ACT 47 BUILDING ENERGY CODE STUDY COMMITTEE REPORT TO THE VERMONT LEGISLATURE

December 1, 2023

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This report was primarily authored by Liz Bourguet and Richard Faesy of Energy Futures Group, but benefitted tremendously from the extensive research, input, discussions, suggestions, and drafting by the engaged Act 47 Building Energy Code Study Committee (BECSC) members listed below in addition to those who testified and otherwise shared their expertise and information with the Committee.

Committee Members

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Chris Burns - Burlington Electric Department

Chris Campany - Regional Planning Commission – Windham Regional Commission

Craig Peltier - Vermont Housing and Conservation Board

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Jim Bradley - Hayward Design Build

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Matt Sharpe - Efficiency Vermont

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Sandra Vitzthum - Sandra Vitzthum Architect LLC

Scott Campbell - Vermont House of Representatives

Ted Brady - Vermont League of Cities and Towns

Timothy Perrin - Vermont Gas Systems

List of Acronyms

ACCD	Vermont Agency of Commerce and Community Development
AGC	Association of General Contractors
AG	Vermont Attorney General
AHJ	Authority Having Jurisdiction
AIA-VT	American Institute of Architects, Vermont
BECSC	Act 47 Building Energy Code Study Committee
BED	Burlington Electric Department
CAP	Consumer Assistance Program (of the Attorney General's Office)
CBES	Commercial Building Energy Standards
CO	Certificate of Occupancy
DFS	Division of Fire Safety (within the Department of Public Safety)
DHP	Division for Historic Preservation
DU	Distribution Utility
EAN	Energy Action Network
ECAC	Energy Code Assistance Center
EEU	Energy Efficiency Utility
EFG	Energy Futures Group
EVT	Efficiency Vermont
DOE	U.S. Department of Energy
EUI	Energy Use Intensity
EVT	Efficiency Vermont
GWSA	Global Warming Solution Act
HERS	Home Energy Rating System
HVAC	Heating, Ventilation, and Air Conditioning
IECC	International Energy Conservation Code
IRC	International Residential Code
ISP	Industry standard practice
OEO	Vermont Office of Economic Opportunity
OPR	Office of Professional Regulation (within the Secretary of State's office)
PSD	Department of Public Service
RBES	Residential Building Energy Standards
SEON	Sustainable Energy Outreach Network
SOS	Vermont Secretary of State's Office
VBRA	Vermont Builders and Remodelers Association
VGS	Vermont Gas Systems

Executive Summary

The Act 47 Building Energy Codes Study Committee (BECSC) was convened by the 2023 Vermont Legislature to address issues related to declining compliance rates with Vermont's mandatory energy codes, known as Residential Building Energy Standards (RBES) and Commercial Building Energy Standards (CBES).[1] Specifically, the Committee was asked to examine three "charges":

1) Assess how the building energy codes interact with the fire and building safety codes.
2) Consider and recommend strategies to increase awareness of and compliance with the RBES and CBES, including the potential designation of the Division of Fire Safety (DFS) in the Department of Public Safety as the statewide authority having jurisdiction (AHJ) for administration, interpretation, and enforcement, in conjunction with DFS' existing jurisdiction, over building codes.
3) Evaluate current cost-effectiveness analyses for the RBES and the CBES, whether they include or should include nonenergy benefits such as public health benefits and the cost of carbon, and how that impacts the affordability of housing projects and provide recommendations.

The Committee met ten times over the summer and fall of 2023 to address the three charges above and compiled the following responses to the Legislature.

Charge 1

The Committee identified two overriding issues impeding progress and compliance with the energy codes: (1) no state agency has comprehensive administrative authority over the RBES and CBES and (2) in the absence of a residential *building* code, there is no regulatory infrastructure on which to base energy code administration.[2]

A majority of the Committee recommends naming the Division of Fire Safety (DFS) as Vermont's AHJ to administer all energy codes. This change will need to go through the legislative process, will take some time to plan and develop, and will require a funding plan. Most committee members believe that without a single entity in charge of Vermont's energy codes, we will neither be able to effectively manage our state's progress toward higher levels of building energy efficiency, nor be capable of ensuring compliance with our "net zero ready" goal by 2030.

The Committee also recognizes that the lack of understanding of building science is leading to buildings experiencing costly failures, such as mold, mildew, and rot within walls and ceilings. As more advanced energy codes are adopted, the likelihood of such failures will likely increase. The Committee further recommends exploration of a statewide residential building code, state-recognized voluntary builder certification, and increased outreach, education, and training to address this deficiency.

[1] The terms "energy codes", "energy code", "RBES" and/or "CBES" are used interchangeably in this document, unless noted otherwise explicitly or in context of a specific discussion. Energy codes are a subset of building codes, which regulate all aspects of construction.

[2] The phrase "energy code administration" is used throughout this report and is meant to serve as the umbrella term to captures all aspects of implementing a code including interpretation, modifications, conflict resolution, plan review, site visits, inspection, variances, appeals, education and training, enforcement, record-keeping, reporting, municipal support, promulgation of new codes, stakeholder communication, etc.

Dissenting Comments: The DFS , Department of Public Service (PSD), and Association of General Contractors (AGC) do not support the recommendation to designate DFS as the AHJ as this cannot be implemented on the strength of existing resources and therefore will require a tremendous amount of new costly resources that will increase the cost of housing, delay permitting, and unnecessarily expand DFS authority to single family residential housing and create additional layers of regulatory oversight. What needs to be accomplished is getting more builders educated and trained in the profession. Building layers of regulatory authority does not fix the underlying issue. The concept of enforcement, integrating plan review and site visits into the existing landscape is not feasible and will cause delays in permitting. Additionally, this takes away from the DFS' mission of protecting lives from fires. There are already systems in place to address records, training, and education that need to be revisited with a focus on achieving outcomes.

Charges 2 & 3

The Committee developed a list of recommended strategies to increase awareness and compliance with the energy codes ("Charge 2") and answered the question about evaluating the cost-effectiveness of the energy codes ("Charge 3"). They also suggested a timeframe when each of these recommendations should be implemented (in the near term [2024] or as "Phase 2" within the next three years). The Committee discussed each recommendation and members noted if they had a dissenting opinion.

The following Table 1 summarizes the recommendations, timeframe, responsible entity, funding source, and dissenters for Charges 2 and 3. While most of the Committee supported naming the DFS as the AHJ, there was recognition that this would be a significant structural and financial shift from the DFS' current responsibilities and may take some time to establish. In recognition that this transition of the DFS to AHJ could take a few years or if another state agency is named as the AHJ, Table 1 provides some options for the "responsible entity" for each recommendation. Table 1 lists other organizations currently involved with energy code and building activities (e.g., PSD, Office of Professional Regulation (OPR), Office of Economic Opportunity (OEO), Efficiency Vermont (EVT), Energy Futures Group (EFG), Distribution Utilities (DUs)) and suggests that they coordinate and continue in their energy code support roles until an AHJ is designated at which time the AHJ would take charge. This would provide multiple "swim lanes" to carry out the recommendations while working out the ultimate state agency with unified authority to have jurisdiction over building and energy codes in Vermont.

Table 1. Summary of Recommendations

Charge 2: Strategies to increase awareness of and compliance with RBES and CBES including the potential designation of DFS as the statewide AHJ.					
Recommendations for Immediate Legislative Action					
Recommendation	**Timeframe for Implementation**		**Responsible Entity**	**Funding Source**	**Dissenters**
	2024	**Phase 2**			
A. Make structural, statutory, policy, and programmatic changes to Vermont's energy code environment.					
A.1. Designate the DFS as the statewide "authority having jurisdiction" (AHJ) over all building construction – public, private, commercial, residential. • A.1.a. Clarify the chain of authority from the General Assembly, through DFS, to municipalities. • A.1.b. Establish an advisory committee to advise on the overall transition to a new AHJ, help with future code revisions and examine building failure cases to improve building science and future codes. • A.1.c. PSD continue in role administering the energy codes in support of the AHJ • A.1.d. Develop a certification designation for contractors trained on the energy codes and include the certification on the OPR Contractor Registry and DFS website	✓		DFS or other AHJ	Identify	DFS PSD AGC
A.2. Amend the energy code update cycle by changing "shall" in the energy code enabling statue to "may".	✓		Legislature	Unnecessary	
A.3. Establish a study committee on adopting a statewide residential building code (e.g., IRC)	✓		Legislature	Identify	
A.4. Require OPR to update contractor registry (A) so contractors explicitly acknowledge RBES/CBES legal requirements, and (B) to alert consumers to RBES/CBES and provide filtering functionality, e.g., by specialties, location, and certifications.	✓		Legislature and OPR	EFG's DOE Grant	DFS VBRA
A.5. Authorize OPR to update their contract requirements and template for contractor-owner agreements to include a clause acknowledging that energy codes are mandatory.	✓		Legislature and OPR	EFG's DOE Grant	

A.6. Develop a certification designation for contractors trained on the energy codes and include the certification on the OPR Contractor Registry and DFS website	✓		OPR and AHJ	EFG's DOE Grant	
B. Improve the process for filing and tracking energy code certificates.					
B.1. Expand DFS's current database redesign to incorporate a statewide, central, publicly accessible repository for all Vermont buildings (including all residential) that includes energy code data. • B.1.a. Eliminate filing certificates in town records and the notarization requirement. • B.1.b. Establish a certificate application tool for both CBES and RBES that generates an energy code "permit" before construction and a final certificate upon completion that is part of the DFS database.	✓		DFS or other AHJ	Identify	DFS PSD
Non-Legislative and Longer-Term Recommendations					
C. Improve workforce training and support.					
C.1. Coordinate and support energy code trainings and certifications. • C.1.a. Develop training materials • C.1.b. Conduct regular trainings	✓		OEO, EVT, EFG until there is an AHJ	EFG's DOE Grant	DFS AIA-VT
C.2. Develop "circuit rider" on-site energy code services statewide.	✓		EFG / EVT until there is an AHJ	EFG's DOE Grant	
C.3. Increase training and support for Energy Consultants.		✓	EFG / EVT until there is an AHJ	EFG's DOE Grant	
C.4. Increase and coordinate building science and energy code trainings including weatherization.		✓	OEO/EVT until there is an AHJ	• OEO • PSD • EVT • ACCD /DHP	
C.5. Coordinate the Energy Code Support Center (call center) with other code support efforts.		✓	EVT until there is an AHJ	EVT	
D. Increase awareness of building energy codes and requirements.					
D.1. Develop and mail out bill stuffers reminding about energy codes	✓		EVT / DUs until there is an AHJ	EVT / DUs	

D.2. Work with lenders and attorneys to include energy information on loan closing checklists	✓		AHJ	Identify	
D.3. Use state, regional, and municipal websites to reinforce energy code requirements.	✓		AHJ	EFG's DOE Grant supports RPCs	
D.4. Create a radio show on building science and energy codes to educate the public		✓	?	Identify	
E. Establish a plan for funding for base-code and above-base code compliance.					
E.1. Develop a funding plan to pay for start-up and on-going costs to support the AHJ and energy code administration.		✓	EFG until there is an AHJ	EFG's DOE Grant	
E.2. Establish a role for EEUs to play in supporting energy codes compliance and incentives.		✓	PSD & EEUs until there is an AHJ	EEUs	
F. Coordinate code compliance grant efforts in Vermont.					
F.1. Coordinate with the U.S. Department of Energy's (DOE) grant to Energy Futures Group for the "Vermont Energy Code Administration Project" to support these strategies.	✓		EFG until there is an AHJ	EFG's DOE Grant	
F.2. Continue the role of the Act 47 Building Energy Code Study Committee as the "Phase 2" Advisory Committee to EFG's DOE grant.	✓		EFG until there is an AHJ	EFG's DOE Grant	
Charge 3: Evaluation of cost-effectiveness analysis for RBES and CBES.					
1. Continue calculating energy code "cost effectiveness" as has been done historically.	✓		PSD until there is an AHJ	Unnecessary	
2. Establish a new committee of energy, economic, and housing experts to research and address whether and how to best include the cost of carbon and non-energy benefits in building energy codes for new and existing buildings.		✓	PSD until there is an AHJ	Identify	PSD DFS VBRA

Findings, background, and details on the recommendations summarized above are included in the full report.

Findings

The Act 47 findings related to energy code compliance state the following:

> "The General Assembly finds that:
>
> 1) Vermont established the Residential Building Energy Standards (RBES) in 1997 and the Commercial Building Energy Standards (CBES) in 2007. The Public Service Department (PSD) is responsible for adopting and updating these codes regularly but does not have the capacity to administer or enforce them.
> 2) The RBES and CBES are mandatory, but while municipalities with building departments handle some aspects of review and inspection, there is no State agency or office designated to interpret, administer, and enforce them.
> 3) The Division of Fire Safety (DFS) in the Department of Public Safety is responsible for development, administration, and enforcement of building codes but does not currently have expertise or capacity to add administration or enforcement of energy codes in buildings.
> 4) Studies in recent years show compliance with the RBES at about 54 percent and CBES at about 87 percent, with both rates declining. Both codes are scheduled to become more stringent with the goal of "net-zero ready" by 2030.[3]
> 5) In December 2022, the U.S. Department of Energy issued the Bipartisan Infrastructure Law: Resilient and Efficient Codes Implementation Funding Opportunity Announcement. The first $45 million of a five-year $225 million program is available in 2023. Vermont's increased code compliance plans should include contingencies for this potential funding."[4]

A majority of the BECSC concurs with the Legislature's findings and identified the following additional findings:[5]

> 6) The lack of a single state agency designated as the "Authority Having Jurisdiction" (AHJ) as described in Vermont's energy codes is hampering efficient and coordinated energy code administration and compliance and is a prerequisite to implementing any new enforcement system improving compliance. All other states have a path to a unified authority at either the state or local level (see assessment in Appendix G).

