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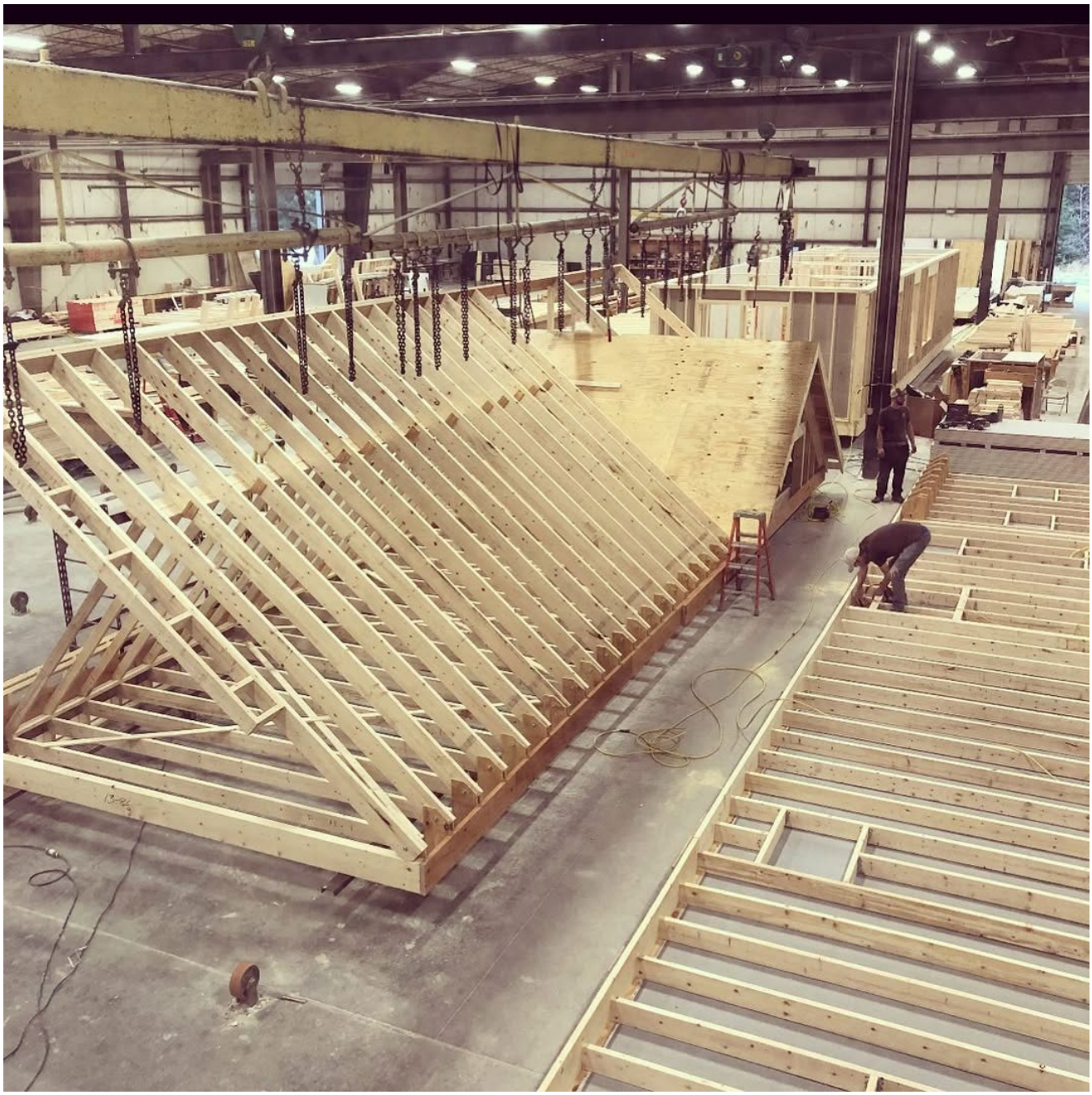
Opportunities to Utilize Off-Site Construction to Meet Vermont's Housing, Workforce and Climate Goals

by Seth Leonard and Jeffrey Lubell



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The cover image shows homes being assembled in Huntington Homes' facility in East Montpelier in December 2019.

