

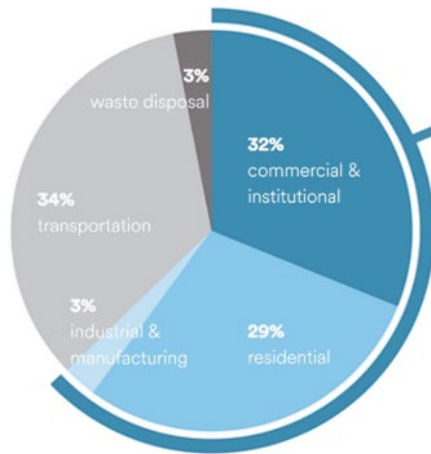


Gearing up for 2021 IECC Kick-off Event

April 10, 2023



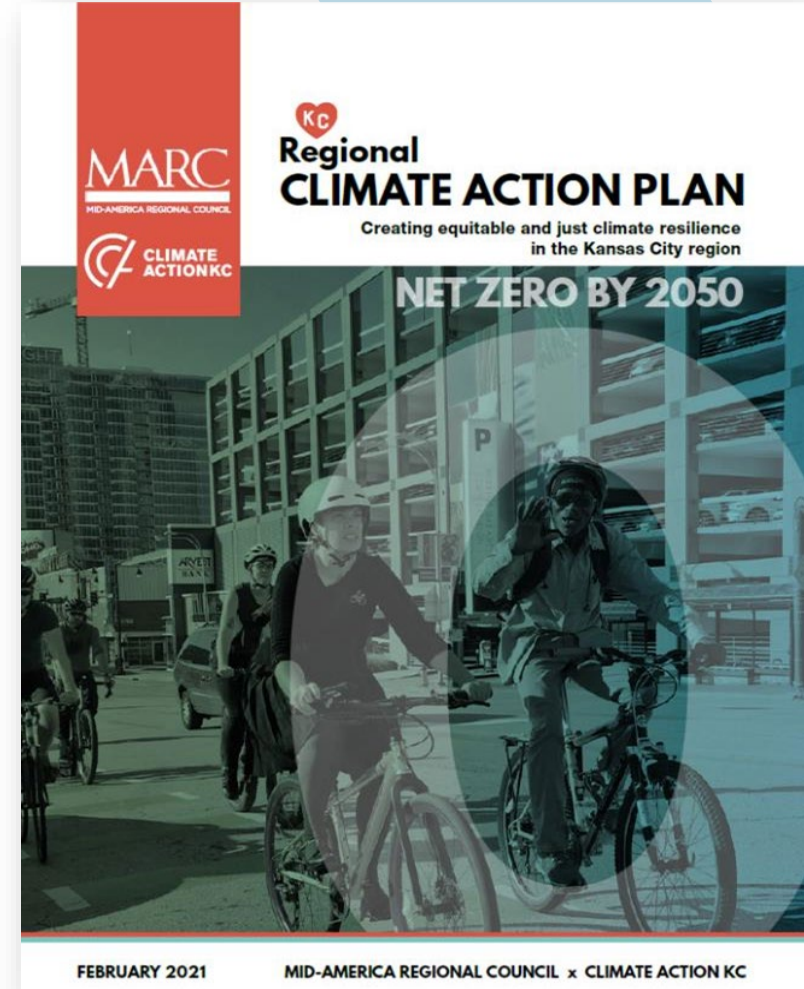
Regional Climate Action Plan | Buildings