[3] Some members of the Committee believe that compliance rates are lower. See Appendix C.

[4] https://legislature.vermont.gov/Documents/2024/Docs/ACTS/ACT047/ACT047%20As%20Enacted.pdf

[5] The PSD doesn't fully concur with the findings listed in Act 47 that state in 2) above "…there is no State agency or office designated to interpret, administer, and enforce [RBES and CBES]." The PSD does perform some administrative functions and provides interpretation of the energy codes and assistance with applying them. The PSD also doesn't fully concur with the additional findings.

7) Lack of a statewide residential *building* code is also hindering energy code administration because the State lacks the "scaffolding" infrastructure that building code administration provides, and it may limit Vermont's access to certain federal funding.[6]

8) Currently the DFS administers building codes for all "public" buildings (covering all habitable building types including residential rental units except for owner-occupied single-family homes). The PSD develops and administers energy codes. Administering both building and energy codes from a single office would promote efficiency, streamline services, and advance sound, building-science-based practices for safer, healthier, more comfortable, more durable, and more efficient buildings.

Assessment of Findings and Underlying Issues

Compliance with energy codes is declining.

Vermont's RBES and CBES are minimum standards of energy efficiency for new and renovated buildings in the state. Though following these energy codes is mandatory, compliance has been decreasing over time. The lack of compliance with the energy codes is detrimental to Vermont builders and homeowners, and underscores larger problems, including the lack of an AHJ for Vermont energy code administration and enforcement.

The latest PSD "2020 Vermont Single-Family Residential New Construction Baseline and Code Compliance Study"[7] conducted by NMR Group showed that 54% of newly constructed residential buildings surveyed complied with the technical components of the 2015 RBES, the standard set two code cycle updates ago. The "2021 Vermont Business Sector Market Characterization and Assessment Study"[8] conducted by Cadmus showed 87% compliance with the 2015 Commercial Building Energy Standards (CBES). These rates of compliance are down from the previous code compliance studies, which showed a 66% compliance rate with the 2011 RBES and 92% compliance with 2011 CBES (although the latest CBES compliance rate is within the margin of error of the previous compliance rate).

However, these compliance rates are a simplistic view of overall compliance. There are multiple approaches and details that can be considered when turning a sample of homes into an overall representation of the industry. While the PSD's historical approach to measuring compliance has focused on "technical" compliance as a consistent measure that allows comparisons between studies over time of how homes are being built, a broader approach might include looking at "administrative" compliance such as whether the code certificates were properly filed with the town and the state. The studies also examine those "program homes" that participated in a new construction program offered by the Energy Efficiency Utilities (EEUs) and "non-program homes" and then need to determine what mix is best representative of all new Vermont homes.

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[6] One Committee member said that Vermont wasn't eligible for FEMA BRIC funding because we hadn't adopted a residential building code.

[7] https://publicservice.vermont.gov/efficiency/evaluations-and-studies

[8] https://publicservice.vermont.gov/efficiency/evaluations-and-studies

Additional details are also considered. The 2015 RBES includes additional Basic Requirements and Ventilation Requirements, beyond insulation levels, window U-factors, glazing, and heating system efficiency. These additional requirements include air leakage, duct insulation and sealing, pipe insulation, Manual J compliance, spillage testing, and ventilation. However, with limited time on-site, auditors prioritized shell, mechanical system, and appliance/electronic data. While blower door tests were conducted at all sites, in some cases the auditors were unable to collect information on additional requirements due to the inaccessibility of certain spaces and equipment in finished homes. Because there is not sufficient information available to consistently assess the compliance of non-program homes with all the additional requirements, the study does not factor compliance with these additional requirements into the primary estimates of the compliance rate. A similar approach was undertaken in prior code compliance studies for Vermont.

The NMR study also showed that in non-program homes there is 19% compliance with the requirement for an automatically controlled mechanical ventilation system, 7% compliance with equipment sizing with Manual J, and low compliance with posting the certificate. For RBES, the NMR study found that the code-compliant homes were on average 3-4% above code level and non-compliant homes averaged 21-27% below code level. Auditors found that two common physical compliance issues consisted of (1) insufficient insulation in basements (including on basement walls and floors over unconditioned basements or crawlspaces) and, (2) insufficient wall cavity insulation (including insufficient combination of wall cavity and continuous insulation). The study also noted that decreased participation in EEU programs were likely one factor in the decreased compliance rate (program penetration has decreased from 33% in 2015 to 12% in 2020). Program homes are significantly more efficient and have better code compliance than non-program homes. As shown in Appendix C, the filing of RBES certificates relative to homes built (i.e., “administrative compliance”) since the inception of RBES in 1998 is significantly lower than the 54% technical compliance rate.

For CBES, the biggest area of non-compliance was the envelope, generally wall insulation (around 66% of walls met or exceeded requirements), while roof insulation tended to meet or exceed code. Hot water systems were another area of non-compliance that stood out with around 75% compliance with the standards. HVAC and lighting showed improvements.

The Vermont energy codes are mandated to be updated on a cycle corresponding with the issuance of a new national building energy standard by the International Energy Conservation Code (IECC), with CBES specifying they must be updated every three years. Each code update results in more stringent energy efficiency requirements, and therefore lower building energy use intensity (EUI, or MMBtu/sq. ft.), as Vermont strives to hit its target of net-zero ready construction for all newly constructed buildings by 2030.[9] Figure 1 below illustrates the past recorded compliance rates with RBES in comparison to the EUI required by each standard set by RBES.

[9] https://publicservice.vermont.gov/sites/dps/files/documents/VT%20Energy%20Code%20Roadmap11-19_8_FINAL.pdf

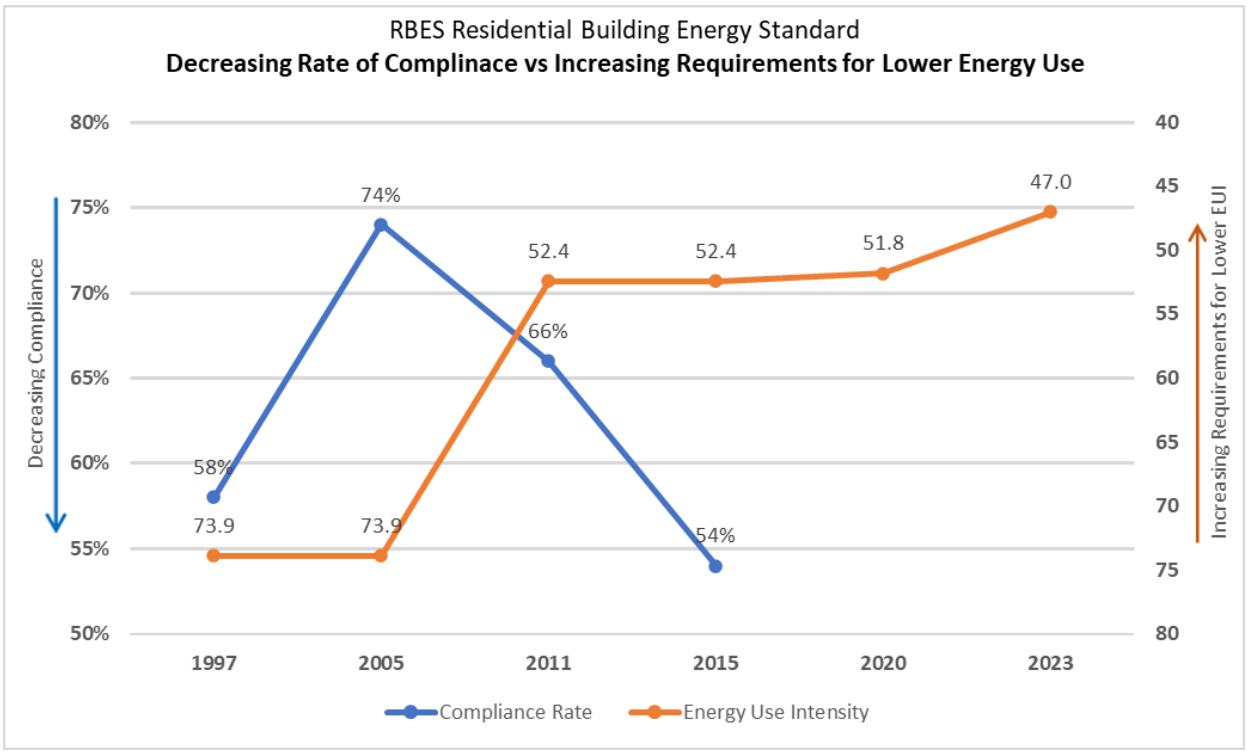


Figure 1. RBES code compliance in relation to Energy Use Intensity (EUI or MMBtu/sq. ft.) requirement improving over time.

Since 2015, the year which the latest Code Compliance Study was measured against, Vermont has adopted the more stringent 2020 RBES and is in the process of adopting an even stronger RBES (to go into effect in 2024). While new construction represents a relatively small part of Vermont's total energy use, it does not make sense to build *new* substandard buildings. Building energy codes are one way for the state to reduce Vermonters' energy use, thereby lowering greenhouse gas emissions, and is one piece of Vermont's efforts to meet the Global Warming Solution Act (GWSA) requirements.[10]

There is no definitive, unified statewide authority over all Vermont buildings.

Currently there is no statewide authority having jurisdiction over all buildings. The PSD develops and updates the energy codes. DFS in the Department of Public Safety administers building safety codes for commercial, multifamily, and rental buildings (not including owner-occupied single-family residences). Also, the Secretary of State's Office of Professional Regulation (OPR) manages Vermont's new homebuilder registry, and the Division of Historic Preservation oversees changes to historic buildings.

There is currently no statute or statewide mechanism that establishes comprehensive statewide authority for project review, inspections, variances,[11] appeals, reporting, enforcement for single-family residential owner-occupied homes, or builder certification. This lack of a central authority having jurisdiction can lead to a lack of coordination, mixed messages, divergent priorities and policies, lack of

[10] https://climatechange.vermont.gov/about

[11] Though PSD does this for CBES to the extent it is allowed. 30 V.S.A. § 53 (c) (5) details the narrow parameters in which a variance can be granted

accountability, customer and builder confusion, administrative inefficiencies, and a lack of consumer protection.

It is important to note that while we do have statewide *energy* codes (i.e., RBES and CBES), Vermont does *not* have a statewide residential *building* code. Most states have a residential building code, which establishes building standards that ensure safe and durable construction standards, and the health and safety of the building occupants, in line with the International Residential Code (IRC).[12] The lack of a residential building code not only could impact safe and durable construction practices, but also means that there is no statewide administrative structure to address issues like building code interpretation, conflicts, variances, integration with building science issues and other issues. While this is out of scope for the charge given to the BECSC, the Committee suggests that it would be useful for the Legislature to consider a residential building code that would address all construction elements, proper building science, and serve as the structure to house the energy codes. Figure 2 shows how other states are organized under a single authority with jurisdiction over building codes, energy codes, and training. This is compared to Vermont with no statewide authority, no building code, and multiple agencies overseeing different aspects of the energy codes and training.

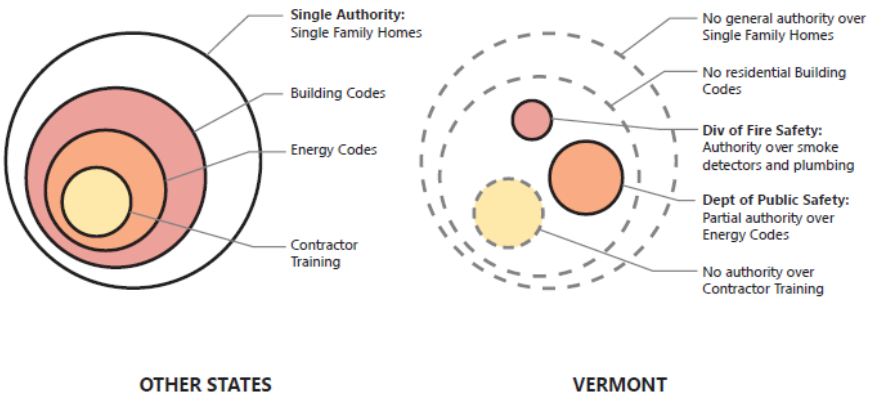


Figure 2. Vermont vs. other states' building and energy code structures

It is important to emphasize that Vermont is the only state without a clear path to establish authority over single family homes. Some states enable authority at the state level, some at the county or municipal level, but only Vermont has no path, no way to establish the “right way” to build a home. See table in Appendix H.