Contents

Executive Summary

To address rising construction costs, rents and home prices, Vermont needs to build more housing. Significantly expanding Vermont's housing production will require fundamental changes in the residential construction process. Vermont has already taken the important step of reforming land use policy to make residential development more feasible by adopting S. 100 (2023), which increased minimum densities, and Act 181 (2024), which streamlined Act 250. To make further progress in boosting housing construction, Vermont should pair these land use reforms with innovations in construction methods to make the construction process more efficient. In particular, Vermont should consider expanding use of off-site construction to achieve the economies of scale that are difficult to achieve on-site in a rural state like Vermont.

Off-site construction involves the production of housing in factories, rather than on-site. The main forms of off-site construction are **manufactured housing** – in which homes are produced in factories that conform to the national HUD Code and contain a chassis – **volumetric modular** (or just modular for short), in which three-dimensional "boxes" are constructed offsite and joined onsite, and **panelized construction**, in which two-dimensional wall, floor or ceiling panels are constructed offsite and then incorporated into a building onsite. Some off-site manufacturers produce **kit homes** comprised of pre-assembled panels and other **pre-cut** parts.

There are three volumetric modular factories in New England that produce residential housing. One is in Vermont, and a second is in nearby Claremont, NH. There are also volumetric modular plants in Maine and Quebec capable of delivering homes to Vermont. A number of additional Vermont facilities produce panels or kits that can be assembled onsite to produce Accessory Dwelling Units or other structures. A survey and interviews with these manufacturers indicate that manufacturers are generally optimistic about the future of off-site construction in the region. The research also identified challenges and opportunities associated with expanding the use of off-site construction in Vermont. One challenge is the cyclicality of the housing market, which makes it risky for manufacturers to expand their operations. An opportunity is the possibility to achieve greater economies of scale through bulk purchases of large numbers of homes using a standardized design. One interviewee also discussed the potential to restart operations at a former manufactured housing facility in Fair Haven to increase the state's off-site construction capacity.

The increased use of off-site construction in Vermont could produce a number of benefits:

- **Cost Savings:** Off-site construction helps to shorten project timelines, allowing projects to generate sales or rental revenue more quickly than site-built housing. Further cost savings could be achieved from the bulk purchase of a large volume of modular or manufactured homes utilizing a simple, repeatable design, which allow design and engineering costs to be shared across homes and production lines to be optimized to achieve economies of scale.
- **Workforce development**. Starting or expanding off-site construction facilities in Vermont could lead to the creation of well-paying year-round jobs in Vermont. These jobs would make it easier to recruit and retain skilled workers.

- **Mitigate Labor Shortages:** Because housing is produced on an assembly line, workers in off-site construction facilities do not need the same level of physical strength or specialized skills as traditional construction workers, broadening the potential labor pool.
- **Higher volume and pace of building:** Through efficient assembly lines, off-site homes can be built faster and with fewer workers than site-built housing, allowing more homes to be produced in less time. The ability to produce homes quickly makes **off-site construction a good source of housing to help victims of natural disasters**.
- **Statewide Climate Goals:** Off-site construction can advance the state's climate goals by utilizing energy-efficient home designs and by reducing waste in the construction process through precision manufacturing.
- **Standardize design and building standards:** Off-site construction could be used to create homes that are compliant with state and local codes (both form and function) with most quality inspections taking place centrally, reducing the need for intensive on-the-ground regulatory inspection. This could both reduce costs and speed up the overall development timeline.