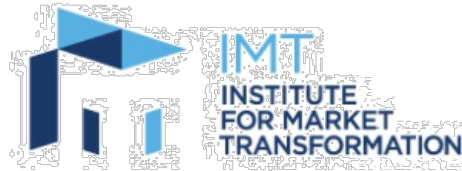
63%
BUILDINGS

of Kansas City Metro Area's Greenhouse Gas Emissions are **BUILDINGS**

Greenhouse Gas Inventory of Metropolitan Kansas City, MARC, 2021



National Partners + Mentors



ELEVATE ENERGY
Smarter energy use for all

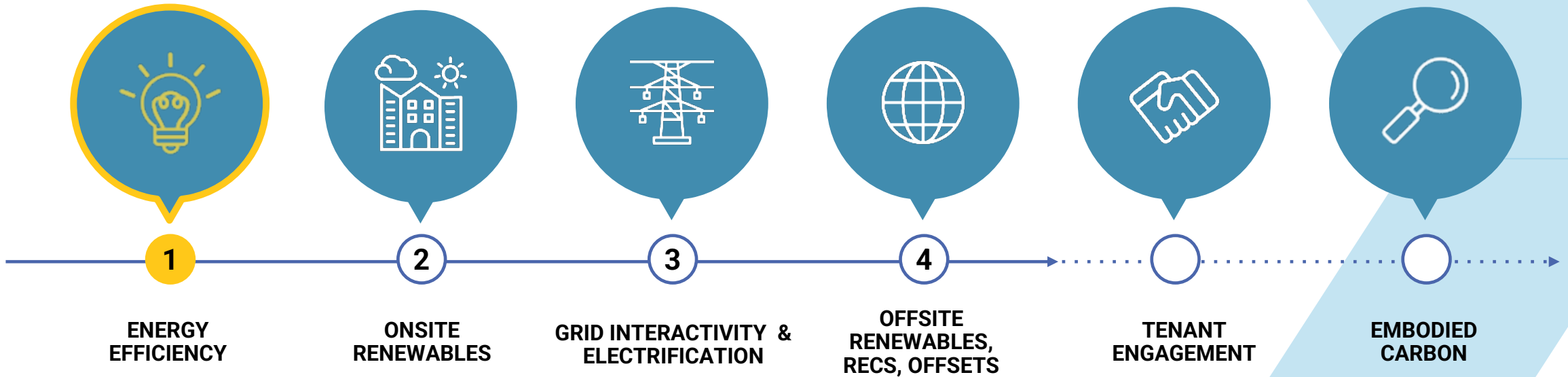


ULI Greenprint Center for Building Performance



Journey to Portfolio-Wide Net Zero

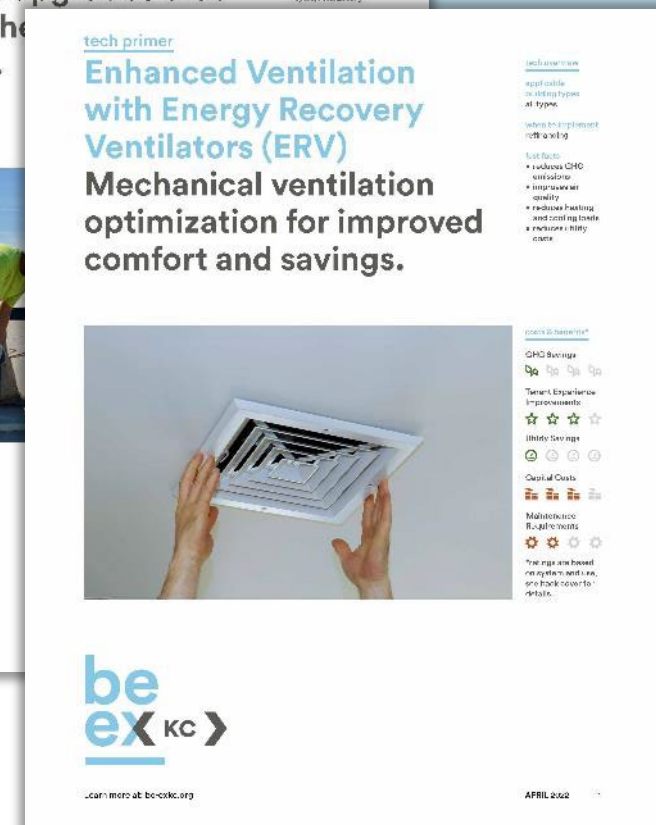
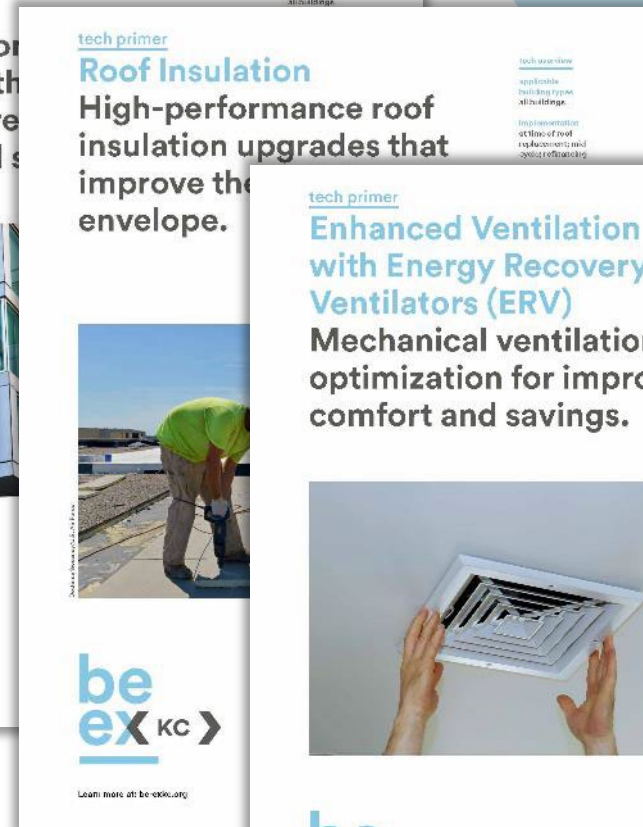
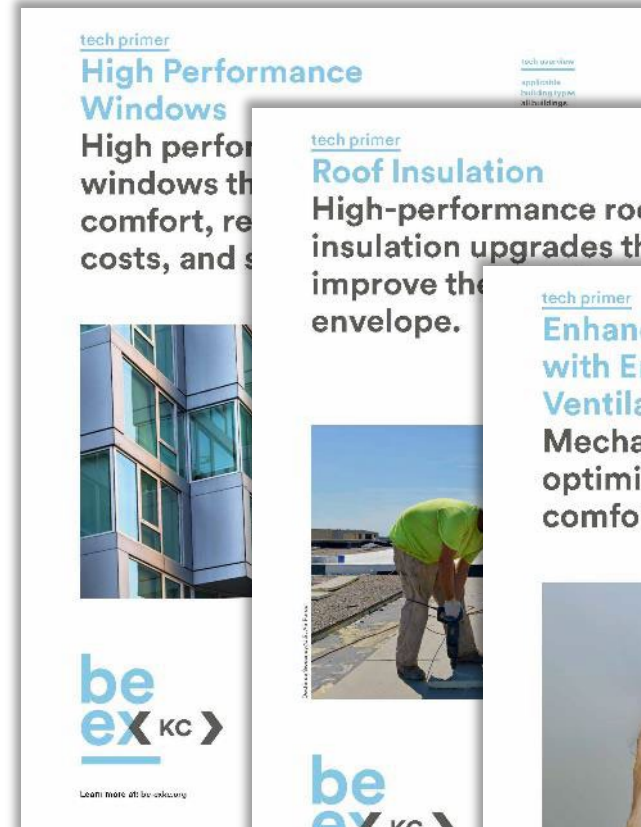
A net zero building portfolio is highly efficient and fully powered by on-site and off-site renewable energy sources and offsets



Resource | Building Decarb Toolkits

www.be-exkc.org/resources

- LED Retrofits
- High Performance Windows
- Envelope Insulation
- Air Sealing
- Solar PV
- DOAS and ERV
- Tenant Energy Use Reduction
- Heat Pumps
- POU Domestic Hot Water





City of Kansas City, MO

Administrative Considerations





EXCLUSIVE SNEAK PREVIEW!

COMMERCIAL ENERGY CODES COURSE FOR NEW AND EXISTING BUILDINGS

TUESDAYS, MAY 3, 17, 31 - JUNE 14TH, 10:30 AM-12:30 PM

Instructor: Matt Belcher



INTRODUCTIONS





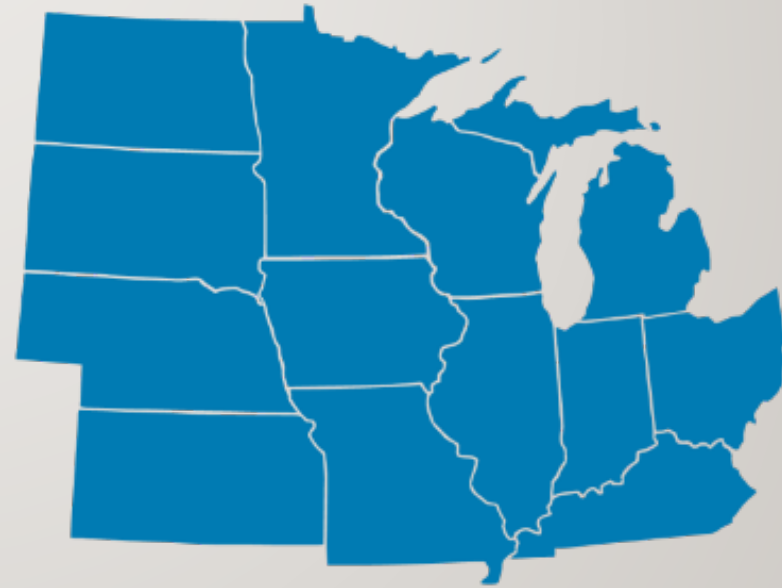
ABOUT MATT/VERDATEK SOLUTIONS

- 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, Advanced Business Management

ABOUT MEEEA

THE TRUSTED SOURCE ON ENERGY EFFICIENCY

- Nonprofit membership organization with 160+ members
- Serve 13 Midwest states
- Resource and champion for energy efficiency
- Our mission: advancing energy efficiency in the Midwest for sustainable economic development and environmental stewardship



ENERGY CODES TRAINING PROGRAM

- Goal: prepare the Missouri's workforce for upcoming changes in construction best practices
- Commercial Energy Code
- Focused on providing training to builders, code officials, design professionals, public officials and students
- For more information, visit:

<https://www.mwalliance.org>

SYLLABUS

1. Introduction and Energy Code History
2. Basic Building Science
3. IECC V.ASHRAE. Building Team/Energy Modeling
4. The Building Envelope
5. Mechanical Systems
6. Electrical/Lighting/Power Systems
7. Advanced Energy Components and Technologies
8. Energy Code Benefits, Economics and Marketing, and Final Exam

SESSION SCHEDULE

Date	Topic
May 3rd Session 1 Part 1	Introduction and History of Energy Codes
May 3rd Session 1 Part 2	Building Science
May 17th Session 2 Part 1	IECC vs.ASHRAE
May 17th Session 2 Part 2	Commercial Energy Codes Basics
May 31st Session 3 Part 1	Mechanical Systems
May 31st Session 3 Part 2	Electrical: Lighting and Power Systems
June 14th Part 1	Comcheck Overview & Advanced Technologies
June 14th Part 2	Commissioning, Business Benefits, Marketing and Course Review

COMMERCIAL ENERGY CODE – IECC SESSION I

HISTORY OF BUILDING CODES

INSTRUCTOR: MATT BELCHER

TUESDAY, MAY 3RD 10:30AM-12:30 PM

CODE OF HAMMURABI – THE FIRST KNOWN BUILDING CODE

- The Code of Hammurabi is a well-preserved Babylonian code of law from ancient Mesopotamia, circa 1754 BCE. The sixth Babylonian king, Hammurabi, enacted the code.
- The basic idea is an eye for an eye. Meaning if you build a building and it collapses and kills someone. The penalty is Death....



BUILDING CODE HISTORY



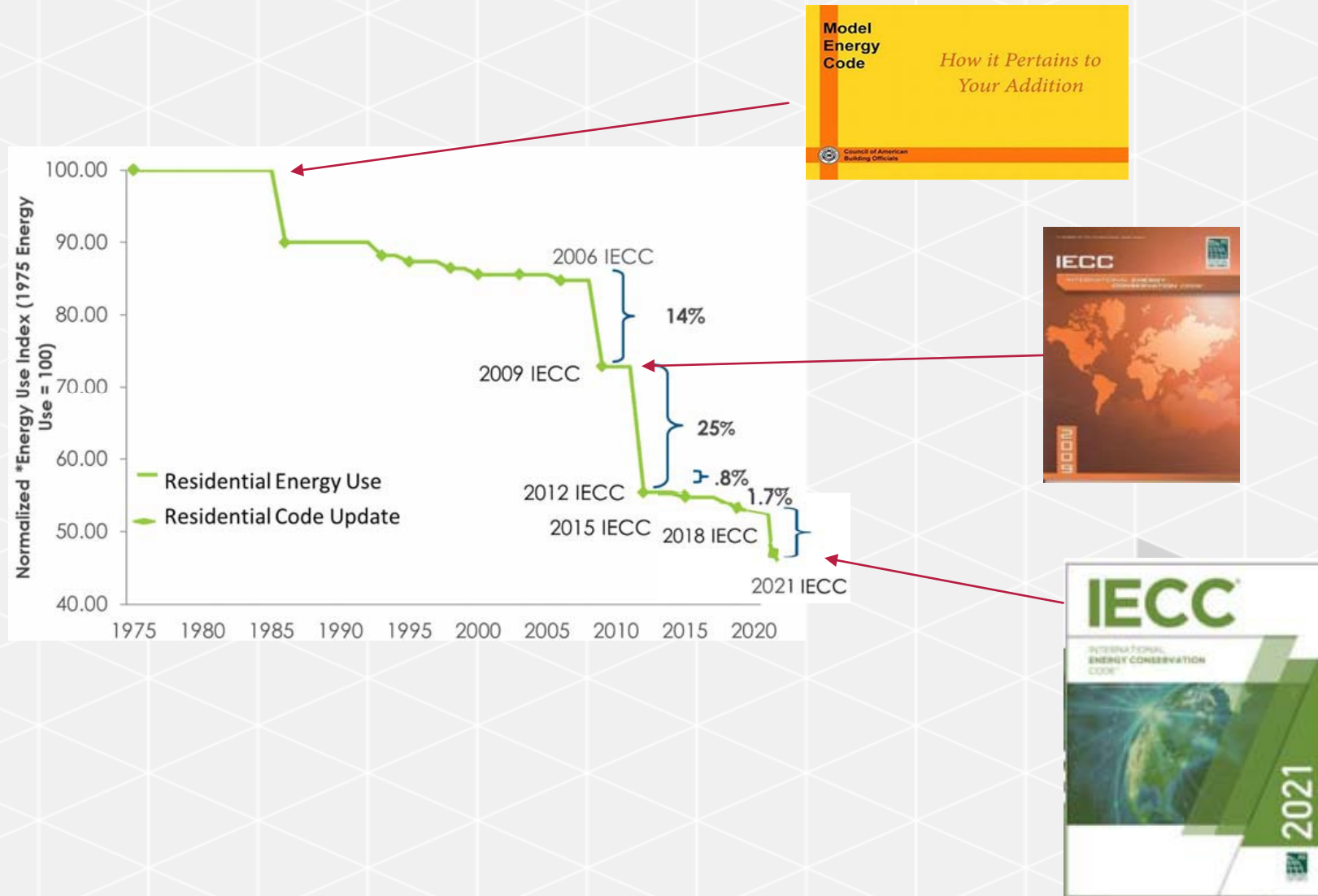
“Legacy Codes”

INTERNATIONAL ENERGY CONSERVATION CODE (IECC)

- Developed by the International Code Council
 - Robust stakeholder process
 - Proposed changes accepted from all parties
- New editions published every 3 years



ENERGY CODE BACKGROUND

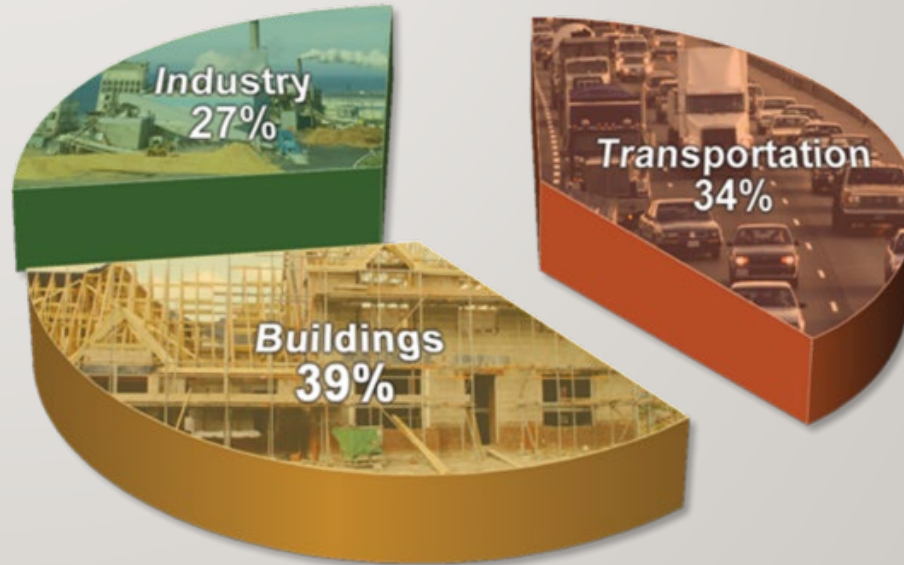


ABOVE CODE PROGRAMS

- National Green Building Standard
- Energy Star
- Building America's Builder's Challenge (Challenge Home)
- Active House
- LEED-H

WHY ARE ENERGY CODES IMPORTANT?