Note that the DFS and PSD do not support implementing a statewide building code for owner-occupied single-family homes currently.

[12] https://publicservice.vermont.gov/sites/dps/files/documents/50%20State%20comparison%20v.0904%20-%20S.Vitzhum.pdf

Statute may not clearly give municipalities enforceable authority to administer the building energy codes they adopt.

It appears the General Assembly has not clearly specified whether municipalities have the authority to administer the building energy codes (RBES and CBES) at the local level. By contrast, there is clear and specific authority under 20 V.S.A. § 2736 for a municipality to enforce the building and fire safety code adopted by DFS if the municipality is assigned that responsibility by the Commissioner of Public Safety.[13] There is also a path for variance requests and appeals to move up through the levels of authority. The statewide building and fire safety code applies to a wide variety of buildings ("public buildings" as defined in 20 V.S.A. § 2730(a)) but generally does not apply to owner-occupied single-family residences. For municipalities then, the landscape includes (1) a building energy code applicable to single-family residential construction (RBES), without clarity as to municipal authority, and (2) a building and fire safety code where the potential role of municipalities is clear, but that generally does not apply to single-family residential construction:

- **30 V.S.A. §§ 51 and 53** provide for the establishment of the RBES and CBES (the residential and commercial building energy codes) and describe PSD's and other parties' responsibilities as to those codes. The RBES generally applies to owner-occupied single-family residences. However, 30 V.S.A. §§ 51 and 53 do not specifically provide for municipal administration of the building energy codes at the local level.[14]
- **24 V.S.A. Chapter 83** gives municipalities authority to adopt building codes and regulations, and authority to appoint building inspectors with right of enforcement, as long as the codes adopted are consistent with the current rules and standards adopted by DFS.
- **20 V.S.A. Chapter 173** provides that a municipality may be assigned responsibility for enforcement of the statewide building and fire safety code, if the Commissioner of Public Safety determines that the municipality has appointed adequately trained and qualified officials and has established satisfactory procedures.

There is a lack of builder training and awareness in current building science and the energy codes.

While there needs to be better data collected and improved reporting, there are problems associated with the lack of awareness of and compliance with energy codes. The lack of a full widespread understanding of building science and sound building practices increases the potential for increasing building failures. There seems to be a rising number of building failures and "sick" buildings, although without a statewide entity collecting data and providing reports, it is challenging to quantify how

[13] While municipalities can be assigned responsibility for enforcement, the Commission of Public Safety and DFS also retain authority and may revoke the assignment under certain circumstances.

[14] The statutes do discuss the role of municipalities in certain areas. The statute governing RBES explains that if a stretch code is adopted by PSD, "The stretch code shall be available for adoption by municipalities under 24 V.S.A. chapter 117." Both statutes also explain that an RBES or CBES certificate is required before:

A. A municipal official acting under 20 V.S.A. § 2736 issues any final occupancy permit required by the rules of the Commissioner of Public Safety for use or occupancy of residential [or commercial] construction that is also a public building as defined in 20 V.S.A. § 2730(a); and
B. A municipality issues a certificate of occupancy for residential [or commercial] construction if the municipality requires certificates of occupancy under 24 V.S.A. Chapter 117.

pervasive this problem is. Current standard practice to comply with the energy codes typically includes more insulation and air sealing than a decade or two ago. This requires a more sophisticated understanding of moisture management, indoor air quality and proper insulation installation techniques. While somewhat sensationalized, a May 22, 2023, VTDigger article increased public awareness of potential issues when insulation is not installed correctly. The article detailed instances of houses with improper spray foam insulation in Vermont, leading to building failures, including moisture damage and mold.[15]

The Vermont Attorney General (AG)'s Consumer Assistance Program (CAP) has been recording housing related complaints since 2012.[16] They have found 82 deficit-related complaints, with 51 specifying damages totaling $527,342. Larger cases are typically pursued by insurers with non-disclosure agreements that don't report the damages, leaving these smaller cases reported to the AG's office. Since 2012 there have been 36 (44%) complaints related to HVAC/mechanical/plumbing, 26 (32%) carpentry/building envelope related complaints, and 20 (24%) solar related issues. Most of these complaints are related to improper building techniques and not necessarily the energy codes. The solar complaints are not necessarily energy code-related since solar generation was not part of RBES during this time period, but are included here since they are part of the CAP data. Since 2012, complaints have been increasing annually. Members of the Committee reported more known cases. See Appendix I. Committee members that have been involved with these situations noted that cases with larger losses typically go through insurance and/or court and are often settled with non-disclosure agreements. Many cases are not made public, especially large failures that settle through insurance companies. Because there is no identified authority with responsibility over construction, it is difficult to quantify the exact scope and statewide cost of the failures as no one is tasked with collecting data on building science issues.[17]

Vermont needs significant statewide training to ensure builder knowledge of building science.

The BECSC discussed the need for statewide training to ensure builder knowledge of building science. While the Secretary of State's Office of Professional Regulation (OPR) now registers homebuilders and oversees the execution of owner-builder agreements, which stipulate minimum requirements for contractor agreements for service with consumers, OPR only regulates for fraud. Because there is no standard of care (i.e., a building code) for residential construction in Vermont and no credential standard, certification, or licensure of builders, OPR has no ability to adjudicate for competence. Vermont has a clear need both for an authority over workforce competence standards as well as significant statewide training to bring our workforce up to par with neighboring states.

[15] https://vtdigger.org/2023/05/22/i-wanted-to-cry-devastating-risks-of-spray-foam-insulation-hidden-from-vermont-homeowners/

[16] Data provided by Sandra Vitzthum via email to EFG on 10/21/2023, based upon data supplied by the Consumer Assistance Program. https://publicservice.vermont.gov/efficiency/building-energy-standards/building-energy-code-study-committee.

[17] OPR Sunrise Report, op. cit., page 6.

Figure 3. Remediation crew repairing relatively new Vermont home extensively damaged by moisture from indoor air that migrated into the walls (courtesy of Jim Bradley, Hayward Design Build).

Whereas most other states have state-approved continuing education – either required (licensure) or voluntary (certification)- Vermont has no state-approved continuing education and therefore no real incentive for most of the building trades. Outside Chittenden County, participation in building science trainings is rare. See Appendix D for a summary of current training programs.

Builders who comply with energy codes are at a competitive disadvantage.

Some members of the BECSC discussed the negative impact that the RBES compliance disparity has on builders. With only about half of buildings being built to code, builders who build to the energy code are at a price-competitive disadvantage and feel that they are operating on an unlevel playing field. For example, a Committee member related his experience that customers, given the option to adhere to RBES at slightly higher upfront cost, will often choose not to adhere to RBES, despite the potential for the building energy improvements to pay off over time.

Documentation of energy code compliance is inconsistent.

The Committee also discussed a lack of documentation, as an issue with Vermont energy code administration. This includes inconsistent filing of RBES and CBES certificates, which are intended to document compliance with the standards. In addition, there is no central database of building permits, and inadequate tracking of investigation and resolution of structural and health and safety problems. It is worth noting that Agency of Natural Resources' Act 250 Project Review sheets and their Permit Guidebook notify property owners and design professionals of mandatory energy code requirements. Act 250 projects are required to conform to CBES and RBES stretch codes; but Act 250 has no provision for assurance of compliance.

Currently, there is no central data system for registering a residential construction project that reports what is being built, where, when, by whom and whether it meets RBES. Commercial public buildings need to be reviewed by the DFS for building code compliance and usually involve a professional architect or engineer, so they are captured in the DFS database system, which is currently being updated and enhanced. But there are no central records of single-family residential projects. For towns that issue permits and certificates of occupancy, they keep records on file in the town office along with completed RBES and CBES certificates, but that does not always happen. Nor do all builders regularly file RBES and CBES certificates with the PSD which they are also supposed to do. And if they do, there is no publicly available database of filed energy code certificates for towns, lenders, lawyers, buyers, or anyone else to check, although the PSD will periodically provide information on filed certificates. With no centralized filing system in place, it is very challenging to know what is happening with residential construction, how we can influence its compliance with energy codes, and whether compliance rates change over time. The DFS is currently updating their permit data system; it could potentially be enhanced to cover single-family homes if provided with sufficient resources. The database is due to be completed in 2025 and would need sufficient budget to include single-family homes.

Pre-construction determination of energy code compliance would be beneficial.

Vermont would benefit from a process that requires the builder (both commercial and residential) and owner to agree before construction on the specific methods and assemblies the project will use to meet energy code requirements. While written contracts are now required in Vermont for residential construction projects over $10,000, there is no requirement for the builder and owner to formalize how the project will comply with RBES. It would be very helpful if this initial agreement could become the first step in a statewide database as an online application. A tool for designers and builders tied into a statewide database could help guide compliance with the energy codes before construction starts and could be a repository of completed certificates upon completion.

Vermont Energy Code Background

Energy Code History and Current Status

Vermont statute 30 V.S.A. § 51 established residential building energy standards.[18] The statute was initially passed by the Vermont legislature in May 1997 and sets a minimum standard of energy efficiency for new and renovated residential buildings three stories or less.

RBES includes two levels of stringency: base code and stretch code. The base code is the standard level of energy efficiency that all new and renovated residential buildings three stories or less must meet. The stretch code is the required level of energy efficiency for all Act 250 projects and in Vermont towns that

[18] https://legislature.vermont.gov/statutes/section/30/002/00051

choose to implement a higher energy standard. The stretch code includes higher points requirement to achieve compliance.[19]

The statute requires that "appropriate revisions are made promptly after the issuance of updated standards for residential construction under the IECC." Updates to the energy code are designed to provide reductions in energy use and emissions over the life of a building. RBES has been updated in 2006, 2011, 2015, and 2020, and has been updated again this year, with the latest RBES update going into effect in 2024 (target effective date of July 1, 2024).

CBES was enacted into law in 2006 by statute 30 V.S.A. § 53 and took effect January 1, 2007.[20] It is the energy code for all commercial buildings and residential building four stories or greater above grade in Vermont. CBES is required to be updated every three years with appropriate revisions in line with the IECC or ASHRAE standard, whichever provides the greatest level of energy savings. CBES has been updated in 2011, 2015, and 2020, and has been updated again this year, with the latest CBES update going into effect in 2024 (effective date of July 1, 2024).

Measuring Vermont's Progress Towards Safe, Energy-Efficient Buildings

Addressing energy code administration and compliance has been an ongoing effort in Vermont for over a decade. In 2012, the PSD published the "Vermont Energy Code Compliance Report," which intended to provide a roadmap to "achieve 90% compliance with Vermont's then current commercial and residential building energy codes by February 1, 2017." [21] The roadmap also included a plan to address how to implement RBES and CBES trainings and included suggestions for "unified energy code enforcement measures, as well as a process to evaluate and report annual rates of energy code compliance."[22] Conclusions from that report include the need for measurement and evaluation of compliance, leadership and policy in support of code compliance, education and outreach to stakeholders, and funding and staff resources dedicated to code compliance. And in 2013, EFG worked on an update to that report, "Vermont Code Compliance Recent Initiatives 12-5-13," which included a survey of initiatives intended to address energy code administration and compliance a decade ago.[23]

The Committee has noted some other past and ongoing efforts to increase energy code compliance. Builder trainings, for example, are one way Vermont has tried to increase awareness of and ability to build to the energy code. Organizations that have offered building energy code trainings in the past (and some of which continue still) include Efficiency Vermont (EVT), Building Safety Association of Vermont

[19] https://publicservice.vermont.gov/sites/dps/files/documents/2020-VT_Residential_Energy_Code_Handbook_v8.pdf

[20] https://legislature.vermont.gov/statutes/section/30/002/00053

[21] https://publicservice.vermont.gov/sites/dps/files/documents/Vermont_Energy_Code_Compliance_Plan%20FINAL.pdf

[22] https://publicservice.vermont.gov/sites/dps/files/documents/Vermont_Energy_Code_Compliance_Plan%20FINAL.pdf

[23] https://publicservice.vermont.gov/efficiency/building-energy-standards/building-energy-code-study-committee

(BSAVT), Vermont Builders and Remodelers Association (VBRA), and Association of General Contractors (AGC). See Appendix D for more information on training in Vermont.

The Committee has also noted some additional efforts towards energy code administration outside of builder training efforts. For example, the DFS currently requires that a commercial building have a CBES certificate in order to issue a certificate of occupancy.[24] Municipalities are also required by Act 89 (of 2013) to notify residents of the energy codes when issuing building permits and certificates of occupancy (CO) (for those towns that issue permits and COs). Town officials must provide RBES and CBES information when someone applies for a building or zoning permit. See Appendix F for more information on town zoning information in Vermont. Additionally, any building that requires a CO must be certified for CBES or RBES compliance before the CO is issued. Note that third-party certification is not required and that builders may self-certify compliance. Municipalities also have the option of adopting the stretch code if and when the Commission or Commissioner of PSD adopts such a code.[25]

Office of Professional Regulation (OPR) Builder Registry

The Office of Professional Regulation (OPR) builder registry is an effort closely related to energy codes involving raising professional standards in the construction industry and could be an important part of improving energy code administration. The builder registry, as required by Vermont law passed in 2022, was established in April 2023 to reduce fraud to protect consumers by registering builders. [26] While currently voluntary, starting in March 2024 OPR requires that all contractors who perform residential construction for a homeowner where the estimated value of the contract is $10,000 or more must register. No licensure or training is required, but voluntary certifications are encouraged. The Contractor Registry will someday allow contractors to list optional approved certifications, and it will provide consumers with a public database to search for certified contractors.