This report reviews a range of policy options for facilitating the increased use of off-site construction in Vermont, including bulk purchases and guarantees, financial assistance for starting or expanding off-site production facilities in Vermont, adoption of a statewide building code and pre-approval for specific designs. Should Vermont wish to move forward with increasing the use of off-site construction, the report recommends consideration of these next steps:

Potential Next Steps

1. Review and confirm the state's policy objectives and priorities.
2. Develop a plan for using bulk purchases of homes produced through off-site construction to achieve lower construction costs for single-family and missing middle housing types.
3. Develop a plan for using offsite construction to achieve lower multifamily construction costs.
4. Consider issuing a formal Request for Information to get input from potential manufacturers about how best to achieve cost savings through a bulk purchase program.
5. Allocate funding to support bulk purchases.
6. Implement prioritization and incentives for using off site construction within existing funding programs.
7. Facilitate restarting the Fair Haven plant and support the expansion of other existing Vermont manufacturers.
8. Consider providing business planning support in the form of small grants and technical assistance to existing Vermont businesses seeking to develop or expand offsite construction businesses.
9. Consider adopting a state-wide building code for offsite construction and procedures for factory-level inspections and pre-approved designs.
10. Create a Northern New England working group that reaches across state lines and considers a regional market and shared approach.

Introduction

Report Objective

The objective of this report is to explore the potential of off-site construction strategies to reduce the costs of newly developed housing in Vermont, increase Vermont's housing supply, expand manufacturing and well-paying jobs in Vermont, and advance the state's climate goals.

Report Roadmap

- This **Introduction** defines off-site construction and other key terms and explains why policymakers are interested in exploring off-site construction.
- The **Background** section briefly summarizes the history of offsite construction in the U.S. and provides state-level and national context for this inquiry.
- The **Survey** section summarizes the results of a VHFA-fielded survey about off-site construction activity in Vermont and findings from supplementary interviews.
- The **Analysis** section identifies the policy objectives that Vermont may seek to achieve in supporting off-site construction and explores the implications of the survey and interview findings for achievement of Vermont's objectives.
- The final sections identify **Financial** and other **Policy options** for advancing Vermont's objectives and propose a series of **Next Steps**.

Key Definitions

Off-site construction involves the production of housing in factories, rather than on-site. The main forms of off-site construction are **manufactured housing** – in which homes are produced in factories that conform to the national HUD Code and contain a chassis – **volumetric modular** (or just modular for short), in which three-dimensional "boxes" are constructed offsite and joined onsite, and **panelized construction**, in which two-dimensional wall, floor or ceiling panels are constructed offsite and then incorporated into a building onsite. Some off-site manufacturers produce **kit homes** comprised of pre-assembled panels and other **pre-cut** parts.

All forms of off-site construction other than manufactured housing must conform to state and local building codes. Manufactured homes generally have limited designs (e.g., single-wide and double-side designs) though a recent amendment to the HUD Code authorized manufactured homes with multi-unit structures, such as duplexes and triplexes. Homes produced through volumetric modular and panelized construction can utilize a much wider array of designs and by and large look just like stick-built homes.

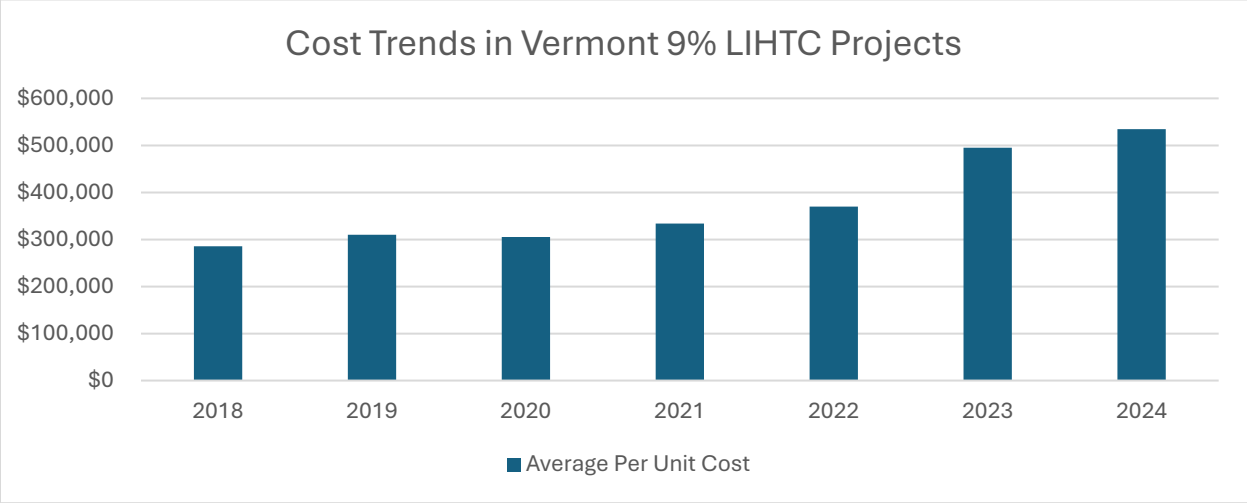
Why Explore the Expanded Use of Off-site Construction in Vermont?

