

UPDATING VERMONT'S COMMERCIAL ENERGY CODE

Stakeholder Input Meetings

JUNE 19 AND 25, 2014

http://publicservice.vermont.gov/topics/energy_efficiency/code_update



Welcome and Purpose

- ▶ To get stakeholder input on specific Commercial Building Energy Standards (CBES) requirements
- ▶ NOT for wordsmithing– please submit suggestions (online or paper)

Agenda

- ▶ 1:00 Introductions / Background
- ▶ 1:20 Overview of Code Structure
- ▶ 1:30 Proposed Code Changes
(Scope/Existing Buildings, Envelope, Mechanical)
- ▶ 2:30 Break
- ▶ 2:45 Proposed Code Changes
(SWH, Lighting, Add'l Efficiency, Commissioning)
- ▶ 3:45 Wrap-up
- ▶ 4:00 Adjourn

Introductions / Background

Introductions–Update Team

- ▶ Kelly Launder and Barry Murphy, *Vermont Public Service Department*
- ▶ Stu Slote and Tim Guiterman, *Navigant*
- ▶ Richard Faesy and Jim Grevatt, *Energy Futures Group*
- ▶ Eric Makela, *Britt Makela Group*
- ▶ Jim Edelson, *New Buildings Institute*
- ▶ Mike DeWein, *Consultant*

Introductions–Attendees

- ▶ Who are you?
- ▶ What organization do you represent?
- ▶ What is your stake in the codes update?

Background

- ▶ Energy code update required by Vermont Law
- ▶ Residential Building Energy Standards (RBES)
- ▶ Commercial Building Energy Standards (CBES)
- ▶ Every 3 years
- ▶ Process managed by Public Service Department

Background

- ▶ Act 89–
 - Town administrator requirements
 - Provide information
 - Certificate of Occupancy tied to code certificate
 - Stretch code for residential
 - Adoption by local jurisdictions; optional
 - Act 250

Schedule for Update Process

- ▶ Stakeholder meetings mid-June
- ▶ Comment period ends July 9
- ▶ Draft filed with LCAR by end of July
- ▶ Public Hearing – September
- ▶ End of Public Comment period –1 week following Public Hearing
- ▶ File rule with LCAR and LCAR hearing– October 2014
- ▶ Target Code Adoption Date – December 2014
- ▶ Target Code Effective Date – March 2015

Public Comments

- ▶ Due by July 9
- ▶ http://publicservice.vermont.gov/topics/energy_efficiency/code_update



The screenshot shows the Vermont Public Service Department website. The header includes the Vermont logo and the text "Public Service Department State of Vermont". A navigation menu contains links for "PSD Home", "About Us", "Contact Us", "Announcements", "Request for Proposals & Info", "Public Service Board Website", and "Site Map". A sidebar on the left lists various topics. The main content area features a "Commercial Building Energy Standards Update Feedback Form" with a request for feedback on proposed updates to the 2011 Vermont Commercial Building Energy Standards (CBES). The form includes fields for Name, Email, Company/Organization, Town/City, and Code Topic, all marked as required.

Public Service Department
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Commercial Building Energy Standards Update Feedback Form

Please use the below form to provide feedback on the proposed updates to the 2011 Vermont Commercial Building Energy Standards (CBES).

Name: *

Email: *

Company/Organization: *

Town/City: *

Code Topic: *

Overview of Code Structure

Foundational Document

2011 CBES	2015 CBES
2009 IECC (w/ significant adds from 2012 IECC and ASHRAE 90.1–2010)	2015 IECC (and ASHRAE 90.1–2013)

- ▶ 2012 IECC represented significant change to historically “simple” IECC format
 - VT Core Performance → MA Stretch Code → 2012 IECC → 2015 IECC
- ▶ 2015 IECC cleaned, clarified, improved and added

Chapter Overview

1. Scope and Administration
2. Definitions
3. General Requirements
4. Commercial Energy Efficiency
 - C408: System Commissioning *(NEW)*
 - C406: Additional Efficiency Package Options *(New)*
5. Existing Buildings *(NEW)*
6. Referenced Standards

Today's Process

- ▶ High-level overview (via slides)
- ▶ Examine code language (via code document)
- ▶ Q&A and discussion throughout
 - Mindful of time/agenda
 - Detailed discussions can happen at breaks, after meeting or via phone/email/in-person

Proposed Code Changes: C101 Scope/ Chapter 5 Existing Buildings

C101: Scope/General Requirements

- ▶ C101.4.1 Mixed occupancy
 - Clarified for consistency with state statute

- ▶ C101.5.2 Exempt Buildings
 - Greenhouses added
 - Consider adding temporary language to inflatable buildings exemption