The Committee discussed some enhancements that OPR might consider for making the registry easier to locate and complete for builders and more user-friendly for consumers looking for contractors. OPR evaluates complaints related to builders on the registry to determine if a contractor has committed fraud but does not evaluate complaints for issues related to quality of work. They could ask contractors to explicitly attest that they will follow Vermont laws –including RBES and CBES—and if they do not, acknowledge that could be considered fraud. OPR could also provide language in their contract requirements and templates that states that the project will be built in compliance with the energy codes. OPR may need to be directed to take these additional steps since some of these efforts were not part of OPR's original legislative charge, so they may require statutory changes. See the PSD website for

[24] One Committee member noted that DFS has experienced challenges in this area specifically when it comes to conditional occupancy or phased in occupancy which allows use before the project is 100% complete. In some circumstances the certificates are not present because the building is not complete. So DFS may be missing some validations.

[25] Municipal Guide for Vermont Energy Codes and Above-Code Programs, Energy Code Assistance Center, September 2013.

[26] https://legislature.vermont.gov/Documents/2022/Docs/ACTS/ACT182/ACT182%20As%20Enacted.pdf#page=19

a presentation given to the Committee by the Vermont Secretary of State's Office (SOS) and OPR on the Contractor Registry.[27]

Resilient and Efficient Codes Implementation Department of Energy (DOE) Grant

As an effort outside of this Committee, Energy Futures Group (EFG) assembled a team of Vermont energy code stakeholders to apply for funding through the Department of Energy (DOE)'s Bipartisan Infrastructure Law: Resilient and Efficient Codes Implementation Funding Opportunity Announcement (FOA): DE-FOA-0002813. The team includes the Vermont Secretary of State (SOS) and their Office of Professional Regulation (OPR); the International Code Council (ICC); Vermont's energy efficiency utilities (EEUs) including Efficiency Vermont (EVT), Burlington Electric Department (BED) and Vermont Gas Systems (VGS); and the Vermont Association of Planning and Development Agencies (VAPDA). In July 2023, the team was awarded $1 million through this FOA.[28]

The overall goal for the project is to develop and implement an energy code administration system for Vermont that will result in significant and sustained improvement in energy code compliance. The intent of the funding available through this grant is to take what has been accomplished by this Committee and continue to further the efforts towards improved Vermont energy code administration. This will include building off this report to develop an energy code administration and funding plan, convening an advisory committee to provide input to the plan, advance Vermont's energy professionals workforce, and continue efforts towards education and training in support of Vermont's building energy professionals.

Legislative Directive

Governor Scott signed Act 47, also known as the "HOME Act", into law on June 5, 2023, to enable new opportunities for housing development. Section 23 of Act 47 named an "Energy Code Compliance; Study Committee" with a goal to "…to recommend strategies for increasing compliance with the Residential Building Energy Standards (RBES) and Commercial Building Energy Standards (CBES)." Powers and duties included the following three charges (re-ordered for clarity):

1. Assess how the building energy codes interact with the fire and building safety codes.
2. Consider and recommend strategies to increase awareness of and compliance with the RBES and CBES, including the potential designation of the Division of Fire Safety (DFS) in the Department of Public Safety as the statewide authority having jurisdiction for administration, interpretation, and enforcement, in conjunction with DFS' existing jurisdiction, over building codes; and

[27] https://publicservice.vermont.gov/sites/dps/files/documents/RBES%20CBES%20Committee%20Presentation.pdf

[28] https://www.energy.gov/eere/buildings/articles/meet-btos-newest-projects-support-more-resilient-and-efficient-building

3. Evaluate current cost-effectiveness analyses for the RBES and the CBES, whether they include or should include nonenergy benefits such as public health benefits and the cost of carbon, and how that impacts the affordability of housing projects and provide recommendations.

The Building Energy Code Study Committee (BECSC) reviewed and discussed these charges and provides the following recommendations, organized by "charge".

Response to Legislative Directive

Charge 1

Assess how the building energy codes interact with the fire and building safety codes.

Vermont currently has no statewide fire and building safety codes that cover all buildings. Through 20 V.S.A. 173, the Division of Fire Safety (DFS) has jurisdiction over public buildings, multifamily buildings, and rental properties. They currently do not have any jurisdiction over owner-occupied single-family homes.

The DFS has adopted and amended several nationally recognized safety standards to protect certain buildings and systems in those buildings. Vermont's building codes[29] include the following:

- Vermont Fire and Building Safety Code (based on ICC's International Building Code and NFPA's Life Safety Codes)
- Vermont Electrical Safety Rules
- Vermont Plumbing Rules
- Vermont Elevator Safety Rules
- Vermont Access Rules (ADA)

DFS' mission is "to protect the public and fire service through coordinated efforts in code enforcement, fire service training, public education, hazardous materials response, fire investigation and urban search and rescue. Thereby, maximizing life safety and property conservation and minimizing environmental impacts due to fire, natural disasters, and other emergencies in the State of Vermont."[30] Their mission is accomplished by the following for the buildings over which they have jurisdiction:

- Code Review
- Permits
- Inspections
- Trade Licensing and Certifications
- Legislative Rule Making
- Emergency Response - Life Safety and Hazard Mitigation

[29] https://firesafety.vermont.gov/sites/firesafety/files/documents/dfs_codesheet_codes%20.pdf

[30] https://firesafety.vermont.gov/

- Investigation
- Fire Safety Education and Training
- Fire Service Training and Certifications
- Urban Search and Rescue

DFS does not oversee energy code compliance in commercial buildings because they have no established authority in that area. They do check to ensure a CBES certificate is filed at the completion of a project, in compliance with Act 89. Given their building code authority over public and multifamily buildings, DFS theoretically has a role in conflict resolution between the energy code and other building codes.

Vermont's building energy codes (RBES and CBES) interact with four state agencies in different ways. These agencies include the DFS, the Department of Public Service (PSD), the Secretary of State (SOS), and the Division of Historic Preservation (DHP). While there is no officially designated authority among the agencies to oversee the energy codes, the PSD is considered the agency that oversees energy codes.

The PSD has responsibility for RBES and CBES promulgation, certificate collection, education, and some energy code interpretation. The PSD does not have the responsibility, nor resources to implement an inspection and enforcement system.

The SOS' Office of Professional Regulation (OPR) became peripherally involved with energy codes in 2023 when it began to register and minimally regulate homebuilders. Currently their primary function is to adjudicate for fraud. They have plans to display indications of energy code and building science certifications/trainings earned by contractors.

And finally, the Agency of Commerce and Community Development's Division of Historic Preservation (DHP) interacts with both DFS and PSD to protect historic buildings. DHP has in the past worked with DFS on variances, and they review and validate exemption requests to RBES and CBES if compliance with a particular provision would threaten, degrade, or destroy the historic form, fabric, or function of a building. The number of requested variances coming from either program is minimal, although DHP actively and frequently does assist owners of historic buildings.

Charge 2

Recommend strategies to increase awareness of and compliance with RBES and CBES including the potential designation of the Division of Fire Safety (DFS) in the Department of Public Safety as the statewide authority having jurisdiction (AHJ) for administration, interpretation, and enforcement, in conjunction with DFS's existing jurisdiction over building codes.

The Committee has six broad recommendations with more suggestions and details. Note that in the details below, **** IMMEDIATE ACTION ITEMS (2024)** and ** PHASE 2 (2-3 YEAR ACTION ITEMS)** are identified:

A. Make structural, statutory, policy, and programmatic changes to Vermont's energy code environment.

B. Improve the process for filing and tracking energy code certificates.

C. Improve workforce training and support.

D. Increase awareness of building energy codes and requirements.

E. Establish a plan for funding base-code and above-base code compliance.

F. Coordinate code compliance grant efforts in Vermont.

While the Committee was generally in agreement that RBES needs attention and resources to improve compliance, there was divergence in whether enhanced incremental approaches would be sufficient or if it is time to make a large step in increasing the DFS' role in administering the energy code. The State Agencies were clear in representing the Administration's opposition to an expanded role for the DFS and supported a more incremental approach while others on the Committee advised that now is the time to take a big step and expand the DFS' role in overseeing all aspects of the energy codes.

The Committee discussed each of the following recommendations. Where someone opposed a recommendation, they were invited to provide a written position as to why they dissented. Dissenting comments are included following the recommendations where there was opposition to a recommendation.

The Committee separated out its list of recommendations into two sections; those that the Legislature should address in 2024 ("Recommendations for Immediate Legislative Action") and all the others that either don't require legislative action or have a longer time horizon ("Non-Legislative and Longer-Term Recommendations"). The recommendations that follow are broken into these two categories.

Recommendations for Immediate Legislative Action

The following recommendations in sections A and B are those that the Committee believes the Legislature should consider and act upon in 2024. While action should be taken in 2024, some of the initiatives can be undertaken this year ("**") while others would follow in subsequent years as "phase 2" ("*").

A. Make structural, statutory, policy, and programmatic changes to Vermont's energy code environment.

A.1. Designate the DFS as the statewide "authority having jurisdiction" (AHJ) over all building construction – public, private, commercial, and residential. **

This would be the most significant immediate structural change that can be made to positively impact Vermont's energy code environment and a foundational change in Vermont's code environment but would provide the necessary structure that the state is currently lacking. It would bring Vermont's practice in line with other states. This expanded role for DFS would require time to plan, develop systems, staff up, and prepare for offering these services. It will be important to phase in the authority over time commensurate with available budgets and staffing, but as quickly as constraints allow.

A unified authority would play a critical role in overseeing all aspects of the energy codes including serving as a single point of contact for interpretation, conflict resolution, plan review, site visits, inspections, variance determination, addressing appeals, education and training of all building trades,

enforcement, record-keeping, reporting, municipal support, promulgation of new codes, stakeholder communication, etc. As AHJ, DFS would provide a clear chain of authority and could coordinate with other state agencies, counties, municipalities, and the private sector for effective, efficient and a unified administration of the energy codes.

Recognizing the importance of DFS in the building industry – not only regarding energy codes, but also its existing administration of building code – the Committee suggests considering renaming the office "Division of Fire *and Building* Safety." We acknowledge the significant costs and hassles that this change would entail but think that it is important that the office's name convey the scope of its authority.

There will be a cost to these changes that will be important to estimate, to identify funding sources, and to develop a plan to cover these costs. At the same time, there may be opportunities to be creative and innovative in approaching how to offer and cover the cost of some of these services. For instance, as the DFS does now for many of its other code support services, they could contract out technical services until such expertise can be brought in-house. There may also be opportunities for partnering with Vermont's Energy Efficiency Utilities (EEUs) to support increased energy code compliance.

Dissenting Comments:
The DFS and Department of Public Service (PSD) do not support the recommendation to designate DFS as the AHJ as this cannot be implemented on the strength of existing resources and therefore will require a tremendous amount of new, costly resources that will increase the cost of housing, delay permitting, and unnecessarily expand DFS authority to single family residential housing and create additional layers of regulatory oversight. What needs to be accomplished is getting more builders educated and trained in the profession. Building layers of regulatory authority does not fix the underlying issue. The concept of enforcement, integrating plan review and site visits into the existing landscape is not feasible and will cause delays in permitting. Additionally, this takes away from the DFS' mission of protecting lives from fires. There are already systems in place to address records, training, and education that need to be revisited with a focus on achieving outcomes.

Further, DFS opposes this recognizing PSD has oversight and administration of the energy efficiency program. PSD currently does rule making and has technical expertise in this energy efficiency. They feel there is no tangible benefit gained and this will add a financial cost to the initiative. This system is not broken and DFS has zero bandwidth to add any more rule making.

AGC dissents.

A.1.a. Clarify the chain of authority from the General Assembly, through DFS, to municipalities.**

A majority of the Committee recommends increasing the memorandum of understanding (MOU) provision in DFS statute (25 VSA 173) to include oversight of municipality administration to owner-occupied single-family homes.

Dissenting Comments: DFS opposes a chain of authority to municipalities as they feel a broad application of the energy efficiency code is much more practical reducing bureaucracy and recognizing our authority does not extend to single-family owner-occupied dwellings. DFS does not have the resources to manage this and would do a disservice to their constituents.

A.1.b. Establish an advisory committee to advise on the overall transition to a new AHJ, help with future code revisions and examine building failure cases to improve building science and future codes. **

Utilizing stakeholders and experts from the building community can help the DFS make the transition to the AHJ over all buildings in Vermont and guide its future direction.

Dissenting Comments: DFS and PSD oppose this on the basis that they do not agree with the AHJ designation proposal.

A.1.c. PSD continue in role administering the energy codes in support of the AHJ. **

The PSD currently plays a role in energy code administration that they could continue under an arrangement with the DFS or other AHJ when designated. Until such a time, the PSD should continue in their current role.