Vermont needs more homes. The 2025 Vermont Statewide Housing Needs Assessment identified a need for between 24,000 – 36,000 additional year-round homes in the state between 2025 and 2029 to normalize vacancy rates and keep pace with expected population growth.[1] With fewer than 16,000 housing units produced in the past five years, Vermont would need to increase the pace of construction in the state by 50 percent to reach the low end of this projection and by more than 100 percent to reach the high end.

A key consequence of Vermont's limited production of new housing is a sharp increase in housing costs. Per the 2025 Housing Needs Assessment, between 2001 and 2023 the median rent increased 137 percent compared to a 72 percent increase in median household income.[2] Over the same time period, home prices increased by 275 percent.[3]

The cost of producing housing in Vermont is also rising sharply. Since 2020, Vermont has experienced dramatic increases in the cost of building homes, with costs for projects seeking 9% Low-Income Housing Tax Credits now averaging $520 per square foot and over $500,000 per unit. While somewhat lower, the average costs of projects seeking middle-market program assistance are in the range of $325 to $400 per square foot.[4]

Figure 1: Cost Trends in Vermont 9% LIHTC Projects



Vermont's housing production methods are not adequate to keep pace with demand and slow increases in rents and home prices. While traditional construction techniques are continuously advancing, buildings have mostly been built on site by developers and contractors for decades.

[1] Vermont 2025-2029 Statewide Housing Needs Assessment

[2] Vermont 2025-2029 Statewide Housing Needs Assessment

[3] U.S. Federal Housing Finance Agency, All-Transactions House Price Index for Vermont [VTSTHPI], retrieved from FRED, Federal Reserve Bank of St. Louis

[4] Data provided by FHFA.

Traditional construction methods require complex on-site management and sequencing of labor, materials, and highly trained or specialized workers. Unlike many more populous states, Vermont does not have the size and density to support large subdivisions that can benefit from economies of scale that make development more economically feasible. The problem is compounded by statewide labor shortages, which make it difficult for builders to find workers. As recently as July 2024 there were two job openings for every unemployed Vermonter.[5]

Many of these problems are also being experienced around the U.S. With shortages of homes, sharply increasing housing and construction costs, and constrained labor markets in Vermont and across the nation, interest has grown in investigating alternative approaches that can speed delivery and lower the construction costs of new homes. Attention has focused on the increased use of off-site construction, which could produce a number of benefits:

- **Cost Savings:** Off-site construction helps to shorten project timelines, allowing projects to generate sales or rental revenue more quickly than site-built housing. While individual projects that utilize modular or panelized construction report only modest construction cost savings relative to stick-built housing, the significantly lower construction costs associated with manufactured housing demonstrates the potential for significant cost savings from off-site construction approaches that involve the construction of large volumes of homes utilizing simple repeatable designs. Under the right conditions, similar efficiencies could potentially be achieved through bulk purchases of single-family or multifamily homes using volumetric modular construction.

- **Workforce development**. Starting or expanding off-site construction facilities in Vermont could lead to the creation of well-paying year-round jobs in Vermont. These jobs would make it easier to recruit and retain skilled workers.