- Reduce energy use of buildings
- Impacts energy use for the life of a building
 - Most cost-effective to implement during initial design and construction
- Benefits building owners and operators by guaranteeing a minimum of efficiency
- Health and resilience benefits to building owners and occupants



MOVING FORWARD

- **2021 IECC & IECC-R**
- Major changes
- ASHRAE as an Alternative, not just a reference.
- More daylighting/Alternative Energy references.



Peeking over the Horizon:

- **2024 Moving from an Energy Code to a National Standard.**
- Updates on progress
- What the new process entails.
- What to expect.
- How to be involved!

COMMERCIAL ENERGY CODE –IECC SESSION 1 PART 2

ENERGY CODES & BUILDING SCIENCE

INSTRUCTOR: MATT BELCHER

TUESDAY, MAY 3RD 10:30 AM-12:30 PM

PART 2 BUILDING SCIENCE

Objectives: Building Science

- Advanced Detailed Physics
- Water (aka: “The Enemy”)
- Air & Air Movement
- Temperature & Temperature Transfer
- Building Envelope
- Quality Control
- Tightness testing



ADVANCED PHYSICS IN BUILDING SCIENCE:

Hot

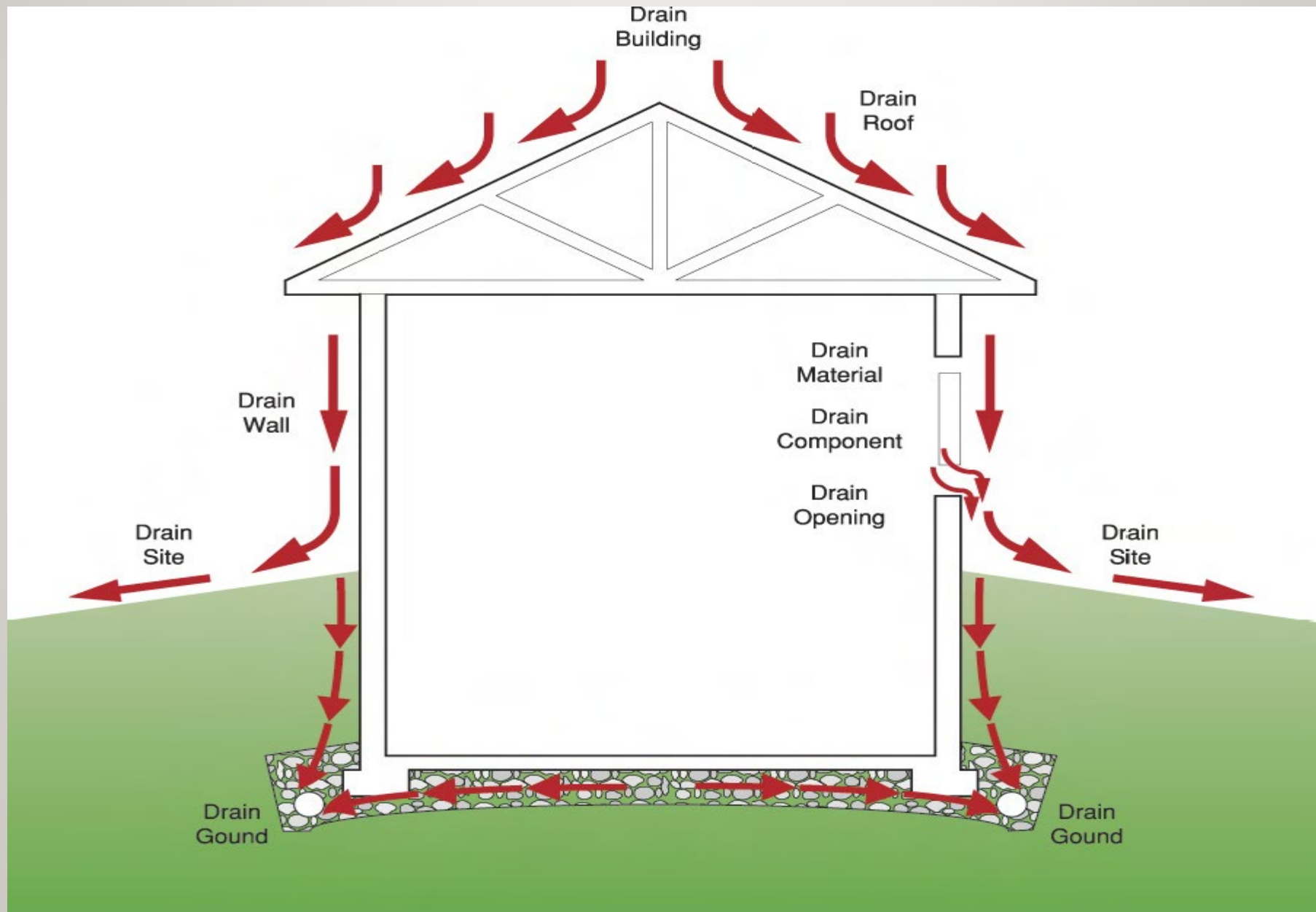


Cold

Wet



Dry



WATER: A Builder's (and Buildings) worst enemy!

AIR TRANSPORT OF WATER VAPOR – PRIORITY #3

- Air leakage
 - Moisture flow
 - 4X8 Drywall
 - 70 F
 - 40% RH
 - 1 square inch hole
- Flow quantity
 - 30 Quarts of water!!

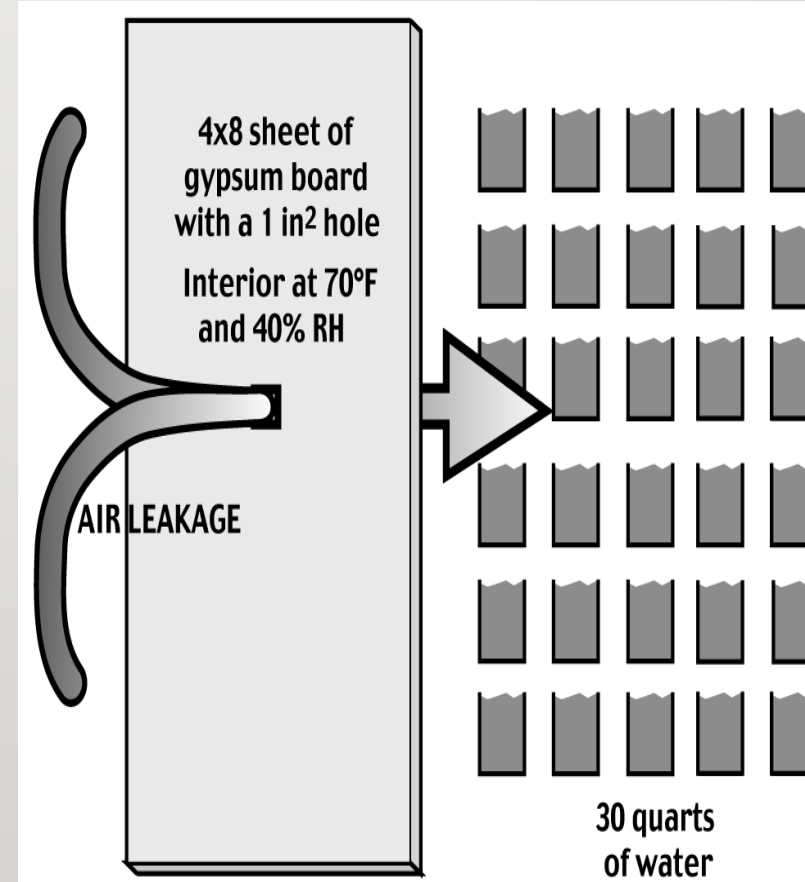


Image courtesy of Building Science Corp.