A.1.d. Develop a certification designation for contractors trained on the energy codes and include the certification on the OPR Contractor Registry and DFS website. **

Develop a voluntary, generic certification for each trade (homebuilder, insulator, weatherizer, energy consultant, etc.) to demonstrate energy code proficiency and coordinate with OPR's Contractor Registry and DFS to list the certifications. Include certifications on OPR's Contractor Registry[31] and DFS's Trades Licensing and Certification[32] webpages. Require Contractors (OPR) and Trades (DFS) to disclose at registration and renewal whether they have obtained certification appropriate to their trade. (This is the same recommendation at A.6. below, but is repeated here to clarify that this task would fall under DFS or the AHJ once designated.)

A.2. Amend the energy code update cycle by changing "shall" in the energy code enabling statue to "may". **

As a separate step in supporting Vermont's energy code environment, recognizing the declining compliance rates with RBES with each subsequent adoption of a new more stringent energy code, the Committee recommends considering amending or postponing the energy code update cycle. Instead of spending the time to update the energy codes, those efforts may be better spent focusing on ways to close the compliance gap. Both RBES and CBES enabling legislation requires the PSD to regularly update these energy codes, so there would need to be legislation to change that update cycle. The Committee recommends at least changing "shall" in the energy code enabling statue to "may" to allow this timing flexibility. This would also allow for more sporadic updates once the target of net-zero ready construction is met, and regular updates may not be needed after that point.

[31] https://sos.vermont.gov/residential-contractors/

[32] https://firesafety.vermont.gov/licensing

AIA-VT and VBRA also recommend delaying the implementation of the next update of RBES, scheduled to go into effect July 1, 2024, until it is amended to reflect sound building science principles.

It is also important to recognize that Vermont's 2022 Comprehensive Energy Plan sets a target to achieve net-zero ready construction for all newly constructed buildings by 2030.[33] If the energy code update cycle were postponed, that goal may not be met in terms of the energy code enacted.

A.3. Establish a study committee on adopting a statewide residential building code (e.g., IRC). **

Most states have a residential building code, which establishes building standards that ensure safe and durable construction standards, and the health and safety of the building occupants, in line with the International Residential Code (IRC). The lack of a residential building code not only could impact safe and durable construction practices, but also means that there is no statewide administrative structure to address issues like building code interpretation, conflicts, variances, integration with building science issues and other issues. The Committee spent a lot of time discussing this missing element and suggests that it would be useful for the Legislature to establish a study committee to explore adopting a residential building code that would address all construction elements, proper building science, and serve as the structure to house the energy codes.

A.4. Require OPR to update Contractor Registry (A) so contractors explicitly acknowledge RBES/CBES legal requirements, and (B) to alert consumers to RBES/CBES and provide filtering functionality, e.g., by specialties, location, and certifications. **

OPR's Contractor Registry could serve as a means of reminding contractors that they need to abide by Vermont's laws--including the energy codes--which they should explicitly acknowledge when they register or renew their listing.

The Contractor Registry could also serve to inform consumers of RBES and CBES. It would be useful to consumers to provide filtering functionality in searching for construction specialties, locations and certifications including energy code and building science.

Dissenting Comments: VBRA: No other building professional is required to make a similar acknowledgement, nor is any entity required to acknowledge other requirements such as building codes or wastewater rules. The registry should be used to register contractors, not statements or rankings.

DFS: Adding continuing education hours or validation of energy efficiency training for 10,000 trade professionals is a major challenge and a heavy lift for the DFS.

A.5. Authorize OPR to update their contract requirements and template for contractor-owner agreements to include a clause acknowledging that energy codes are mandatory. **

Require OPR to add information about the RBES/CBES mandatory requirements in any contract template they make available to contractors and consumers.

[33] https://publicservice.vermont.gov/sites/dps/files/documents/2022VermontComprehensiveEnergyPlan_0.pdf p. 180

A.6. Develop a certification designation for contractors trained on the energy codes and include the certification on the OPR Contractor Registry and DFS website. **

Develop a voluntary, generic certification for each trade (homebuilder, insulator, weatherizer, energy consultant, etc.) to demonstrate energy code proficiency and coordinate with OPR's Contractor Registry and DFS to list the certifications. Include certifications on OPR's Contractor Registry[34] and DFS's Trades Licensing and Certification[35] webpages. Require Contractors (OPR) and Trades (DFS) to disclose at registration and renewal whether they have obtained certification appropriate to their trade. (This is the same recommendation at A.1.d. above where it is placed to convey that this task would fall under DFS or the AHJ once designated. However, until that time, the Committee recommends that this task be OPR's.)

Estimated Costs for A: Designating DFS and the AHJ will have both start-up and on-going operational costs. Start-up costs will involve developing systems, standards, support materials, tools, etc. and hiring and training staff. Start-up costs may be in the range of $500,000 to $1,000,000. On-going operational costs to cover staff salaries, expenses, trainings, etc. would be in a similar range each year but may be able to be at least partially offset if permit fees or other revenues are established.

Dissenting Comments: DFS and PSD oppose DFS being designated the AHJ because it creates unnecessary bureaucracy and there is virtually no research pertaining to the financial impact this will impose on our housing community. Additionally, this report proposes extending DFS jurisdiction into single-family owner-occupied homes, which DFS strongly opposes.

B. Improve the process for filing and tracking energy code certificates.

B.1. Expand DFS's current database redesign to incorporate a statewide, central, publicly accessible repository for all Vermont buildings (including all residential) that includes energy code data. **

The DFS is currently updating their permit data system that could potentially be enhanced to cover owner-occupied single-family homes if provided with sufficient resources. It is due to be completed in 2025 and would need sufficient budget to include single-family homes.

However, just having a central housing database available will not ensure that it is used. To get builders and designers to register their projects and then generate an energy code certificate at the end of the process, they will need to be strongly encouraged to participate. Options range from "carrots" to "sticks" including offering incentives to requiring participation.

Dissenting Comments: DFS opposes the reference to DFS housing this data repository. They are in the process of procuring a new database and this recommendation assumes that all aspects of the energy efficiency program will be structurally moved to DFS. Their new system is budgeted, and they have not selected a vendor and are very concerned about the cost. For this reason, DFS opposes this as written. DFS can support an enhanced tracking system, but not in support of homebuilder-owner agreements, which adds another layer of regulation. There were other proposals or suggestions made (less

[34] https://sos.vermont.gov/residential-contractors/

[35] https://firesafety.vermont.gov/licensing

regulatory, less expensive, less intrusive and built upon existing systems) that be a better option and should be explored.

Dissenting Comments: PSD dissents as this is tied to DFS being designated as the AHJ, which the PSD doesn't support.

B.1.a. Eliminate filing certificates in town records and the notarization requirement. **

A centralized publicly accessible database would eliminate the current burden imposed by filing in town records, would aid in title searches and could provide valuable housing planning and reporting data. Such a system could also help reduce the need for active enforcement if lenders, closing attorneys, town zoning administrators and others had access to the information in the database.

The current requirement for notarizing RBES certificates will become unnecessary and should be eliminated.

Dissenting Comments: PSD disagrees with the centralized database recommendation and therefore disagrees with this sub-recommendation.

B.1.b. Establish a certificate application tool for both CBES and RBES that generates an energy code "permit" before construction and a final certificate upon completion that is part of the DFS database. **

Commercial and multi-family projects can simply add energy code review to the existing building permit application. The builder closes out the energy code application as part of the large building permit close-out.

A similar, simple online application tool for single-family homes should be developed. This would be the only application that homebuilders need to submit to the state. It would not be enforced except in municipalities that choose to do so. Homebuilders would apply for an energy code "permit" at the start of a project to determine what energy related elements would need to be included in the building, construct the building to those standards, and then close out their application by certifying that they built their projects according to the application (or attach amendments).

Estimated Costs for B: To develop a central database of housing projects and energy code certificates may cost up to $250,000 if added to an existing data system. Development of a "permit tool" may cost an additional $250,000. It would also require initial and ongoing training of builders, designers, and everyone else in the construction and housing industry to inform them of its presence and use which could be upwards of $100,000 per year for several years.[36] Ongoing costs should be covered by permit fees.

[36] Estimated costs are provided for many of the recommendations to provide some level of indication of financial impact. These costs are professional judgements from staff and Committee members.

Dissenting Comments: DFS and PSD do not support this recommendation without the identification of the estimated cost to achieve and a funding source. DFS is currently in the process of updating their database and the current budget is $1.5M with a $200,000 annual maintenance fee. Therefore, developing this type of system for RBES and CBES may be cost prohibitive.

Non-Legislative and Longer-Term Recommendations

The following recommendations in sections C through F and Charge 3 are those that the Committee believes do not require legislative action. These are also important as a means of improving energy code compliance and should be addressed in 2024 (**) or later in "phase 2" (*).

C. Improve workforce training and support.

There was broad recognition on the Committee that statewide training on energy codes is vitally important and that coordination among all the entities involved in this effort will be critical. Therefore, the ongoing energy code and building science trainings and conferences offered by EVT, the PSD, EFG, SEON and others should continue contingent on appropriate available funding being identified and allocated to any entity for training support. It will be important that all of these training efforts continue to coordinate and transition under a unified authority once designated.

C.1. Coordinate and support energy code trainings and certifications. **

The Committee strongly endorsed workforce training and support. However, there were differences of opinion regarding continuing the current approach of offering energy code trainings through various organizations (PSD, Efficiency Vermont, Vermont Office of Economic Opportunity, Better Buildings by Design Conference, etc.) or to hand all training responsibilities over to the DFS to coordinate and oversee these. There were concerns at the DFS about taking on this responsibility without sufficient staff or budget and from others questioning the benefits and timing of such a transition. Most of those on the Committee agree that unless and until the DFS is named as the AHJ, Efficiency Vermont (EVT) and the Office of Economic Opportunity (OEO)should be the entities charged with coordinating energy code training and certification activities in Vermont given their DOE grant and work to establish the Vermont Training Center. EFG will also play a role coordinating and supporting training under their DOE energy code administration grant available from 2024-2026.

As part of EFG's DOE grant in support energy code administration, they are tasked with working with OPR to develop a training certification program that can be listed on the Builder Registry as discussed in A.6. above. This activity should start as soon as possible, but builder training should not wait until it is fully developed.

Dissenting Comments: DFS opposes moving these areas of responsibility to DFS due to lack of resources, lack of expertise in the field of energy efficiency, and the cost to hire full time positions. They feel this can be handled efficiently and effectively in the private sector without stacking more regulations onto contractors. The assumption here is that DFS is the AHJ. They are concerned that this is a very broad list of topics and developing programs and delivery training cost is not known.

AIAVT disagrees with the idea of establishing OEO as the authority overseeing a broad range of building science training with demanding issues such as retrofitting 150-year old buildings. This move would add yet another state agency into the confusing mix of authorities over single family homes.

C.1.a. Develop training materials **

Develop or utilize existing climate- and building stock-specific energy code and building science training for builders – to be taught also to designers, subcontractors, developers, building distributors and suppliers, planners, housing organizations, municipalities, real estate agents, lenders, appraisers, and other audiences with an interest in housing, construction, and finance – in various formats and levels of detail.

C.1.b. Conduct regular trainings **

Make training available regularly in various formats and venues to all the audiences listed above, in all areas of the state. Make it clear that RBES and CBES are required energy codes and how to comply with the codes, including project registration and certification. Coordinate energy code training through tech centers, efficiency utilities, professional organizations, trade groups, state agencies, regional organizations, municipalities, and the proposed Weatherization Training Center.

C.2. Develop "circuit rider" on-site energy code services statewide. **

Offer energy code and building science support, including help with problem solving. These may initially be EVT consultants or contracted consultants. Efficiency Vermont will be providing a "circuit rider" support service as part of the EFG U.S. DOE grant for a limited period of time. Developing a longer-term service would help support builders and others in the field.

C.3. Increase training and support for Energy Consultants. *

Train, certify, and support third-party energy consultants including Building Performance Institute (BPI) certified energy specialists, Home Energy Rating System (HERS) raters, HEAT Squad, etc. to provide direct support to builders for both base-code and above-code services. For example, energy consultants could provide plan review and/or meeting prior to construction; assist builders with filing the permit or application and completing the owner/contractor agreement; perform site inspections with blower-door tests at critical junctures during construction; provide visits at close-in prior to insulation, at insulation prior to interior wall cladding, and at substantial completion; and assist the builder with closing out online application and producing the RBES or CBES certificate.