- **Mitigate Labor Shortages:** As noted in a recent article about volumetric modular construction, "[due] to the assembly line approach and controlled worksite environment, modular construction could offer access to a wider pool of workers than traditional construction." As Michael Palmer, head of strategy and real estate at the Volumetric Building Companies, a volumetric modular manufacturer with three factories, notes: "[We're] attracting more people to the industry from diverse backgrounds. . . A big component to inviting new people into the industry is we can have folks with disabilities and greater gender parity than we would see on a normal construction site. By virtue of the type of work that is required, you have people working at one station, as opposed to running up multiple flights of stairs on a job site to hoist drywall or some other type of heavy building product. . . At VBC, 1 out of every 5 employees on our production floor identifies as female. With women making up 21% of our factory workforce, that's nearly 10 times the industry standard of 2%, and most of that industry number comprises representation in administrative or office roles."[6] Estimates by the Associated Builders and Contractors indicate the United States needs 501,000 additional workers, beyond normal hiring pace, to meet current building pace and demand.[2]

[5] Vermont Department of Labor, July 2024 Unemployment and Jobs Report

[6] Draffen, Leah. 2023. "Could Modular Construction Open the Floor for More Women?" Builder Magazine.

- **Higher volume and pace of building:** Producing homes built in factories, rather than on-site, facilitates the achievement of economies of scale to produce large volumes of homes. Through efficient assembly lines, off-site homes can be built faster and with fewer workers than site-built housing, allowing more homes to be produced in less time. The ability to produce homes quickly makes **off-site construction a good source of housing to help victims of natural disasters**.
- **Statewide Climate Goals:** Off-site construction can advance the state's climate goals by utilizing energy-efficient home designs and by reducing waste in the construction process through precision manufacturing.
- **Standardize design and building standards:** Off-site construction could be used to create homes that are compliant with state and local codes (both form and function) with most quality inspections taking place centrally, reducing the need for intensive on-the-ground regulatory inspection. This could both reduce costs and speed up the overall development timeline.

Several states have made major investments in recent years to promote or support the use of off-site construction. Building on these examples, a proposal to invest in one or more off-site construction factories in Vermont and fund the bulk purchases of modular homes was discussed during the 2024 Vermont legislative session. In response to the proposal, policy makers requested more information and background on off-site construction initiatives in the state, along with an assessment of potential policy and investment paths for the future.

Background

Brief History of Off-Site Construction in the United States

While a comprehensive history of off-site construction in the United States is beyond the scope of this paper, several aspects of that history are important for understanding the current context. The following is a summary of key points:

1. Off-site construction in the U.S. dates back more than one hundred years. Among other early efforts, Sears, Roebuck and Co. sold home kits through their catalog, which provided pre-cut materials for assembly of homes on-site.[7]

2. Between 1969 and the mid-1970s, the U.S. Department of Housing and Urban Development led an initiative known as Operation Breakthrough which sought to accelerate the pace of technological innovation in the housing industry with a goal of shifting toward more efficient off-site construction.

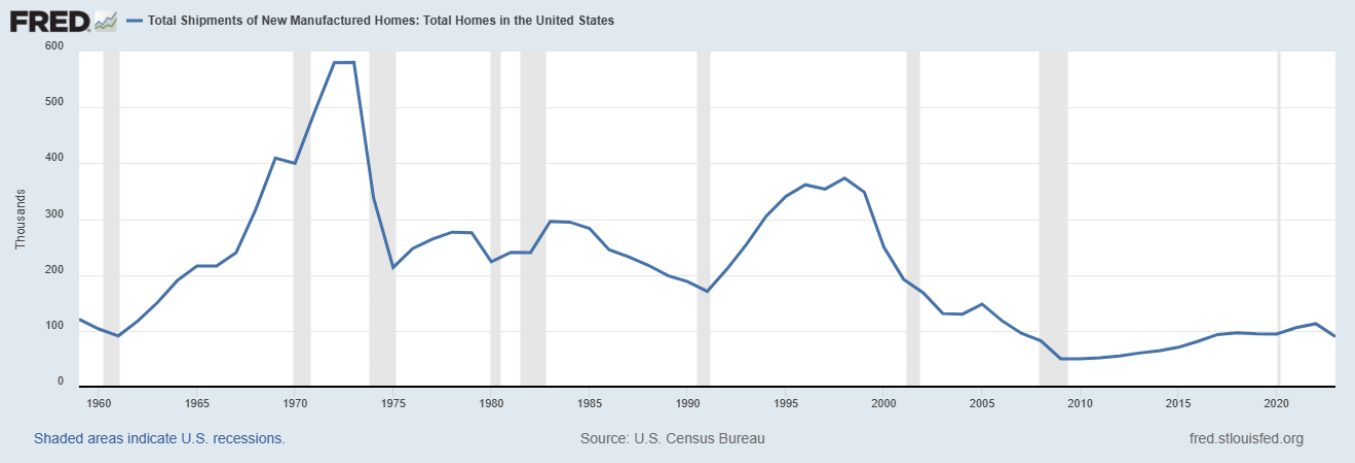
3. While Operation Breakthrough did not succeed in fully revolutionizing the U.S. homebuilding industry, it did lay the groundwork for the adoption of the HUD Code, a federal building code that applies to manufactured housing. The standardization introduced by the HUD Code helped