- ▶ C103.3.1 Approval of construction documents
 - Need to clarify only one set of drawings required

Chapter 5: Existing Buildings

“The updates related to existing and historic buildings clarify and further extend the code’s impact on the current building stock and will mean large energy savings growing over time. Taken together, the approved code changes represent the most significant code revisions for energy consumption of existing buildings since the 1970s,”

–Jim Edelson, New Buildings Institute (NBI) Senior Manager of Codes and Policy

Chapter 5: Existing Buildings

- ▶ Expanded from minor, confusing section to separate chapter with five parts:
 - C501: General (includes historic buildings)
 - C502: Additions
 - C503: Alterations
 - C504: Repairs
 - C505: Change in Occupancy or Use

Chapter 5: Existing Buildings

▶ C501.2 Existing buildings.

“Except as specified in this chapter, this code shall not be used to require the removal, *alteration* or abandonment of, nor prevent the *continued use* and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code.”

Chapter 5 Existing Buildings

▶ C501.5 Historic Buildings

- Eliminates the blanket exemption
- Requires the submission of a report detailing why any code provision would be detrimental to the historic character of the building

Chapter 5 Existing Buildings

▶ C503 Alterations

- Lighting system requirement has biggest impact on existing building energy use
- $\geq 10\%$ new fixtures in a *space* triggers all lighting section requirements

- ▶ C503.6 Lighting systems. New lighting systems that are part of the *alteration* shall comply with Section C405.

Exception. *Alterations* that replace **less than 10 percent** of the luminaires in a space, provided that such *alterations* do not increase the installed interior lighting power.

Proposed Code Changes: C402 Building Envelope

C402: Building Envelope

- ▶ C402.1.4.1 Thermal resistance of cold-formed steel walls
- ▶ $U = 1 / [R_s + (ER)]$
 - Effective R-value (ER) of assemblies de-rated
 - Possibly more insulation than previously assumed to comply
 - Conferring with PNNL, as these values don't align with ASHRAE

C402: Building Envelope

- ▶ Table C402.1 (Opaque Envelope)
 - Refer to code for details on insulation values
 - Discussion Points:
 - Consider higher R-value for Insulation entirely above deck?
 - Metal building descriptions will be added
 - Wall continuous insulation (ci) values to be aligned
 - Non-swinging door: Consider higher R-value?
 - Upward-acting door: Consider R-14.5?

C402: Building Envelope

- ▶ Table C402.4 (Fenestration)
 - Maximum 30% fenestration area
 - 40% in 2011 CBES
 - Discussion Points:
 - Re-organized U-factor requirements
 - Added orientation to SHGC

C402: Building Envelope

- ▶ C402.4.1.1 Increased vertical fenestration area with daylight responsive controls
 - 30–40% fenestration area if:
 - Sufficient floor area is in daylight zone
 - Daylight responsive controls installed
 - Visible transmittance (VT) of vertical fenestration is ≥ 1.1 SHGC

- ▶ C402.4.1.2 Increased skylight area with daylight responsive controls
 - 3–5% skylight area

C402: Building Envelope

- ▶ C402.4.2 Minimum skylight fenestration area
 - If: $> 2,500$ SF and high bay (> 15 feet)
 - Then: total *daylight zone* under skylights shall be not less than half the floor area **and**
 - At least 3% skylight area to daylight zone under skylights ($VT \geq 0.40$) **OR**
 - Min skylight aperture of 1%
 - Daylight responsive controls required in all qualifying zones under skylights

Proposed Code Changes: C403 Building Mechanical Systems

C403: Mechanical Systems

- ▶ Sub-sections re-organized:
 - C403.1 General
 - C403.2 Mandatory Provisions (all systems)
 - Sizing; performance requirements; HVAC system controls; economizer fault detection and diagnostics (FDD) *[NEW]*; DCV; parking garage ventilation *[NEW]*; energy recovery; kitchen exhaust *[NEW]*; duct/pipe insulation; refrigeration equipment performance *[NEW]*;
 - C403.3 Economizers (Prescriptive)
 - C403.4 Hydronic and multiple-zone HVAC systems controls and equipment. (Prescriptive)
 - C403.5 Refrigeration systems

C403.2 – Discussion Points (1)

- ▶ Electric resistance prohibition
 - C403.2.4.1.1: Applies to heat pump supplementary heat. Still appropriate?
- ▶ C403.2.4.7 Economizer fault detection and diagnostics (FDD)
 - Based on Title 24
 - What are impacts on cost (if only VT and CA have in place?)