C.4. **Increase and coordinate building science and energy code training including weatherization**. *

There are several weatherization, energy code, building science, and other funded workforce and training initiatives lined up in Vermont. These should be coordinated and offered in partnership with the multiple organizations involved in these activities.

a. Vermont's Office of Economic Opportunity is partnering with Efficiency Vermont to use $1.7 million in DOE funds to create a special training center. The WxTC will serve as a hub to coordinate existing training programs and develop new training programs for Vermont. A specific goal of the WxTC is to diversify the workforce and bring underrepresented individuals into the weatherization field. If a viable business model is identified for the WxTC, a request for proposals will be issued in 2024 to solicit an entity to establish and run the WxTC. This effort should also be coordinated with the Association of General Contractors of Vermont's (AGC/VT) training facility and programs.

b. The PSD has budgeted a portion of a $875,000 U.S. DOE grant "Workforce Developing Training Funding" to provide workforce development to grow the weatherization workforce in Vermont. This could include Building Performance Institute (BPI) certification and could be expanded to include more general building science and include new construction.

c. Efficiency Vermont has received a $1M Workforce Development Training Grant from the American Rescue Plan Act (ARPA). It provides funding for entities and programs that increase the number of people working in or supporting the weatherization field in Vermont. Programs must directly serve an eligible population, defined as: Low income (defined as less than 80% AMI); or individuals who, as a result of the COVID-19 pandemic, are unemployed or are employed part-time but want and are available for full-time work; or moderate income (defined as income between 80%-120% AMI); or workers whose entry to the weatherization workforce represents greater opportunity for economic advancement.

d. Efficiency Vermont anticipates adding a Workforce Development position. A full-time position will be hired in 2024 to assist with Talent Pipeline Management in the energy efficiency trade workforce. This position will work collaboratively with Vermont partner organizations on helping to build and implement long term strategies to recruit and retain more skilled workers in the weatherization and heating electrification fields.

e. Work with the Division for Historic Preservation to develop appropriate methods and materials for retrofitting and weatherizing historic structures.

C.5. Coordinate with the Energy Code Support Center (call center) with other code support efforts. *

Once the DFS is established as the AHJ, they can manage Efficiency Vermont's Energy Code Support Center and create clear roles and responsibilities. However, until DFS is the AHJ, the PSD and DFS should coordinate with Efficiency Vermont offer code interpretation, project support, training, and specific energy code advice. The current funding for this center at Efficiency Vermont is $105,500 annually.[37]

Estimated Costs and Funding for C: It should be noted that since a coordinating authority does not exist currently, this will be an additional cost to the State of Vermont wherever the authority is housed.

Several major funding streams are becoming available through the federal Department of Energy to help states meet their energy consumption reduction goals. Vermont has already received one grant. While DOE's "Vermont Energy Code Administration Project" grant will provide $1 million in funding for 2024-

[37] From the DRP-DSS budget

2026, there will be additional funding needs during this time and beyond for workforce energy code training and support. Building out DFS's energy code administration capabilities, hiring support staff, developing systems, supporting the ECAC, reaching other audiences with training, and promulgating the next versions of RBES and CBES are all necessary activities requiring funding. On-going funding needs to support these development, implementation, and dissemination activities could cost $500,000 - $ 1,000,000 per year. The U.S. DOE has numerous energy code support grants available to states that could be pursued. One example is DOE's "State-Based Home Energy Efficiency Contractor Training Grant Program" with applications due January 31, 2024.

Dissenting Comments: AIAVT and VBRA do not agree with a temporary authority. Their goal is to work consistently towards a unified authority. DFS is the appropriate authority and oversight should start immediately for what is possible. A two-to-three-year plan should be developed for everything else.

AIA-VT states that no non-government entity should have authority over government functions. To whatever extent possible, the future AHJ should oversee non-government entities.

D. Increase awareness of building energy codes and requirements.

Regardless of improvements to energy code administration, it will take an ongoing effort to ensure that every builder, designer, supplier, subcontractor, lender, agent, lawyer, and everyone else involved in Vermont construction, finance, and real estate—as well as consumers--are made aware of the presence and requirements of the energy codes. As noted above, municipalities and DFS through Act 89 and the Agency of Natural Resources already inform owners and builders of energy codes. The Committee recommends these additional efforts to increase awareness:

D.1. Develop and mail out bill stuffers remining about energy codes. **

The EEUs and others should help develop bill stuffers that municipalities can include in general information and water bills and utilities can include in their electric, gas, water, and sewer bills.

D.2. Work with lenders and attorneys to include energy information on loan closing checklists. **

The AHJ should ensure that the inclusion of energy code certificates is included on lenders' and real estate attorneys' mortgage loan closing checklists.

D.3. Use state, regional, and municipal websites to reinforce energy code requirements. **

Use other existing state and municipal interfaces, such as zoning permit, septic design, and sewer hookup websites, to reinforce RBES/CBES requirements.

D.4. Support efforts to create a radio show on building science and energy codes to educate the public. *

Create an educational question-and-answer show based upon the wildly successful "Car Talk" of years past. Each episode would feature a different issue, a commonly encountered problem, or a submitted

question. The radio show option would encourage call-ins, and perhaps could become a regular feature of Vermont Public. The shows could be archived for the public and also for future improvement of the codes. Committee member Jim Bradley and energy consultant Chris West once had a similar show on WDEV.

Estimated Costs and Funding for D: Costs for each of these measures would be relatively low, running from perhaps $5,000 to $10,000 to program a website or update a checklist with some RBES/CBES information. It may cost $10,000 - $20,000 to print and distribute bill stuffers and brochures. To maintain a concerted ongoing effort to increase energy code awareness may cost $50,000 to $100,000 annually. Grants could potentially be used for some of these costs, but long-term funding solutions would need to be lined up to support these efforts into the future.

E. Establish a plan for funding for base-code and above-base code compliance.

Most of these recommendations will require some amount of funding to be put into place. Estimates of costs are included with most recommendations. However, it will require more work to develop detailed budgets and then figure out the funding sources for both increasing compliance to the required energy code levels and also to support above-code performance.

E.1. Develop a funding plan to pay for start-up and on-going costs to support the AHJ and energy code administration. *

In coordination with the DFS or other designated AHJ, develop a detailed plan for funding and implementing the recommendations that will ultimately be pursued to increase energy code compliance. Elements of this plan should include the costs of start-up, on-going operations, staff, expenses, travel, etc. Revenues from grants, general fund allocations, permit and certification fees, municipal arrangements, etc. should also be estimated. One of the deliverables for EFG's DOE grant will be the development of an energy code funding plan so they will be able to help DFS or the AHJ develop this plan. This will be informed by actions the Legislature takes in 2024 and beyond in addition to grants received and other activities undertaken by state agencies, EEUs and others.

E.2. Establish a role for EEUs to play in supporting energy codes compliance and incentives. *

Given the energy code compliance rates for RBES were 54% in the most recent PSD study and the lack of an existing infrastructure in place in Vermont to support increasing compliance, the Committee recommends leveraging the considerable expertise and capacity of the EEUs to reverse this trend. While the EEUs are not interested in being the "energy code police", there are opportunities for them to support the construction industry and claim energy savings that can help meet their savings goals. They can do so by supporting the building community with technical assistance, training, offering incentives and other approaches as they do in other markets such as promoting weatherization and heat pumps. The Public Utility Commission (PUC) will be undertaking a proceeding to review the EEU's new construction programs and potential changes to the framework and mechanism for measuring energy savings in 2024. The Committee recommends that the PUC consider allowing the EEU's to receive credit for increasing compliance rates for RBES through the services they provide.

While there is a significant amount of support required to bring most residential new construction into compliance with RBES, there is also a need to develop both RBES and CBES to go beyond the base code levels. Currently, the EEUs offer incentives and claim savings for projects that are either built better than code (for commercial) or built better than standard practice determined through market assessments (for residential). The Committee recommends that this parallel effort not only continue, but expand to incentivize the EEUs to support projects meeting "net zero" level of performance.

Funding for EEU support could theoretically be covered through existing funding mechanisms but would take away from other EEU activities and programs.

F. Coordinate code compliance grant efforts in Vermont.

F.1. Coordinate with the U.S. Department of Energy's (DOE) grant to Energy Futures Group for the "Vermont Energy Code Administration Project" to support these strategies. **

EFG has been awarded a three-year U.S. Department of Energy (DOE) grant for the "Vermont Energy Code Administration Project" to support the development of an energy code system in Vermont. This can be considered as a "phase 2" to the Act 47 BECSC and a follow-on to many of the recommendations coming out of this report. This $1 million will fund energy code administration planning, builder training development, energy code trainings, a full-time circuit rider for two years, municipality outreach and training sponsorships, development of the OPR's Contractor Registry training certification, and training and support of energy consultants. EFG will coordinate closely with the Secretary of State as the grant's sponsor, DFS, PSD, EEUs and others. If and when the DFS is named as the AHJ, EFG will coordinate closely and take direction from them.

F.2. Continue the role of the Act 47 Building Energy Code Study Committee as the "Phase 2" Advisory Committee to EFG's DOE grant. **

EFG will organize an advisory committee that resembles the Act 47 Building Energy Code Study Committee and coordinate with interested stakeholders, agencies, and others in carrying out the DOE grant. Once an AHJ is named, this advisory committee could be transitioned to their oversight.

Charge 3

Evaluation of cost-effectiveness analysis for RBES and CBES.

The Committee formed a subcommittee to address the Legislature's charge to "evaluate current cost-effectiveness analyses for the RBES and the CBES, whether they include or should include nonenergy benefits such as public health benefits and the cost of carbon, and how that impacts the affordability of housing projects and provide recommendations." The subcommittee met three times and then presented its recommendations to the full Committee. The Committee's recommendations follow:

1. **Continue calculating energy code "cost effectiveness" as has been done historically.** **

   Calculate cost-effectiveness from the consumers' perspective for a typical Vermont new home based on achieving positive cash flow assuming incremental costs (net of incentives that are available to all customers statewide for the full three-plus-year code cycle, otherwise incentives should not be included) for energy code improvements from current code levels, financed in a 30-year mortgage for RBES (20 years for CBES) at the current construction costs and mortgage rate using average current Vermont fuel costs. Provide the following analyses:

   a. Cash flow
   b. Return on Investment (ROI)
   c. Simple Payback
   d. For informational purposes only but not to be used as the basis of determining "cost effectiveness" and as called for in the 2022 Vermont Comprehensive Energy Plan, include a calculation that adjusts the fuel savings benefits by the social cost of carbon, as determined in the Avoided Cost Proceeding for the EEUs and ordered by the PUC.

2. **Establish a new committee of energy, economic, and housing experts to research and address whether and how to best include the cost of carbon and non-energy benefits in building energy codes for new and existing buildings.** *

   This committee's charge should be:

   a. Develop a methodology for determining an appropriate level of the cost of carbon and non-energy benefits for calculating societal cost effectiveness for building code evolution based on evolving research, PUC proceedings, and approved tools that include the social cost of carbon and health benefits.
   b. Address the relationship of "cost of carbon" screening to "net zero capable" 2030 state goals for energy codes and the state's broader climate goals. Determine a methodology for defining "net zero capable" code standard.
   c. Determine a policy framework for how state and/or utility incentives may be structured to subsidize all or major portions of "cost of carbon" measures with a focus on equity.

a. Identify opportunities through the DRP process and other approaches to cover the societal cost of carbon with incentives in order to shift the costs of the more efficient buildings from the owner to society since they will receive the benefits. Filling this last increment between the current energy code and "net zero capable" may be the role that EEUs play in the new construction market to provide the technical assistance and/or incentives in exchange for claiming the energy and carbon savings.

b. Using available industry research, estimate the quantitative and qualitative values of physical and mental health benefits of building energy codes resulting from improved building durability, comfort, and indoor air quality.

c. Estimate the cost savings from prolonged building durability due to building energy code compliance.

d. Additionally, analyze costs and savings attributable to recommended assembly or equipment by comparing to from the new construction market "industry standard practice" (ISP), in addition to the legacy approach that analyzes costs and savings from the existing code level. Consider sample sizes and self-selection biases with the existing PSD market assessment studies. With available funding since it may be costly to administer, consider using a Delphi panel of experts to determine the current market ISP rather than relying on the PSD's market assessment studies that look back at earlier code versions.

Dissenting Comments:

PSD: The Department does not have the resources to lead this effort.

VBRA: VBRA disagrees with adding more costs to new construction. A recent Marketwatch study[38] in the fall of 2021 found Vermont to be the least affordable new home market in the U.S with only 16% of VT households able to afford the mortgage payment on a median priced new home. The State should be looking at ways to support new construction, not make it more expensive.

[38] https://www.marketwatch.com/story/this-state-has-the-least-affordable-housing-market-in-the-u-s-based-on-income-and-its-not-california-11615974744

Conclusion

The Committee is proud to have engaged in a respectful, informed, and productive series of meetings among a diversity of interests and perspectives. We are gratified to be able to carry forward the Vermont tradition of civil discourse, finding common ground, and making progress. We are at a significant inflection point with our built environment and trust that our recommendations will be helpful in guiding Vermont in a new direction. We believe that the recommendations outlined above will change Vermont's trajectory significantly as well as prepare our construction workforce and our buildings for the future. The future must include safe, healthy, and energy-efficient environments to live and work in.

We thank the Legislature for this opportunity and would be happy to follow up with any additional information, answers to any questions, or provide follow-up testimony.

Appendices

Appendix A: Links to PSD website

Committee meetings minutes, meeting materials, resources and research on other states, the cost effectiveness PowerPoint, and other BECSC resources can be found at the PSD website: https://publicservice.vermont.gov/efficiency/building-energy-standards/building-energy-code-study-committee.

