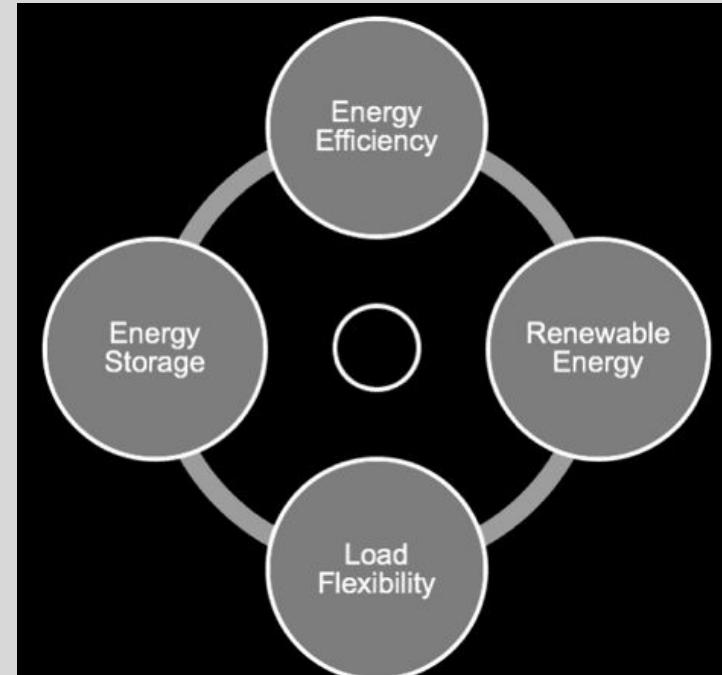
- EVs are growing fast and quickly becoming cost competitive
 - Estimated to be cost comparable by 2024
- EV Ready: 2024
 - Capacity on the electrical panel for at least a 40 amp, 240V dedicated branch circuit.
 - Conduit pre-installed
 - Level 2-ready outlet installed