[7] Keesling, Donna. 2024. Sears Kit Houses: Affordable Housing in the Early 20th Century. The Pursuit of History.

improve the quality of manufactured housing while allowing volume to grow and supply a significant share of the nation's housing. Per the American Housing Survey, there were 7.16 million occupied manufactured homes in the U.S. in 2023, about 5.2% of the overall occupied housing stock.[8]

4. Figure 2 shows the annual volume of manufactured housing shipments over time, which has fluctuated substantially over time.[9] After rising throughout the 1960s and early 1970s, annual shipments peaked at 581,000 in 1973. Shipments barely reached half that volume between 1975 and 1993. After a brief period from 1994 to 1999, in which annual shipments were between 300,000 and 400,000, shipments fell sharply in 2000 and declined substantially between 2000 and 2009, when they reached a low of 50,000 units. Though annual shipments increased to some extent after 2009, they have remained below 120,000 units annually. The sharp reduction in manufactured housing shipments has been attributed to the vulnerability of manufactured housing facilities to the housing market's boom/bust cycles (which are related to economic conditions, changes in interest rates, and foreclosures) and to problems securing conventional financing for manufactured homes not installed on a permanent foundation.[10]

Figure 2 – Annual Shipments of New Manufactured Housing in the United States



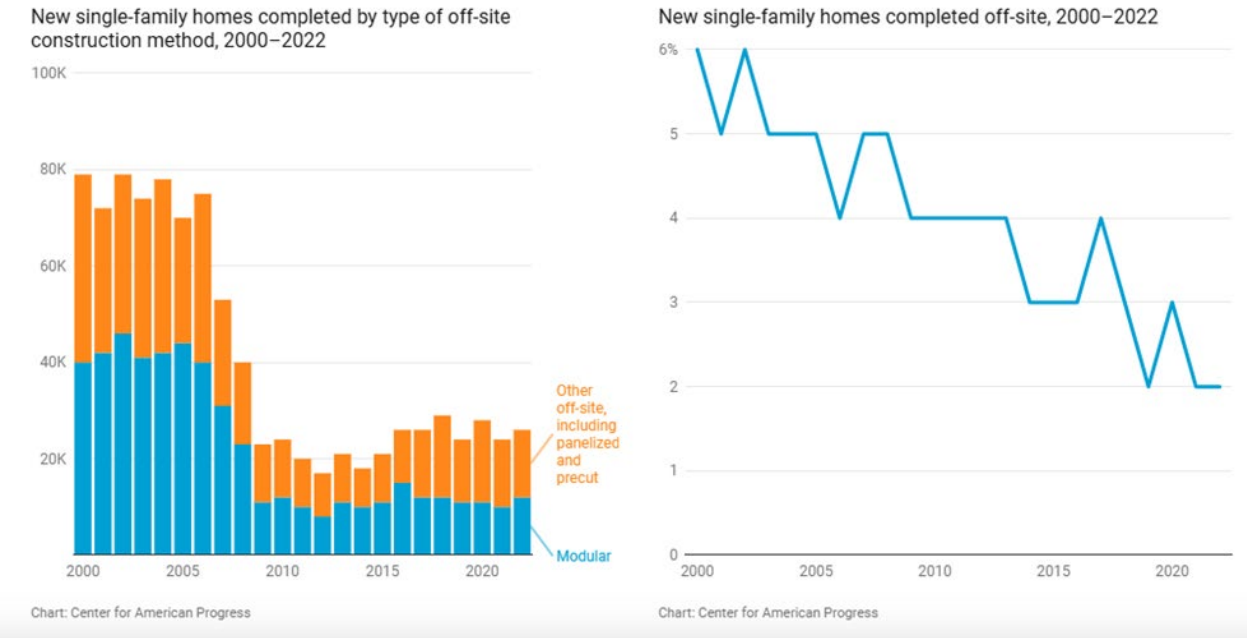
[8] Author Tabulation of the 2023 American Housing Survey. Table: 023 National. Rooms, Size, and Amenities. All Occupied Units. Variable; Units by Structure Type.