Appendix B: Other strategies considered and not recommended by the Committee

1. Enforcement mechanisms
2. Title impact
3. Full builder licensure (credentials or competency testing)
4. Existing certifications (LEED, NGBS, EnergyStar Home, Passive House)
5. Certificate of Occupancy (implying state-required building permit)

Appendix C: More background on RBES certificates

Residential code compliance is difficult to quantify in a state where certificates of occupancy are not required in most towns. There are higher rates of energy code certificates being filed in towns with municipal ordinances and building inspectors. It is interesting to note that municipalities with MOU agreements with the Division of Fire Safety have relatively high levels of certificate submission.

One measure of administrative compliance with the Residential Building Energy Standards is the number of certificates filed compared with the number of building permits filed. According to the PSD, 5,850 RBES certificates were filed from 1997 to 2022. In that period 54,833 residential building permits were filed in Vermont. That means, very roughly, on average 10 certificates were filed for every 100 residential units statewide. AIA-VT analyzed the data and provided Figure 4 that shows the details of the percent of RBES certificates files per single family building permit between 1998 and 2018 by county, plus the statewide rate of homes built over the period having filed RBES certificates.

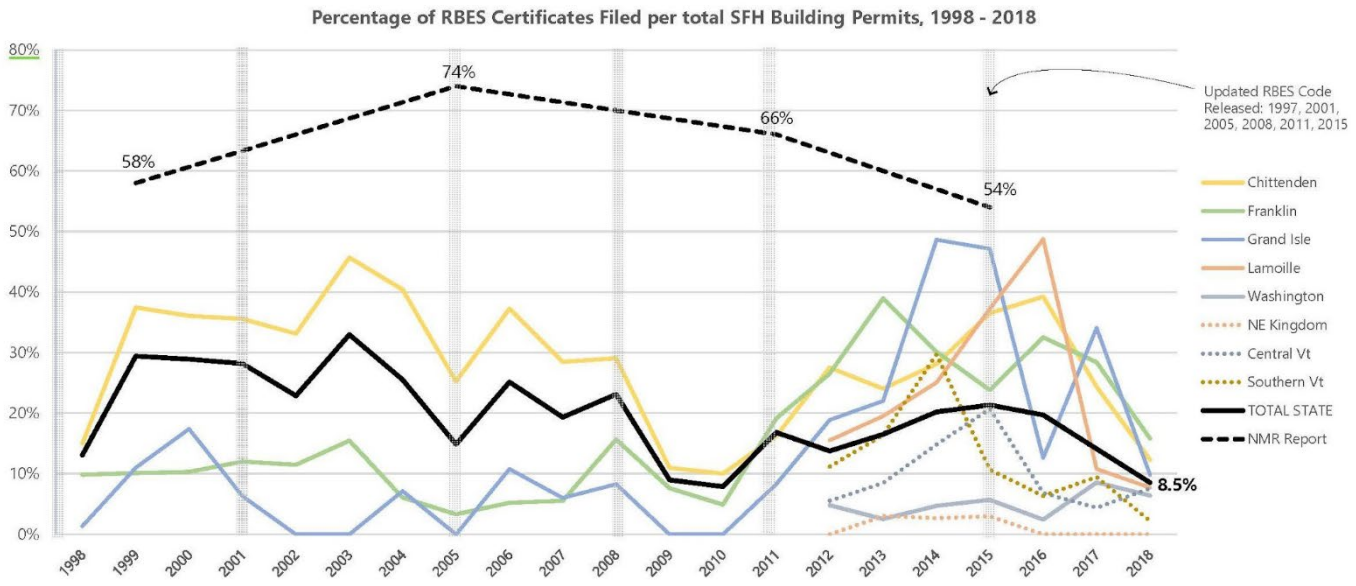


Figure 4. Percentage of RBES Certificates Files per total Single Family Home Building Permits, 1998-2018 (Note that 3 counties reported building permits by 1998; the rest of Vermont started reporting in 2012.)

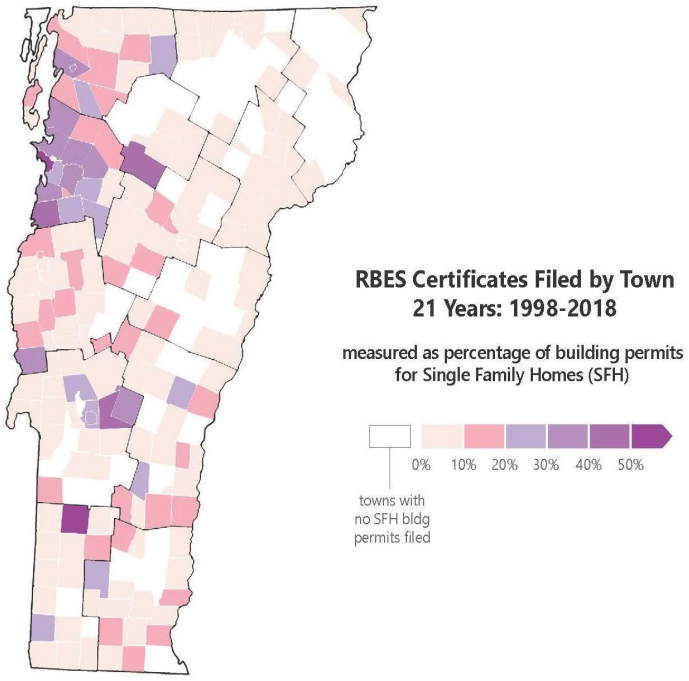


Figure 5. RBES Certificates Filed by Town, 1998-2018[39]

[39] *Note the southern town over 50%, Dorset, had a very low number of permits and a relatively large number of undated certificates. Sources: Vermont Department of Public Service and U.S. Census Bureau.*

Appendix D: More information on training in Vermont

Currently a number of providers train Vermont's construction workforce about energy codes, building science, and weatherization.

1) **Efficiency Vermont**. 12-24 trainings a year typically reaching 65-245 participants depending on the code update cycle. EVT also hosts a two-day Building Better by Design conference in Burlington which typically sees 900-1000 participants. EVT also budgets about $70,000/year to subsidize coursework, field training, and exam fees for Building Performance Institute certifications.
2) **Vermont Builders and Remodelers Association (VBRA)**. Typically offers six courses per year, usually in partnership with Efficiency Vermont. Participation in other courses is very low.
3) **Association of General Contractors (AGC)**
4) **Vermont Retail Lumber Dealers' Association (VRLDA**): primarily commercial training.
5) **Building Safety Association of Vermont (BSAVT):** 2-4 trainings a year, both commercial and residential. Typically 80 - 120 participants a year focused in central and southeastern Vermont.
6) **Vermont's seventeen technical and career centers:** at least three-quarters of these facilities have building trades programs. They are eager to teach professionals, but there is no demand now because there is no incentive (like certification) for participants. The centers do currently host training for electricians and plumbers.
7) **Sustainable Energy Outreach Network (SEON),** based in Brattleboro VT has offered courses reaching 85 builders and carpenters primarily along the Connecticut River Valley. Since 2018, their class "Basics of High Performance Building" includes hands-on flashing using mock-ups: https://buildingscience.org/certification-and-training/. SEON often partners with technical/career centers including Brattleboro, Hartford, and Middlebury. SEON is currently leading a coalition of trainers, trade associations, and builders to develop and promote a state-wide certification program as a High Performance Builder for builders and carpenters. Executive Director Guy Payne says, "We need to ensure there is consistency in what needs to be required for our workforce whether they live in Bennington or the Kingdom."
8) **Yestermorrow** has a 6 week High Performance Design/Build Program.
9) **Northlands Job Corps** in Vergennes is a federally sponsored residential technical center offering basic level carpentry with work-based learning at local construction companies once the basic carpentry skills have been mastered.

Figure 6. Vermont technical and career centers.[40]

10) **Weatherization.** EVT currently teaches some courses, but Vermont's Office of Economic Opportunity handles most of Vermont's weatherization training. There is minimal coordination of retrofit and weatherization training with experts such as the Division for Historic Preservation. There are no state-recognized certifications that providers can teach to. The majority of courses are in the west side of the state; more effort must be made to reach contractors in the east side of the state.

11) Community Training. There are 140 Vermont Energy Committees across the state: volunteer groups working with municipal officials, schools, businesses, and neighbors to get buildings

[40] Vermont Association of Career and Technical Directors, https://vacted.org/

weatherized, solar projects electrified, heat pumps installed, transportation options expanded and far more.[41]

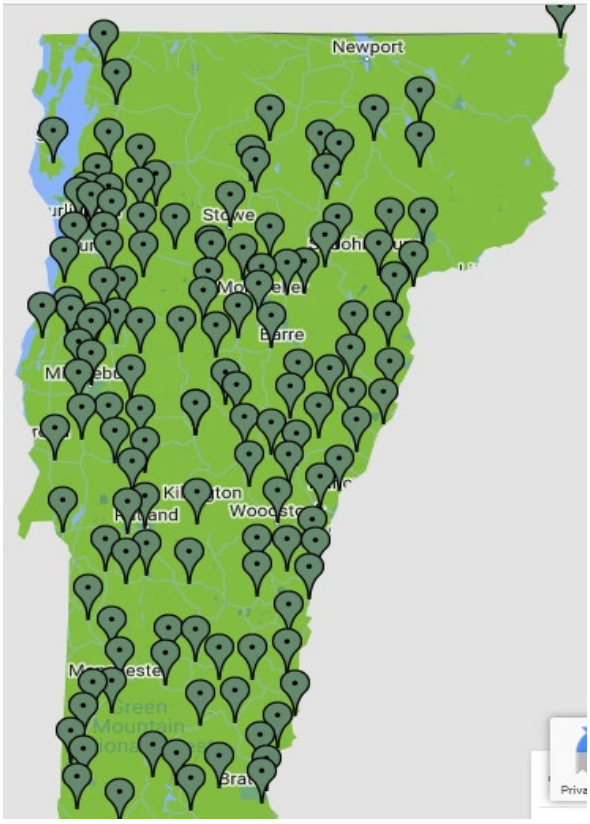


Figure 7. Locations of Vermont's Energy Committees.[42]

VECAN, the Vermont Energy Committee Action Network, office of Vermont Natural Resources Council, supports the committees with training, communication forums, and advocacy in state government. VECAN partners with the state's eleven regional planning commissions and the Vermont League of Cities and Towns. Together, this nearly statewide network is a powerful channel for training homeowners and local experts.

Some of these committees may have established local building energy code ordinances or even adopted Vermont's stretch codes. At this time, it is not known how many municipal ordinances Vermont has, or how many towns with stretch codes.

[41] VECAN website: https://vecan.net/energy-committees/

[42] Ibid.

Appendix E: Page from New Hampshire residential building code application

New Hampshire Energy Code EC-1 **Certification No.:**

Code effective April, 2010

Directions: Complete the "Your Proposed Structure" columns. No measurements or calculations are needed. If you at least meet the New Hampshire Energy Code requirements, your project will be approved. Write N/A in any section that does not apply to your project. **Submit pages 1 and 2 only.** If your planned structure cannot meet these requirements, consider downloading REScheck from http://www.energycodes.gov/rescheck/download.stm and use trade-offs to prove compliance.

You are encouraged to build with higher R-values and lower U-values than you report here. The "Required R or U Values" are the worst permitted in NH.

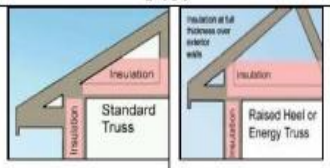
Building Section	Required R or U Values	YOUR PROPOSED STRUCTURE: Write Planned R and U Values	YOUR PROPOSED STRUCTURE: Brands / Models / insulation type and thickness (if known)
Window U Factor (lower U is better)	**U .35** (maximum) U-.31 (if log walls) **U .50** (Thermally Isolated Sunrooms only)	Write in U-Value	**Window Type:** ○ Low-e ○ Low-e Argon Check if: ☐ Sunroom ☐ Log Walls
Skylights	**U .60**		
Flat Ceiling[i] *or* **Flat Ceiling with Raised or Energy Trusses R-value**	 **R-38** (Zone 5) **R-49** (Zone 6) if using the above construction technique **R-30** (Zone 5) **R-38** (Zone 6) if maintaining the full R value over the plates	Write in R-Value → If using only R-30 in Zone 5 or R-38 in Zone 6 you must check this box	NOTE: R-38 will be deemed to satisfy the requirement for R-49 if the full R-38 insulation value is maintained over the outside plates. **If using only R-30 (Zone 5) or R-38 (Zone 6), you must certify that you'll maintain R-38 over the plates by checking the box below.** ☐ By checking this box, I certify that this structure is being built with a raised energy truss or that the full R-value of the ceiling insulation will be maintained over the outside plates.
Sloped or Cathedral Ceiling	**R-30** or **38** if more than 500 ft sq or 20% of total ceiling area **R-24** (Thermally Isolated Sunrooms only)	Write in R-Value	☐ Check if Sunroom
Above Grade Wall[ii] **R-value**	**R-20** Cavity Insulation only *or* **R-13** *plus* **R-5** Cavity *plus* Continuous Insulation **R-13** (Thermally Isolated Sunrooms only)	Write in R-Value	Log walls must comply with ICC400, have an average minimum wall thickness of 5" or greater and must have overall glazing of U-.31 or lower and heating AFUE of 90% (gas) or 84% (oil) and meet all other energy code requirements. Check if ☐ Sunroom ☐ Log Walls
Door U-Value	**U .35** (maximum)	Write in U-Value	
Floor R Value (Basement ceiling)	**R-30** *or* Insulation sufficient to fill joist cavity	Write in R-Value	If conditioning the basement you must insulate **Basement Walls.** If not, you may insulate either **Floor** or **Basement Walls** and/or **Slab Edge**
Basement or Crawl Space Wall R Value	**R-13** Cavity Insulation or **R-10** Continuous Insulation (Zone 5) **R-19** Cavity Insulation or **R-15** Continuous Insulation (Zone 6)	Write in R-Value	
Slab Edge[iii] **R Value**	**R-10** **2'** (Zone 5) **4'** (Zone 6) (see drawing pg 3) ***add*** **R-5** if the Slab is heated	Write in R-Value	
Air Sealing	**Planned Air Sealing Test Method** → By checking this box, I certify that I understand that I have two approaches to demonstrating compliance with air sealing requirements.	☐ Blower Door ☐ Visual Inspect	The visual inspection certification must be consistent with the requirements of Table 402.4.2 (page 4) and the method of compliance planned and approved by the local jurisdiction

Figure 8: Page from New Hampshire residential building code application.