C403.2 – Discussion Points (2)

▶ C403.2.7 Energy recovery ventilation systems

- *2011 CBES:* Systems >5,000 CFM supply air and >70% outdoor air
- *2015 CBES:* Expands requirement to systems >10% outdoor air and min supply CFM (see table)

PERCENT (%) OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE							
≥ 10% and < 20%	≥ 20% and < 30%	≥ 30% and < 40%	≥ 40% and < 50%	≥ 50% and < 60%	≥ 60% and < 70%	≥ 70% and < 80%	≥ 80%
DESIGN SUPPLY FAN AIRFLOW RATE (cfm)							
≥ 26,000	≥ 16,000	≥ 5,500	≥ 4,500	≥ 3,500	≥ 2,000	≥ 1,000	> 0

C403.2 – Discussion Points (3)

- ▶ C403.2.7 Energy recovery ventilation systems
 - *2011 CBES*: Systems >5,000 CFM supply air and >70% outdoor air
 - *2015 CBES*: Expands requirement to systems >10% outdoor air and min supply CFM (<8,000 hours/yr) and all systems >8,000 hours/yr

PERCENT (%) OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE							
≥ 10% and < 20%	≥ 20% and < 30%	≥ 30% and < 40%	≥ 40% and < 50%	≥ 50% and < 60%	≥ 60% and < 70%	≥ 70% and < 80%	≥ 80%
DESIGN SUPPLY FAN AIRFLOW RATE (cfm)							
≥ 26,000	≥ 16,000	≥ 5,500	≥ 4,500	≥ 3,500	≥ 2,000	≥ 1,000	> 0

C403.2 – Discussion Points (4)

- ▶ C403.2.9 RTU/Duct insulation
 - Consider duct insulation at minimum of wall (or roof) insulation? Align with RBES?

- ▶ C403.2.14 Refrigeration equipment performance
 - Efficiency measures now code-required
 - Display case motion sensors
 - Low-temp defrost control
 - Anti-sweat heater controls

C403.3 – Economizers

- ▶ Confirm heat pump exclusion:

“The total supply capacity of all fan-cooling units, excluding heat pumps, without economizers shall not exceed 20 percent of the total supply capacity of all fan-cooling units in the building or 300,000 Btu/h (88 kW), whichever is greater.”

C403.5– Refrigeration Systems

- ▶ **New section to codes**
 - Fan-powered condenser requirements
 - Saturated condensing temperatures
 - Condenser fan motors <1 hp: ECM, PSC or 3-phase
 - Variable speed approach
 - Multiple fans controlled in unison
 - Minimum condensing temperature setpoint <70F
 - Compressors
 - Floating suction pressure control logic (w/ exceptions)
 - Liquid sub-cooling for low-temp systems
 - Crankcase heater cycling must be enabled

Proposed Code Changes: C404 Service Water Heating

C404– Service Water Heating

- ▶ C404.2.1 High input–rated service water–heating systems
 - Water heating equipment (singular or combined) that is $\geq 1,000,000$ Btu/h:
 - $\geq 90\%$ thermal efficiency
 - Exceptions listed
- ▶ C404.5 Heated water supply piping
 - New table; two new methods. All insulated.
 - Maximum pipe length
 - Maximum pipe volume
- ▶ C404.6.1 Circulation systems
 - On–demand start/stop pump controls

C404– Service Water Heating (cont'd)

- ▶ C404.6.2 Heat trace systems
 - Electric heat trace systems must be controlled to adjust energy input and turned off by demand

- ▶ C404.6.3 Hot water storage controls

- ▶ C404.7 Demand recirculation controls
 - Pump controlled on/off and limit temperature of water entering cold water piping to 104F

- ▶ C404.8 Drain water heat recovery
 - Refers to ANSI
 - Need to expand/define this definition in code

C404– Service Water Heating (cont'd)

- ▶ **C404.9.3 Outdoor heated pools, spas and hot tubs.** *Outdoor heated pools, outdoor permanent spas and outdoor hot tubs shall derive no less than 70 percent of the energy for heating, computed over an operating season, from site-recovered energy such as from a heat pump or solar energy source.*
 - Need input on applicability/feasibility
 - 2015 IECC requires vapor retardant cover

C404– Service Water Heating (cont'd)

- ▶ **C404.9.4 Heated pools in conditioned space.**
 - ≥ 25 percent of the annual energy consumption of pool operation and
 - ≥ 50 percent of the peak design space heating, ventilation, and cooling requirements for the space in which the pool is located shall be by one or both of the following:
 - An onsite renewable energy system.
 - A heat recovery system.