THE MAJOR “DAMAGE FUNCTIONS”

- Liquid water (bulk and capillary)
- Air-borne water
- Vapor
- Radiation (uv degradation)
- Pests
- People

THE MAJOR BUILDING ENVELOPE PROTECTION SYSTEMS

- Water Barrier
- Air Barrier
- Thermal Barrier
- Vapor Profile (not just the designated vapor retarder)
- Finishes (UV protection)
- Commissioning & Maintenance documents

QUALITY MANAGEMENT

- Moisture Control testing prior to cover up.



COMMERCIAL ENERGY CODE – IECC SESSION 2 PART 1

IECC VS. ASHRAE

INSTRUCTOR: MATT BELCHER

TUESDAY, MAY 17TH 10:30 AM-12:30 PM

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

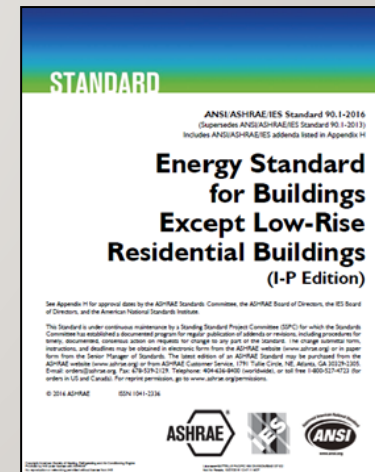
OR

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

STRUCTURE OF STANDARD 90.1-2016

1. Purpose
 2. Scope
 3. Definitions, Abbreviations, and Acronyms
 4. Administration and Enforcement
 5. **Building Envelope**
 6. **Heating, Ventilating, and Air Conditioning**
 7. Service Water Heating
 8. Power
 9. **Lighting**
 10. Other Equipment
 11. Energy Cost Budget Method
 12. Normative References
- Normative Appendices A-H
Appendix G – is a new compliance path!



In addition to IECC:

ASHRAE 90.1 2016 SECTION 5: BUILDING ENVELOPE OVERVIEW

- **Referenced Standard in 2018 IECC. Alternative Method in 2021 IECC.**
- Applies to:
 - New, and new portions of, *buildings* and their *systems*
 - New *systems* and *equipment* in *existing buildings*, and
- Does not apply to:
 - Single-family houses, low-rise multi-family ≤ 3 stories above *grade*, manufactured houses (mobile or modular)
 - *Buildings* that use neither electricity nor *fossil* fuel
- Does not circumvent any safety, health, or environmental requirements



MANDATORY REQUIREMENTS

- 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

COMMERCIAL ENERGY CODE –IECC SESSION 2 PART 2

COMMERCIAL ENERGY CODE BASICS

INSTRUCTOR: MATT BELCHER

TUESDAY, MAY 17TH 10:30 AM-12:30 PM

3 | STRUCTURE OF COMMERCIAL 2018 IECC

- Ch. 1 Scope and Application / Administrative and Enforcement
- Ch. 2 Definitions
- Ch. 3 General Requirements
- Ch. 4 Commercial Energy Efficiency
- Ch. 5 Existing Buildings
- Ch. 6 Referenced Standards
- Index

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



BUILDING ENVELOPE COMPLIANCE OPTIONS

3 Methods for compliance of building components:

- C402.1.3 – Insulation component R-value based method
- C402.1.4 – Assembly U-factor, C-factor or F-factor based method
- C402.1.5 – Component Performance Alternative

MECHANICAL SECTION C403 REORGANIZATION

- For 2018 IECC, there was a major reorganization of the mechanical section (C403)
- Rather than separate mandatory (C403.2) and prescriptive requirements by section group:
 - Similar requirements were brought together
 - Mandatory requirements were indicated (Mandatory) for each section. Sections without the “Mandatory” designation are prescriptive.
- As a result, familiar section numbers have likely changed
- **See individual sections for exceptions**

Mechanical sections:

C403.1: General (Loads)

C403.2: System Design

C403.3: Equipment
Efficiencies & Specs

C403.4: HVAC Controls

C403.5: Economizers

C403.6: Multi-zone/VAV

C403.7: Vent & Exhaust

C403.8: Fan Eff. & Controls

C403.9: Heat Rejection

C403.10: Refrigeration

C403.11: Construction

C403.12: Outside Bldg.

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

COMMERCIAL
ENERGY CODE –IECC
SESSION 3 PART I
COMMERCIAL MECHANICAL SYSTEMS

INSTRUCTOR: MATT BELCHER

TUESDAY, MAY 31ST 10:30 AM-12:30 PM

HVAC LOAD CALCULATIONS

SECTION C403.1.1 (MANDATORY)

Heating and cooling load sizing calculations required:

- ASHRAE/ACCA Standard 183

- OR -

- Other approved computation procedures – defined in Chapter 3
 - Interior design conditions specified by Section C302
 - $\leq 72^{\circ}\text{F}$ for heating load
 - $\geq 75^{\circ}\text{F}$ for cooling load
- Loads reduced from energy recovery systems utilized in the HVAC system shall be accounted for in accordance with the ASHRAE HVAC Systems and Equipment Handbook

ASHRAE 90.1 - 2016

SPACE CONDITIONING CATEGORIES & BASIS - 5.1.2

Envelope Requirements Are Specified by Space-Conditioning Categories

- Conditioned space must be
 - a *cooled space* with a cooling system sensible cooling output capacity larger than 3.4 Btu/h·ft² of floor area
 - a *heated space* with a heating system output capacity larger than that specified in table below
 - Or, an *indirectly conditioned space*

Heating Output, Btu/h·ft ²	Climate Zone
>5	0, 1, 2
>9	3A, 3B
>7	3C
>10	4A, 4B
>8	4C
>12	5
>14	6
>16	7
>19	8

VENTILATION

SECTION C403.2.2 (MANDATORY)

- Natural and mechanical ventilation to be provided in accordance with Chapter 4 of the IMC
- If mechanical: system to provide the capability to reduce outdoor air supply to minimum required by IMC Chapter 4

COMMERCIAL
ENERGY CODE –IECC
SESSION 3 PART 2
COMMERCIAL LIGHTING AND POWER SYSTEMS

INSTRUCTOR: MATT BELCHER

TUESDAY, MAY 31ST 10:30AM -12:30 PM

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

INTERIOR LIGHTING POWER ALLOWANCE

SECTION C405.3.2

Two methods to determine Lighting Power Allowance:

- Building Area Method
 - Floor area for each building area type x value for the area
 - “area” defined as all contiguous spaces that accommodate or are associated with a single building area type as per the table
- Space-by-Space Method
 - Floor area of each space x value for the area
 - Then sum the allowances for all the spaces
 - Some tradeoffs among spaces are allowed

LIGHTING CONTROLS

SECTION C405.2 (MANDATORY)

Lighting systems required to be provided with controls as specified for:

- Occupant sensor controls – C405.2.1
- Time-switch controls – C405.2.2
- Daylight-responsive controls – C405.2.3
- Specific application controls – C405.2.4
- Manual controls – C405.2.5
- Exterior lighting controls – C405.2.6

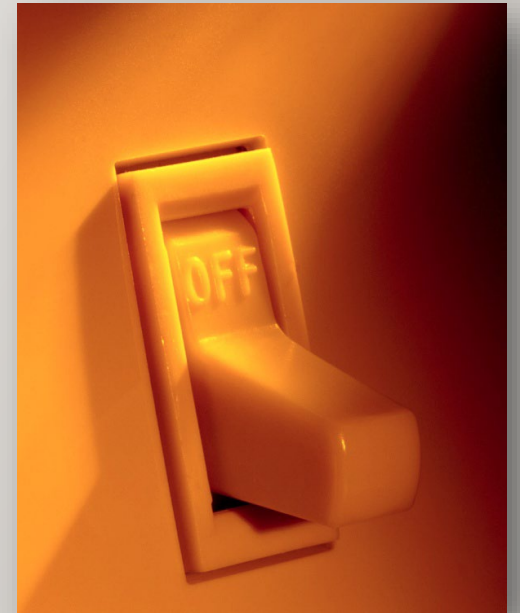


Image: U.S. Dept of Energy

DWELLING ELECTRICAL METER SECTION C405.5 (MANDATORY)

Separate metering required for each dwelling unit



Image: chariotenergy.com

COMMERCIAL ENERGY CODE – IECC SESSION 4 PART I

*COM CHECK BASICS AND
ADVANCED TECHNOLOGY*

INSTRUCTOR: MATT BELCHER

TUESDAY, JUNE 14TH 10:30 AM-12:30 PM

Commercial Compliance Tools

46

Free

Desktop Software Tools



Web-Based Tools





Printed Materials



Compliance Guides
Prescriptive Tables

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..."/>				

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

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



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

ADVANCED FRAMING

- Everything lines up!
- 2x6 framing @ 24" centers
- **Fewer studs = more insulation = better efficiency**

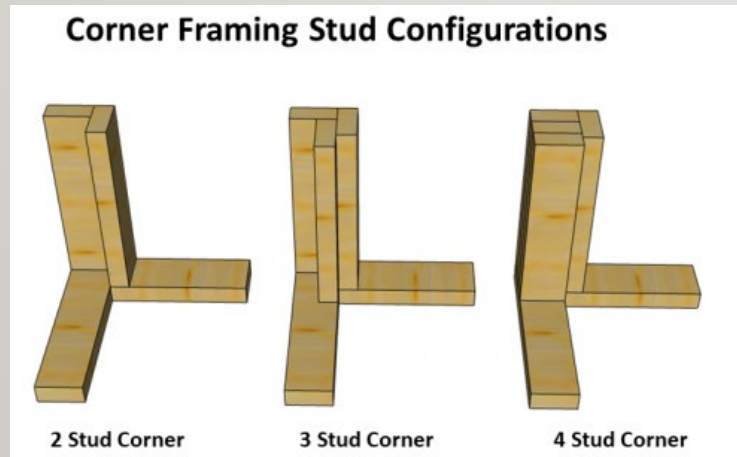
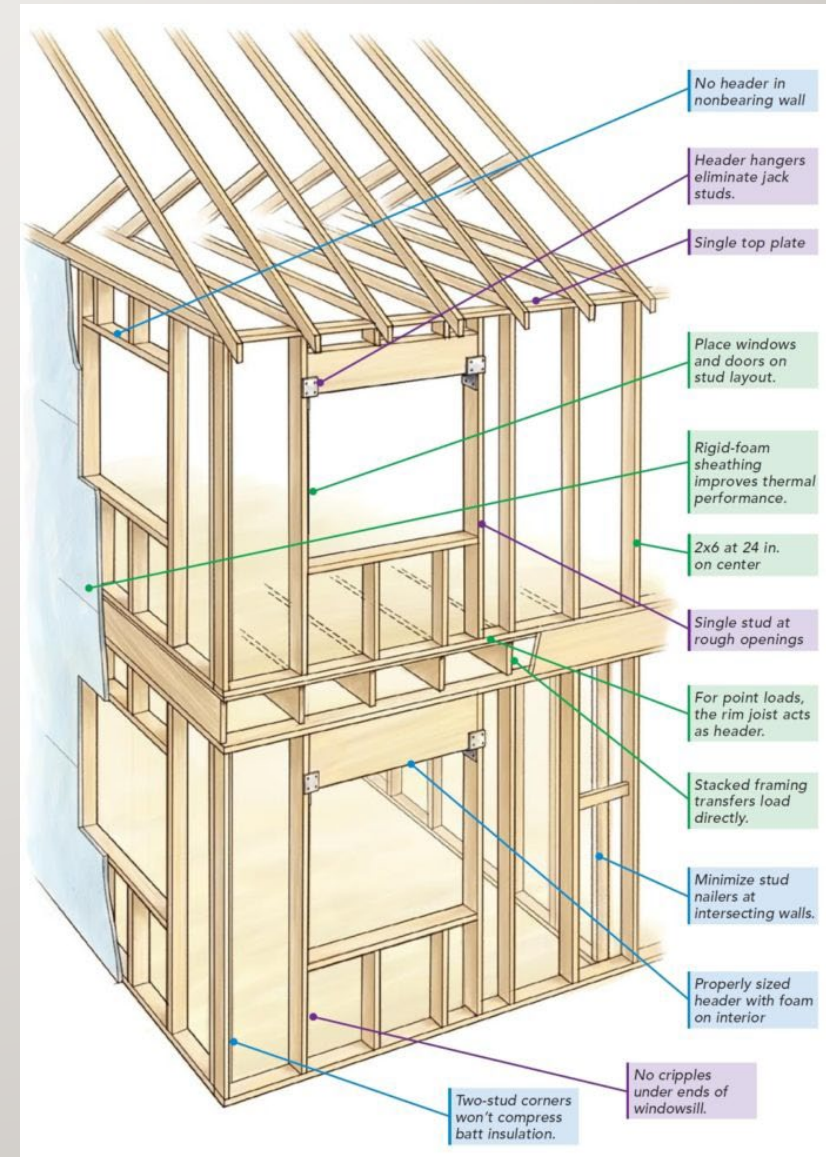


Image: greenbuildingadvosor.com; builderscalculator.com



PHASE CHANGE MATERIALS

- Store thermal energy via the latent heat of phase transitions
- Buffers thermal swings in buildings
- Stores solar thermal energy for short-term or seasonal applications