Appendix F: Vermont town zoning Information

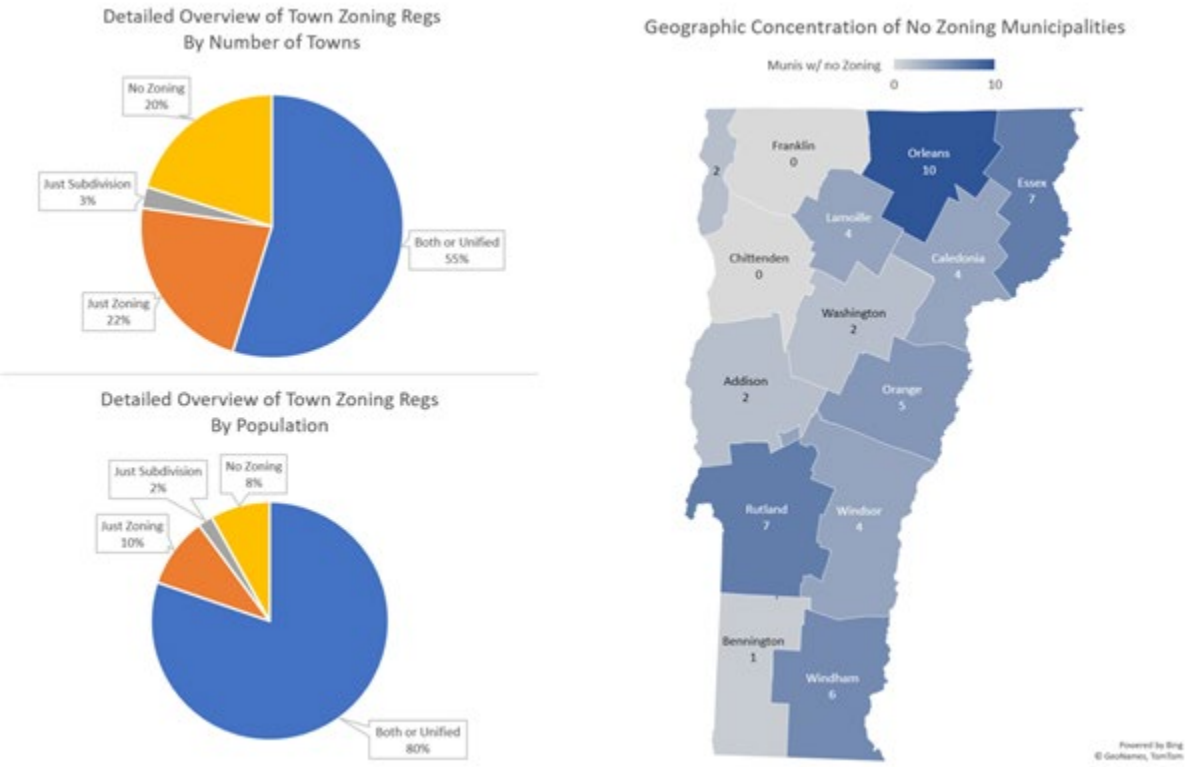


Figure 9. Ratios of towns without zoning regulations by number of towns and by population; Map of Vermont showing concentration of areas with no zoning regulations by county.[43]

[43] "VT Zoning Statistics," Vermont League of Cities & Towns, 7/26/23.

Appendix G: 50 State Building & Energy Code Comparison

Comparison of all 50 States' Building Codes

Level of building code authority and administration (including enforcement)

- Statewide authority; mandated local or state administration
- Statewide authority; optional town or county administration
- Authority and administration is by town or county (optional)
- No authority over single family homes

DOE Building Energy Codes Program: rates level of Energy Code goals (not level of enforcement)

- Statewide to ASHRAE 2019 or better
- Statewide to ASHRAE 2013 or better
- Statewide at some minimum level
- No energy code except in some municipalities

Northeast States

State	CT	DE	MA	MD	ME	NH	NJ	NY	PA	RI	VT
Commercial: Edition of IBC with amend's	2021	By County	2015	2021	2015	2018	2021	2018	2018	2018	2015
Commercial Energy Code	2021	2018	2018	2021	2015	2018	ASHRAE 90.1-2019	2018	2018	2018	2018
Small Resid'l: Edition of IRC with amend's	2021	By County	2015	2021	2015	2018	2021	2018	2018	2018	NONE
Residential Energy Code	2021	2018	2018	2021	2015	2018	2021	2018	2018	2018	2018

Southeast States

State	AL	AR	FL	GA	KY	LA	MS	NC	SC	TN	VA	WV
Commercial: Edition of IBC with amend's	2021	2021	2018	2018	2015	2021	2018	2018	2021	2012	2018	2018
Commercial Energy Code	ASHRAE 90.1-2013	2018/ 2021	2018	2015	2012	2021	2018	2018	2009	2012	2018	ASHRAE 90.1-2013
Small Resid'l: Edition of IRC with amend's	By County	2021	2018	2018	2018	2021	2018	2018	2021	2018	2018	2018
Residential Energy Code	2015	2018/ 2021	2018	2015	2012	2021	2018	2018	2009	2018	2018	2015

Plains States / **North-Central States**

State	KS	ND	NE	OK	SD	TX	IA	IL	IN	MI	MN	MO	OH	WI
Commercial: Edition of IBC with amend's	By County	2021	2018	2018	2021	2012	2015	2021	2012	2015	2018	By County	2021	2015
Commercial Energy Code	2006	2021	2018	2006	2015	2015	2012	2021	2010	2015	2018	By County	2012	2015
Small Resid'l: Edition of IRC with amend's	By County	2021	2018	2018	2015	2012	2015	2021	2018	2015 structure	2018	By County	2018	2015
Residential Energy Code	By County	2021	2018	2009	2009	2015	2012	2021	2018	2015	2018	By County	2018	2015

Pacific States / **Mountain States**

State	AK	CA	HI	OR	WA	AZ	CO	ID	MT	NM	NV	UT	WY
Commercial: Edition of IBC with amend's	2021	2021	2018	2021	2021	By county	By county	2018	2021	2021	2018	2021	2021
Commercial Energy Code	None	2022 CA Code	2021	ASHRAE 90.1-2019	2021	By county	By county	2018	2021	2018	2021	2021	By County
Small Resid'l: Edition of IRC with amend's	None	2021	2018	2018	2021	By county	By county	2018	2021	2021	2018	2021	By County
Residential Energy Code	2018	2022 CA Code	2021	2018	2021	By county	By county	2018	2021	2018	2021	2015	By County

Appendix H: Homebuilder Trainings by State

Homebuilder training requirements by State

	STATEWIDE REQUIREMENTS				COUNTY/ TOWN	BLDG. CODE type when no cert. or licensure
	Licensure	Certification	Home Imp.*	Registration		
Alabama	x					
Alaska	x					
Arizona	x					
Arkansas	x		x			
California	x					
Colorado					x	By county
Connecticut		x	x			
Delaware				x		By county
Florida	x					
Georgia	x					
Hawaii	x					
Idaho				x		Statewide
Illinois					x	Statewide
Indiana					x	Statewide
Iowa				x		Statewide
Kansas					x	By county
Kentucky					x	Statewide
Louisiana	x					
Maine					x	Statewide
Maryland			x	x		Statewide
Massachusetts	x					
Michigan	x					
Minnesota	x					
Mississippi	over $50k					
Missouri					x	By county
Montana					x	By county
Nebraska				x	x	By county
Nevada	x					
New Hampshire					x	Statewide
New Jersey	x					
New Mexico	x					
New York					X	Statewide
North Carolina	x					
North Dakota	x					
Ohio	x					
Oklahoma					x	Statewide
Oregon	x					
Pennsylvania				x	x	Statewide
Rhode Island		x				
South Carolina	x					
South Dakota					x	Statewide
Tennessee	x					
Texas					x	By county
Utah	x					
Vermont				x		NONE
Virginia	x					
Washington		x				
West Virginia	x					
Wisconsin	x					
Wyoming					x	By county

* "Home Improvement Contractor" a person who remodels, retrofits, or repairs homes.

References: National Assoc. State Contractors Licensing Agencies; Bizinsurance.com; contractorsliability.com; procore.com

Appendix I: Vermont Documented Building Failures

This is a sampling of easily available documented examples consultants are finding year after year, under less stringent energy codes.

Single Family Home, Craftsbury VT
Constructed: 2006

Problem: inadequate application of foam insulation and vapor barrier.
In the house's first winter, ice jams of 6-7 inches built up on the roof. The foam insulation had shrunk away from the rafters causing large gaps. A consultant found 2 problems:

(1) the insulation was sprayed in one 6" application, rather than spray in 2" applications. (2) The mixture ration used was "off ration" and "lacking isocyanate. The case was litigated and eventually a second installer was hired to repair the work.

In 2021, the owners again noticed heat loss from the roof. It was determined that they needed to tear off the roof and replace the insulation in full. The rafters were now rotten due to high moisture, so in 2022 and 2023 the entire roof had to be replaced.

Financial Damages:

- $15,000 legal fees 2008 - 2009
- $14,000 insulation repairs 2009
- $40,000 insulation and roof replacement 2022, 2023

Message from the owners: Thank you for this important work you are doing! As consumers of construction, we are currently vulnerable with little protection. We need to ensure contractors are trained, certified and held accountable for standard of care and workmanship.

Single Family Home, Bridport VT
Built: 2017

Problem: ice damming, moisture trapped in wall; sheetrock damage; can lights not sealed; gaps in cellulose insulation with improper venting; failed structural sheathing.
Estimated cost to repair: $75,000

Single Family Home, Essex VT
Built: approx. 2002

Problem: Medium density closed cell foam was installed without a vapor control layer. Moisture destroyed the wall sheathing. Windows were installed without nailing fins (no waterproofing/ flashing). The building wrap was poorly installed and vinyl siding was installed without a rain screen. A ventilation system was improperly installed, so the house was overpressurized, which pushed the moisture even more.

Estimated cost to repair: $50,000 - $75,000.

Single Family Home, Warren VT
Built: ca. 2013

Problem: Failed roof sheathing, insulation, and finishes due to lack of vent channel (to make a cold roof) and lack of air sealing. Air moved through, dropping moisture. After eight years (2021), the entire roof assembly, including most rafters, had to be rebuilt.

Cost to repair: over $20,000

Single Family Home, Swanton VT
Built: after 2000

Problem: Poor ventilation and sealing; incorrect installation of chopped fiberglass.

Estimated cost to repair: approx. $15,000

Single Family Home, Worcester VT
Renovation: approx. 2013; original construction 1960/1970

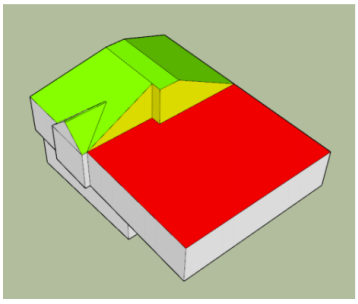
Problems: During a renovation, the builder added closed cell foam with improper tape. Air penetrated and condensed against the tin roof. Child developed asthma; the failure was not proved to be the cause but certainly exacerbated the situation. The owners had to replace most of the structure, all insulation, and sheathing; they installed an HRV.
Cost to repair: approximately $15,000

Single Family Home, Williston
Built: around 2015

Problem: Spray foam with hot roof assembly and improper vapor management. Roof and wall sheathing were destroyed.

Estimated cost to repair: up to $200,000

Single Family Home, Highgate VT
Built: 2015



Problems: Under-insulated low-slope roof with improper ventilation (neither soffit nor ridge); air infiltration at outlets and window/door openings; air gaps between trusses; propane leak. Ghosting began to appear on the ceiling. Insulation had to replaced with air sealing and ventilation; mold mitigation.

Estimated cost to repair: approx. $15,000 - $20,000

Many long-term failures are related to health issues for the occupants including asthma, myalgia, and headaches. It is expensive to establish a causal link, but mold tests can be conducted both in the building and in the patient.