Image: Verdatek Solutions

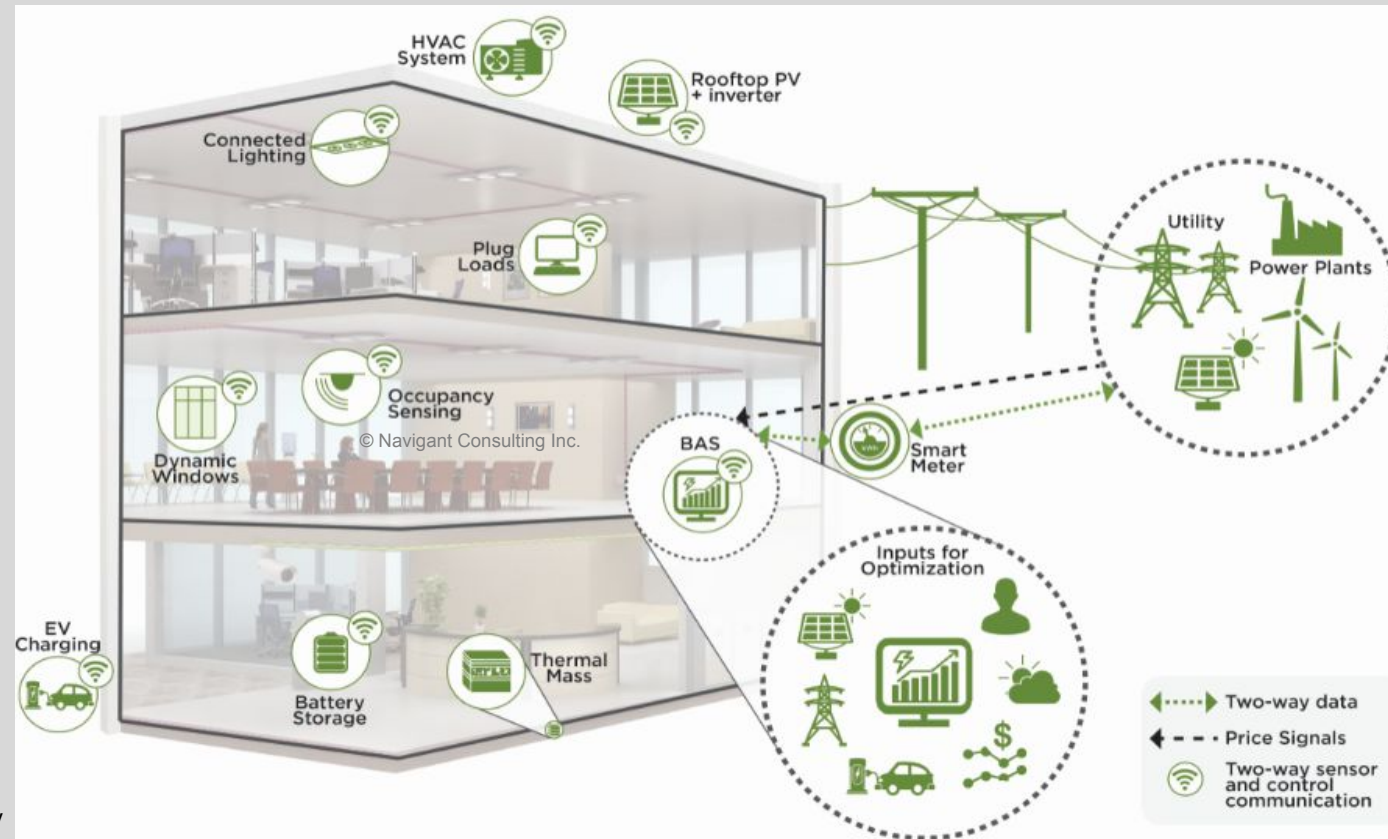
Energy/Battery Storage

- Growing part of Energy design
 - AC, DC and hybrid converter systems
 - 2.5 kW to 10kW
- Benefits
 - Pair with solar
 - Energy and peak savings
- Next Step towards a micro grids



Grid-integrated Efficient Building (GEB)

- Highly efficient building
- Smart technology
- Two-way communication with the grid

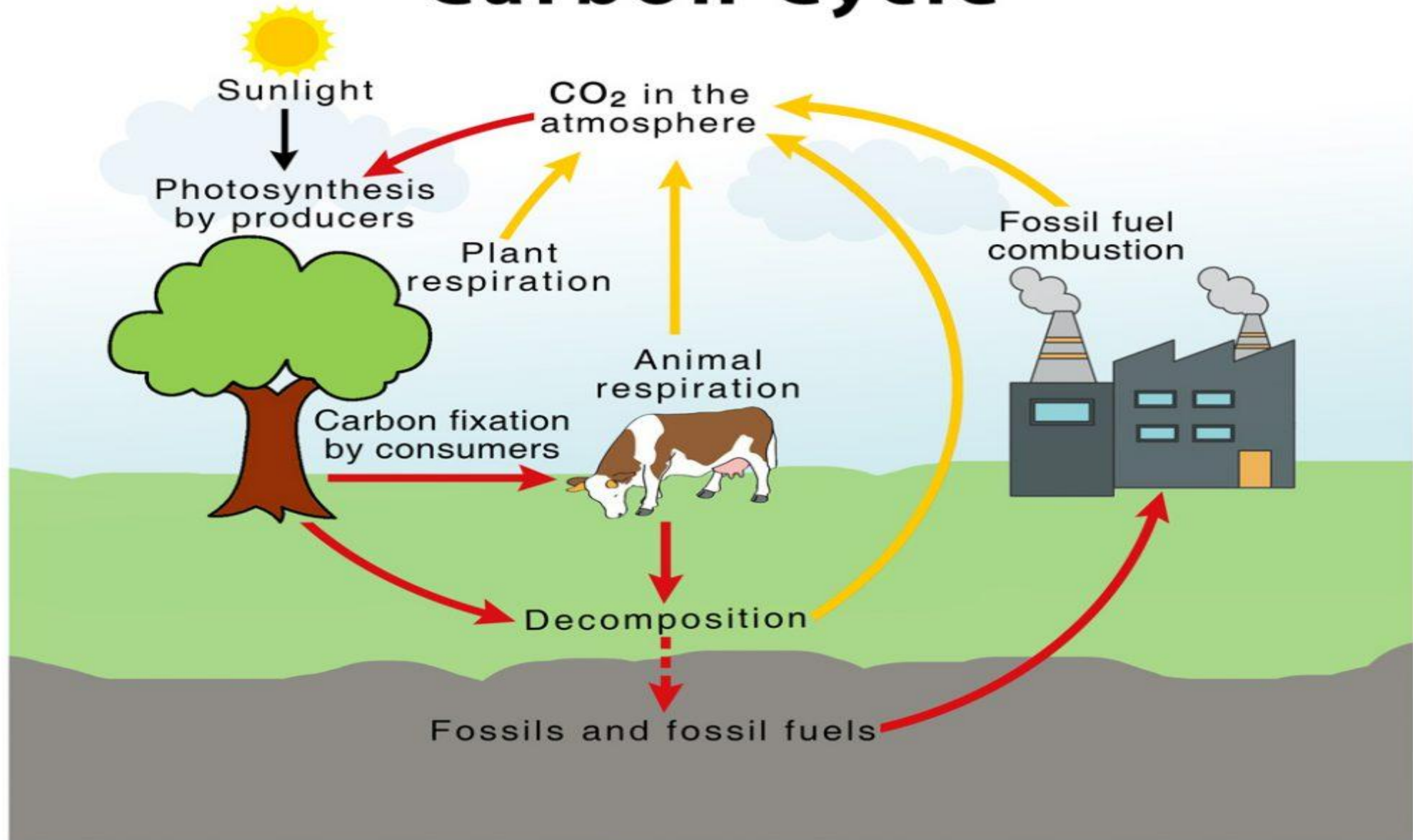


Carbon

What is a carbon credit?