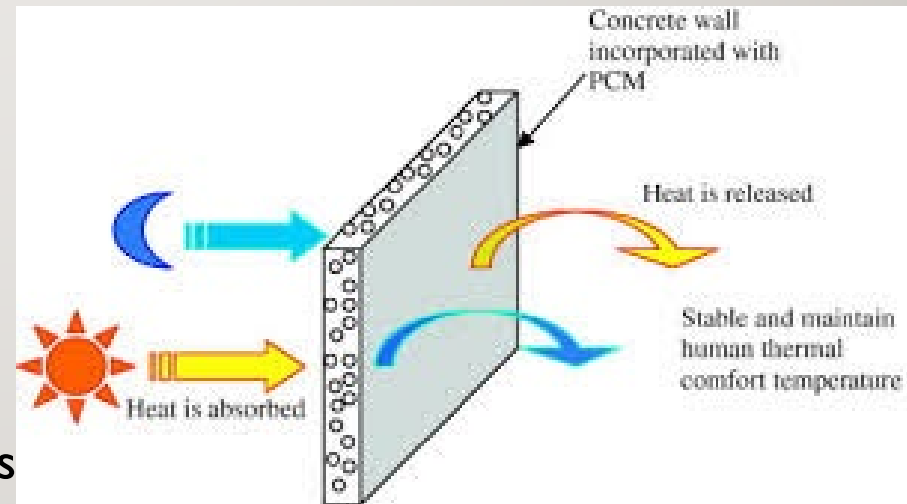


Image: sciencedirect.com

MODULAR/VOLUMETRIC

- Gaining single family market share
- *REALLY* gaining multi-family market share



Image: bonestructure.ca; columnandbeam.com

EV READY AND EV CAPABLE

- EV Chargers
 - Level 1 EVSE – Charging through 120V AC plug
 - Adds 2-5 miles of range per hour of charging
 - No special equipment, but does require dedicated branch circuit
 - Level 2 EVSE – Charging through 240V AC plug
 - Adds 10-60 miles of range per hour of charging
 - Requires special charging equipment and dedicated electrical circuit of 20-100 amps
 - More expensive than Level 1
- EVs can also serve as a home battery in the future



Images: [tesla.com](https://www.tesla.com); [wsj.com](https://www.wsj.com)

MICROGRIDS

- A small, decentralized group of electricity sources and loads
- Normally operates connected to with the traditional grid
- Can "island mode" and function autonomously
 - Resilience benefits
- Saves energy because of the reduced transmission losses
- Saves even more energy, depending on the microgrid's storage capability, power source and other factors.

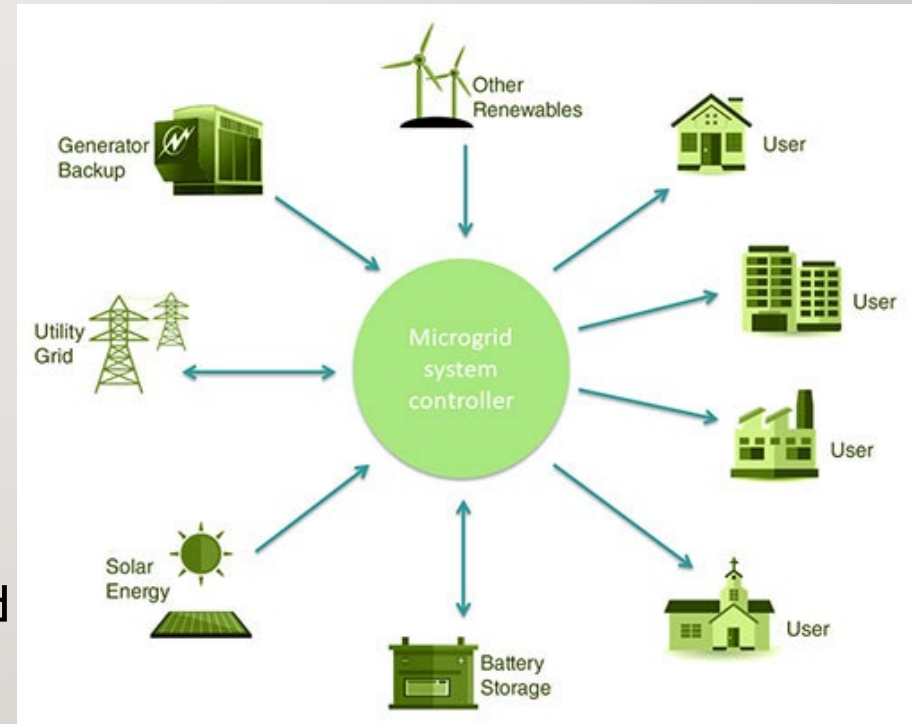


Image: strategicmicrogrid.com

COMMERCIAL ENERGY CODE –IECC SESSION 4 PART 2

COMMISSIONING AND THE BUSINESS BENEFITS

INSTRUCTOR: MATT BELCHER

TUESDAY, JUNE 14TH 10:30 AM-12:30 PM

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



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

HVENTILATEAC: MINIMUM VENTILATION GUIDELINE

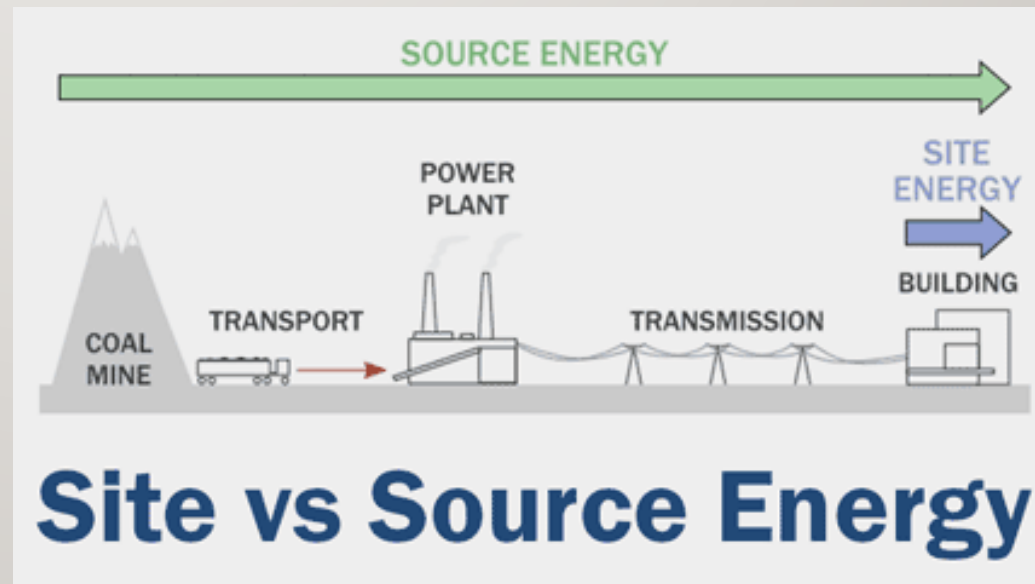
- Blower door test result is in CFM.
- Converting to ACH creates a baseline for a building's MVG:
 - \geq the MVG, then no additional ventilation is needed.
 - \leq the MVG, then mechanical ventilation is required.
- Achieving the MVG should be planned for in advance.



