

2015

# VERMONT

## RESIDENTIAL BUILDING ENERGY STANDARDS



## 2015 Vermont Residential Building Energy Standards

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# PREFACE

## Introduction

Internationally, code officials recognize the need for a modern, up-to-date energy conservation code addressing the design of energy-efficient building envelopes and installation of energy-efficient mechanical, lighting and power systems through requirements emphasizing performance. The 2015 *Vermont Residential Building Energy Standards* (RBES) is based on the *International Energy Conservation Code*® 2015 edition, and is designed to meet these needs through model code regulations that will result in the optimal utilization of fossil fuel and nondepletable resources in all communities, large and small.

This comprehensive energy conservation code establishes minimum regulations for energy efficient buildings using prescriptive and performance-related provisions. It is founded on broad-based principles that make possible the use of new materials and new energy efficient designs.

The *International Energy Conservation Code* provisions provide many benefits, among which is the model code development process that offers an international forum for energy professionals to discuss performance and prescriptive code requirements. This forum provides an excellent arena to debate proposed revisions. This model code also encourages international consistency in the application of provisions.

## Development

This 2015 RBES is founded on principles intended to establish provisions consistent with the scope of an energy conservation code that adequately conserves energy; provisions that do not unnecessarily increase construction costs; provisions that do not restrict the use of new materials, products or methods of construction; and provisions that do not give preferential treatment to particular types or classes of materials, products or methods of construction.

## Background

During the 1995 legislative session, there was a consensus that a Task Force should be created to examine the issues related to developing an energy efficiency standard and address the concerns of interested parties. To this end, the Governor's Task Force on Energy Efficiency Standards for New Residential Construction was created in September, 1995 and was charged with developing a legislative proposal prior to the 1996 session.

The Governor's Task Force included stakeholders from many different perspectives on this issue. The Task Force reached a consensus that the legislature should adopt an energy code and that this code should include the following provisions:

- The code should be kept current by establishing a three-year cycle for revision and modification of the code through rule making;
- Compliance with the residential code should be given the presumption of compliance with 10 V.S.A. Chapter 151 (Act 250) Sub-Criterion 9(f), Energy Conservation;
- To demonstrate compliance, builders should be required to complete a form self-certifying that the energy efficiency requirements of the code have been met for each new home that is built;
- Owner/builders should be allowed to build a home that does not comply with the code as long as they disclose how that home is deficient to subsequent prospective buyers; and
- In order to address indoor air quality, a requirement for automatic, mechanical ventilation systems should be included in the first update of the code three years from adoption.

The *Vermont Residential Building Energy Standards* (RBES) was adopted by statute in 1997 and incorporated virtually all of the Task Force's recommendations. Since that time, an Energy Code Assistance Center has been established to provide builders and consumers with information on the

code and answers to their questions. Workshops have also been held throughout the state to train builders, architects and trade allies about the code requirements and how to comply.

Act 89 passed in 2013, established a Stretch Code defined as a building energy code for residential buildings that achieves greater energy savings than the RBES. The stretch code shall be available for adoption by municipalities under 24 V.S.A. §117, and shall apply in proceedings under 10 V.S.A. §151 (Act 250).

## **Update Process**

The Residential Building Energy Standards Statute (30 V.S.A. § 51) requires that revisions to the RBES are made promptly after the issuance of updated standards for residential construction under the IECC. The PSD is required to convene stakeholders that include mortgage lenders, builders, building designers, utility representatives, and other persons with experience and expertise prior to the adoption of a revised RBES to provide recommendations.

The Vermont DPS held a series of stakeholder meetings in 2014 to gather feedback on proposed changes to RBES. The revisions to the 2015 edition of the *International Energy Conservation Code* presented in this document were drafted based on input received from these meetings.

# EFFECTIVE USE OF THE 2015 RESIDENTIAL BUILDING ENERGY STANDARDS

The 2015 *Vermont Residential Building Energy Standards* (RBES) is a code that regulates minimum energy conservation requirements for new buildings. The 2015 RBES addresses energy conservation requirements for all aspects of energy uses in residential construction, including heating and ventilating, lighting, water heating, and power usage for appliances and building systems.