Proposed Code Changes: C405 Electrical Power and Lighting

C405– Lighting

▶ C405.2.1 Occupant sensor controls

◦ Consistent with ASHRAE 90.1

- Classrooms/lecture/training rooms. *(NOTE: ASHRAE excludes K-12 classrooms. Discussion point)*
- Conference/meeting/multipurpose rooms.
- Copy/print rooms.
- Lounges.
- Employee lunch and break rooms.
- Private offices.
- Restrooms.
- Storage rooms.
- Janitorial closets.
- Locker rooms.
- Other spaces 300 square feet or less that are enclosed by floor-to-ceiling height partitions.
- Warehouses.

C405– Lighting

- ▶ C405.2.1.1 Occupant sensor control function
 - Non-warehouses
 - Automatic off within 30 minutes
 - Manual on *or* controlled to turn on to 50% power
 - Incorporate manual control to turn lights off

- ▶ C405.2.1.2 Occupant sensor control function in warehouses
 - Lighting in aiseways and open areas shall be controlled with occupant sensors
 - Automatically reduce lighting power by ≥ 50 percent when the areas are unoccupied.
 - Each aisleway controlled independently and shall not control lighting beyond the aisleway being controlled by the sensor.

C405– Lighting

- ▶ C405.2.3 Daylight–responsive controls
 - Need to understand definitions of toplight zone or sidelight zone
 - Lights are controlled independently in toplight and sidelight zones
 - Calibrated within space
 - Offices, classrooms, laboratories and library reading rooms:
 - Dim lights continuously from full light output to 15 percent of full light output or lower.
 - Capable of a complete shutoff
 - Independent controls in different cardinal directions

C405– Lighting

▶ C405.2.4 Specific application controls

1. Display and accent light shall be controlled by a dedicated control that is independent of the controls for other lighting within the room or space.

2. Lighting in cases used for display case purposes shall be controlled by a dedicated control that is independent of the controls for other lighting within the room or space.

3. Hotel and motel sleeping units and guest suites shall have a master control device that is capable of automatically switching off all installed luminaires and switched receptacles within 20 minutes after all occupants leave the room

→And three additional applications...

C405– Lighting

- ▶ Lighting Power Densities
 - Refer to LPD tables
 - Red font and parentheses show 2011 CBES values

C405.9 Horizontal/Vertical Transport

▶ C405.9.1 Elevator cabs

- <35 lumens/watt
- Ventilation fans < 0.33 Watts/Square foot
- Controls to de-energize when unoccupied for >15 minutes

▶ C405.9.2 Escalators/Moving Walks

- Automatic controls to reduce speed

▶ C405.9.2.1 Regenerative drive

- Variable frequency regenerative drive that supplies electrical energy to the building electrical system

Proposed Code Changes:
C406
Additional Efficiency Package
Options

C406– Additional Packages

- ▶ Projects must choose one of six packages
- ▶ Six Packages:
 1. Efficient lighting (90% of stated LPD values)
 2. Efficient HVAC (e.g., 10% improvement)
 3. Enhanced digital lighting controls
 4. On-site renewables
 5. Dedicated outdoor air system
 6. Reduced energy use in service water heating
- ▶ Consider adding solar roof-ready language
- ▶ (Refer to code document for details on packages)

Proposed Code Changes: C408 System Commissioning

C408– Building Commissioning

- ▶ Sourced from WA state energy code. In place for several years
- ▶ Water heating
- ▶ Mechanical
- ▶ Lighting Controls

CBES Stretch Code

Stretch Code

- ▶ Will post draft as addendum week of 6/23
- ▶ Notify stakeholders and solicit feedback
- ▶ Application:
 - Possible reference for ACT 250 “Best Available Technology”

Stretch Code

- ▶ Air Leakage
 - Materials list *plus* blower door test or
 - Material list *plus* continuous air barrier commissioning
- ▶ Insulation values
 - Refer to Matrix document
- ▶ Energy Recovery
 - Require for all systems with $>1,000$ CFM outdoor air

Stretch Code

▶ Duct leakage

- Maximum leakage lowered from 6 to 4 for high pressure systems
- No more than 5% of ductwork can be located outside of thermal envelope (Note: Depends on base code language)

▶ Pipe Insulation

- Increased requirements (refer to pipe insulation table)

Stretch Code

- ▶ **Computer/Server Rooms**
 - NBI Core Performance Tier 2: Separate economizer, HVAC controls, humidification and fan power limitation and controls for computer rooms over 5 tons

- ▶ **Electric Vehicle Charging Stations**

- ▶ **Additional Efficiency Packages**
 - Stretch requires two packages

Reminder: Stakeholder Input

Comments:

http://publicservice.vermont.gov/topics/energy_efficiency/code_update/cbes_feedback

Questions:

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Thank you!

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