Courtesy of AC Tool Supply, Inc.

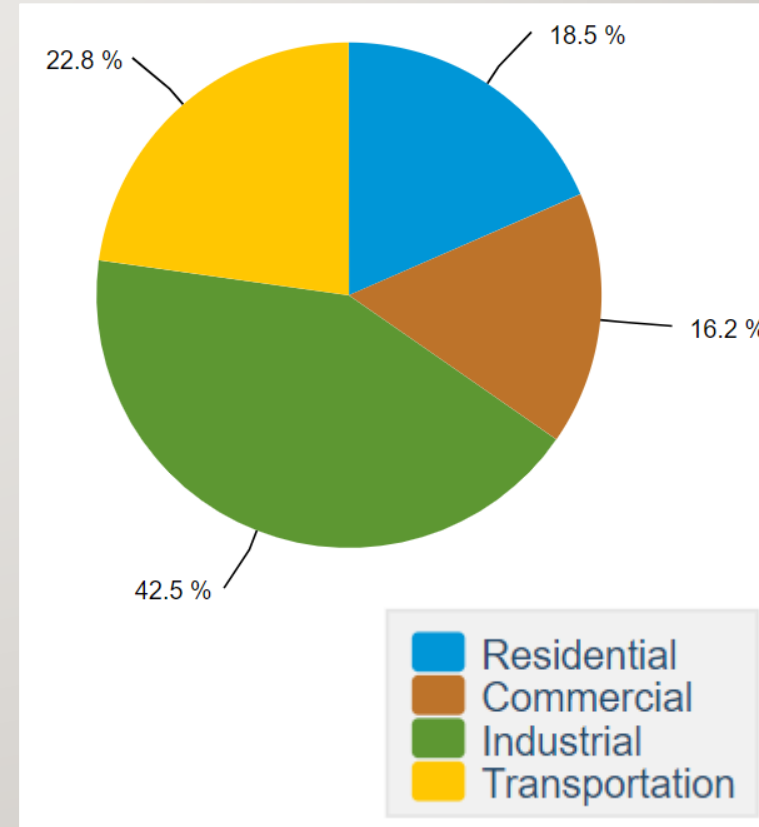
ENERGY CODE ECONOMICS

- DOE conducts technical analysis evaluating the impacts of the updated code (relative to the previous edition). DOE estimates national savings for:
 - Energy cost savings
 - Source energy savings
 - Site energy savings



ENERGY USE BY SECTOR

- Buildings account for nearly 50% of energy use*
- Big opportunity to reduce consumption through building energy efficiency
 - Updated energy codes
 - Improved compliance
 - Advanced technologies

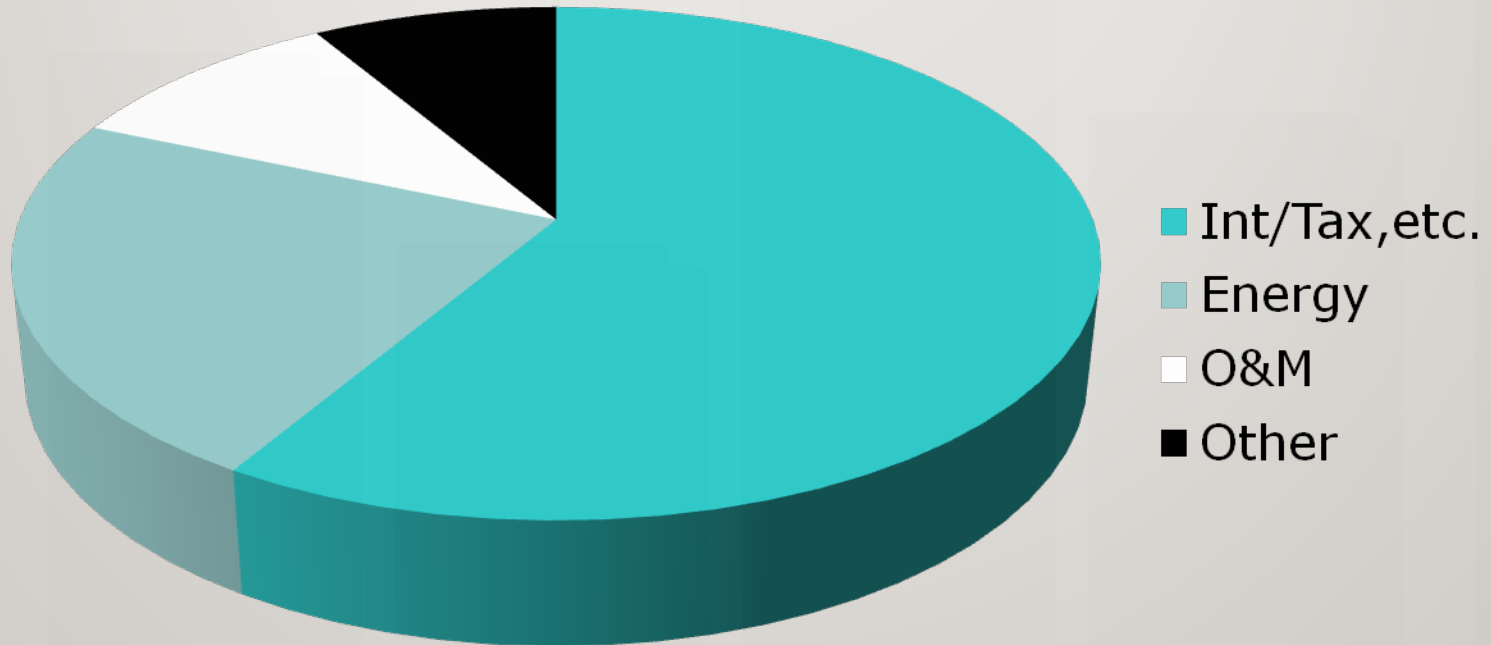


TOP 2 PRIORITIES: INCREASED COMFORT AND SAVING MONEY

- Use technology and data to your advantage
 - Show concrete and measurable data using thermal imaging, temperature readings and manometers used in blower door testing
- Assurance = Less liability = High referral rate
- More control over the building
- As an industry, we continue to leverage technology to offer better ways to lower utility expenses, increase comfort and help keep the environment clean.

EQUITY!

Cost



Monthly Cost

THANK YOU! QUESTIONS?

Matt Belcher, Verdatek Solutions

matt@verda-solutions.com

Cell: (314) 749-4189

Michelle Thorsell MEEA

MThorsell@mwalliance.org



Don't Forget to Register!

www.be-exkc.org/news

Designing + Building to **2021 IECC**

April 10th: Gear Up for 2021 IECC Kick-Off Event

May 3rd: Commercial Energy Code Basics*

May 17th: Understanding the Building Science*

May 31st: IECC vs. ASHRAE*

June 14th: ComCheck + Advanced Technology*

***1.5 AIA Credits Each**

May 3rd-June 14th are virtual events, April 10th is in-person



Questions? Contact: Ashley Sadowski, asadowski@be-exkc.org