The 2015 RBES is a design document. For example, before one constructs a building, the designer must determine the minimum insulation *R*-values and fenestration *U*-factors for the building exterior envelope. The RBES sets forth minimum requirements for exterior envelope insulation, window and door *U*-factors and SHGC ratings, duct insulation, lighting and power efficiency, mechanical ventilation, and water distribution insulation.

## Arrangement and Format of the 2015 RBES

Before applying the requirements of the 2015 RBES it is beneficial to understand its arrangement and format. The 2015 RBES, like other codes published by ICC, is arranged and organized to follow sequential steps that generally occur during a plan review or inspection. The 2015 RBES is divided into six different parts:

Chapters	Subjects
1-2	Administration and definitions
3	General requirements
4	Residential Energy efficiency
5	Existing buildings
6	Referenced standards

## Italicized Terms

Selected terms set forth in Chapter 2, Definitions, are italicized where they appear in code text. Such terms are not italicized where the definition set forth in Chapter 2 does not impart the intended meaning in the use of the term. The terms selected have definitions that the user should read carefully to facilitate better understanding of the code.

The following is a chapter-by-chapter synopsis of the scope and intent of the provisions of the 2015 Vermont Residential Building Energy Standards:

**Chapter 1 Administration.** This chapter contains provisions for the application, enforcement and administration of subsequent requirements of the code. In addition to establishing the scope of the code, Chapter 1 identifies which buildings and structures come under its purview. Chapter 1 is largely concerned with maintaining “due process of law” in enforcing the energy conservation criteria contained in the body of this code. Only through careful observation of the administrative provisions can the code official or other authority having jurisdiction, where one exists, reasonably expect to demonstrate that “equal protection under the law” has been provided.

**Chapter 2 Definitions.** Chapter 2 is the repository of the definitions of terms used in the body of the code. Codes are technical documents and every word, term and punctuation mark can impact the meaning of the code text and the intended results. The code often uses terms that have a unique meaning in the code and the code meaning can differ substantially from the ordinarily understood meaning of the term as used outside of the code.

The terms defined in Chapter 2 are deemed to be of prime importance in establishing the meaning and intent of the code text. The user of the code should be familiar with and consult this chapter because the definitions are essential to the correct interpretation of the code and the user may not be aware that a term is defined.

Where understanding of a term's definition is especially key to or necessary for understanding of a particular code provision, the term is shown in *italics* wherever it appears in the code. This is true only for those terms that have a meaning that is unique to the code. In other words, the generally understood meaning of a term or phrase might not be sufficient or consistent with the meaning prescribed by the code; therefore, it is essential that the code-defined meaning be known.

Guidance regarding tense, gender and plurality of defined terms as well as guidance regarding terms not defined in this code is provided.

**Chapter 3 General Requirements.** Chapter 3 provides interior design conditions that are used as a basis for assumptions in heating and cooling load calculations, and provides basic material requirements for insulation materials and fenestration materials, and provides standards for residential mechanical ventilation and combustion safety.

**Chapter 4 Residential Energy Efficiency.** Chapter 4 contains the energy-efficiency-related requirements for the design and construction of residential buildings regulated under this code. It should be noted that the definition of a *residential building* in this code is unique for this code. In this code, a *residential building* is an R-2, R-3 or R-4 buildings three stories or less in height. All other R-1 buildings, including residential buildings greater than three stories in height, are regulated by the energy conservation requirements in the Vermont Commercial Building Energy Standards (CBES). The applicable portions of a residential building must comply with the provisions within this chapter for energy efficiency. This chapter defines requirements for the portions of the building and building systems that impact energy use in new residential construction and promotes the effective use of energy. The provisions within the chapter promote energy efficiency in the building envelope, the heating and cooling system, lighting and the service water heating system of the building. Vermont has adopted a two-tiered code structure with a "base code" that applies statewide, and a "*Stretch Code*" that is more stringent. The *Stretch Code* applies to all Act 250 development projects and is also available for municipalities that choose to adopt a higher energy standard.