- A carbon credit represents one unit of greenhouse gas (GHG) emissions reduced or carbon dioxide removed from the atmosphere.
- Carbon credits can be used to offset emissions.

Carbon Cycle



Business Impacts:

Efficient Buildings Have Higher Resale/Lease Value

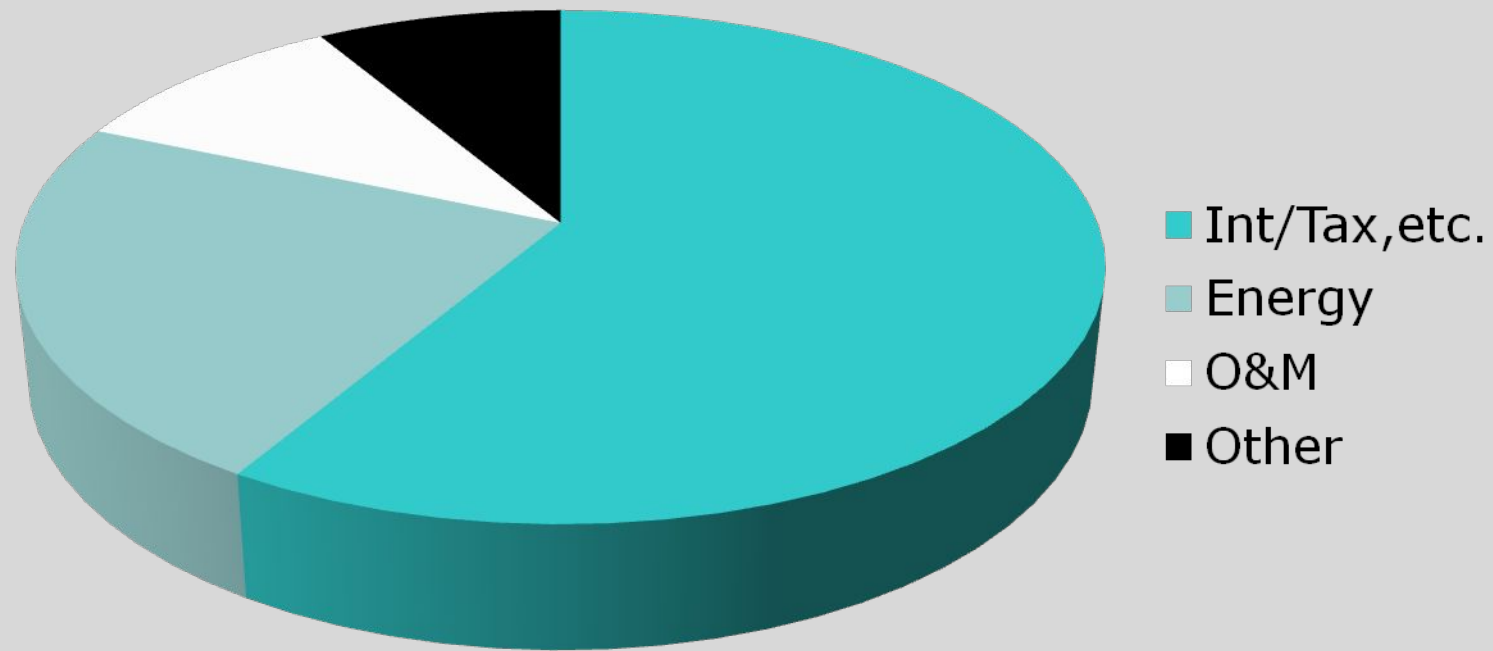
- Above Code/Certified Buildings have a higher market value than less efficient buildings.
- Research shows that, on average, certified buildings sell/lease faster than noncertified
- The odds of financial default are also one-third less for certified buildings.
- Appraisal and Equity \$\$

Lender Specification

- *“This Building is being built/renovated/updated to standards above prevailing code. It is designed and constructed with unique features and materials and with high efficient equipment and in accordance with high efficiency standards. The Lender shall choose an Appraiser educated and knowledgeable in this type of valuation of these specialized Buildings. It is understood that unless said Appraiser can provide verification of education and knowledge, they will not be permitted to conduct the appraisal for this project.”*

Equity!

Cost



Monthly Financial Snapshot



Thank you!!!

**Matt Belcher
(314) 749-4189**

matt@verda-solutions.com

Commercial Energy & Building Codes Updates and Applications;

**Wednesday, July 19, 10 a.m. – 12 p.m. CDT: COMcheck
Walk-through**

Nebraska Energy Code: COMcheck Walk-through Tickets, Wed, Jul 19,
2023 at 10:00 AM | Eventbrite