**Chapter 5 Existing Buildings.** Chapter 5 of each set of provisions contains the technical energy efficiency requirements for existing buildings. Chapter 5 provisions address the maintenance of buildings in compliance with the code as well as how additions, alterations, repairs and changes of occupancy need to be addressed from the standpoint of energy efficiency. Specific provisions are provided for historic buildings.

**Chapter 6 Referenced Standards.** The code contains numerous references to standards that are used to regulate materials and methods of construction. Chapter 6 contains a comprehensive list of all standards that are referenced in the code. The standards are part of the code to the extent of the reference to the standard. Compliance with the referenced standard is necessary for compliance with this code. By providing specifically adopted standards, the construction and installation requirements necessary for compliance with the code can be readily determined. The basis for code compliance is, therefore, established and available on an equal basis to the code official, or other authority having jurisdiction, where one exists, contractor, designer and owner.

Chapter 6 is organized in a manner that makes it easy to locate specific standards. It lists all of the referenced standards, alphabetically, by acronym of the promulgating agency of the standard. Each agency's standards are then listed in either alphabetical or numeric order based upon the standard identification. The list also contains the title of the standard; the edition (date) of the standard referenced; any addenda included as part of the ICC adoption; and the section or sections of this code that reference the standard.

## Marginal Markings

Solid vertical lines in the margins within the body of the code indicate a technical change from the requirements of the 2011 edition. Vermont specific additions and changes are designated through xxx markings in the margin. Deletion indicators in the form of an arrow (➡) are provided in the margin where an entire section, paragraph, exception or table has been deleted or an item in a list of items or a table has been deleted.

## Abbreviations and Notations

The following is a list of common abbreviations and units of measurement used in this code. Some of the abbreviations are for terms defined in Chapter 2. Others are terms used in various tables and text of the code.

AFUE	Annual fuel utilization efficiency
bhp	Brake horsepower (fans)
Btu	British thermal unit
Btu/h-ft <sup>2</sup>	Btu per hour per square foot
C-factor	See Chapter 2—Definitions
CDD	Cooling degree days
cfm	Cubic feet per minute
cfm/ft <sup>2</sup>	Cubic feet per minute per square foot
ci	Continuous insulation
COP	Coefficient of performance
DCV	Demand control ventilation
°C	Degrees Celsius
°F	Degrees Fahrenheit
DWHR	Drain water heat recovery
DX	Direct expansion
$E_c$	Combustion efficiency
$E_v$	Ventilation efficiency
$E_t$	Thermal efficiency
EER	Energy efficiency ratio
EF	Energy factor
ERI	Energy Rating index
F-factor	See Chapter 2—Definitions
FDD	Fault detection and diagnostics
FEG	Fan efficiency grade
FL	Full load
ft <sup>2</sup>	Square foot
gpm	Gallons per minute
HDD	Heating degree days
HERS	Home Energy Rating System
hp	Horsepower
HSPF	Heating seasonal performance factor
HVAC	Heating, ventilating and air conditioning
IEER	Integrated energy efficiency ratio
IPLV	Integrated Part Load Value
Kg/m <sup>2</sup>	Kilograms per square meter
kW	Kilowatt
LPD	Light power density (lighting power allowance)

L/s	Liters per second
Ls	Liner system
m <sup>2</sup>	square meters
MERV	Minimum efficiency reporting value
NAECA	National Appliance Energy Conservation Act
NPLV	Nonstandard Part Load Value
Pa	Pascal
PF	Projection factor
pcf	Pounds per cubic foot
PSD	Public Service Department (Vermont)
psf	Pounds per square foot
PTAC	Packaged terminal air conditioner
PTHP	Packaged terminal heat pump
R-value	See Chapter 2—Definitions
SCOP	Sensible coefficient of performance
SEER	Seasonal energy efficiency ratio
SHGC	Solar Heat Gain Coefficient
SPVAC	Single packaged vertical air conditioner
SPVHP	Single packaged vertical heat pump
SRI	Solar reflectance index
SWHF	Service water heat recovery factor
U-factor	See Chapter 2—Definitions
VAV	Variable air volume
VRF	Variable refrigerant flow
VT	Visible transmittance
W	Watts
w.c.	Water column
w.g.	Water gauge



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