[9] U.S. Census Bureau, Total Shipments of New Manufactured Homes: Total Homes in the United States [SHTSAUS], retrieved from FRED, Federal Reserve Bank of St. Louis, accessed Dec. 15, 2024.

[10] Potter, Brian. 2022. The Rise and Fal of the Manufactured Home, Part II. Construction Physics.

5. Figure 3 reproduces charts on off-site construction prepared and published by the Center for American Progress based on the U.S. Census Bureau's Survey of Construction.[11] The blue bars show the annual volume of volumetric modular single-family housing while the orange bars show the volume of other forms of single-family off-site construction, such as panelized construction. (Note that modular construction is also used for multifamily housing and commercial construction, which are not shown here.) As indicated, there was a sharp drop-off in the volume of both forms of off-site construction between 2006 and 2009, corresponding to the Great Recession. Across all building types (including on-site and off-site construction), the number of single-family home starts has increased since 2009 (not illustrated here),[12] though at levels well below those of earlier decades, but as shown in the second panel of Figure 3, modular and panelized construction has continued to drop as a share of single-family new construction.

Figure 3: The market share of single-family homes built off-site has shrunk since 2000.



6. These data illustrate the high degree of vulnerability of off-site construction to the booms and busts of the economic / housing cycles, especially the Great Recession. Nationwide, the number of home builders declined by more than 50% between 2007 and 2012 in a building

[11] Center for American Progress. 2023. Increasing Affordable Housing Stock Through Modular Building. CAP tabulations of data from the U.S. Census Bureau, "Characteristics of New Single-Family Houses Completed, Construction Method." These charts are reproduced with permission of the Center for American Progress in conformity with their terms of use and fair use policy.

[12] U.S. Census Bureau and U.S. Department of Housing and Urban Development, New Privately-Owned Housing Units Started: Single-Family Units [HOUST1F], retrieved from FRED, Federal Reserve Bank of St. Louis, accessed Dec. 15, 2024.

slowdown linked to the Great Recession.[13] While the number of employees in residential construction has slowly rebounded since that time, there were still fewer residential construction workers in the U.S. in 2023 (927,200) than the peak year of 2006 (1,008,700).[14] Adjusting for the growth in the overall U.S. workforce underscores the severity of the shortage; the share of the nonfarm workforce devoted to residential construction in 2023 was only 80% of its peak in 2006.[15]

The cumulative shortage of builders over the past 17 years is a key driver of the construction shortfall that has led to rising housing affordability challenges across the U.S. But the problem is even more acute in the offsite construction business, which involves large investments in factories. While a conventional homebuilder can lay off their staff and lay low during challenging economic times, a factory owner that has invested millions in building a volumetric modular plant will have debt they need to service and struggle to survive a downturn. To illustrate, there used to be eight volumetric modular manufacturers of full-size residential homes in New England, but only three survived the Great Recession and there are still only three today, one each in Maine, New Hampshire, and Vermont. (Some New England manufacturers utilize volumetric modular construction to produce other types of structures, such as temporary housing, accessory dwelling units (ADUs), and structures for business use.)

7. In our interviews, we heard that the attitudes of home builders changed dramatically after the Great Recession. Whereas many took risks to expand their volume prior to then, they are much more risk adverse now, focusing on the most lucrative parts of the market and avoiding becoming overextended and unable to survive the next downturn. While operating at a modest volume may lower profits for home builders and constrain supply below optimal levels, it increases the builders' long-term sustainability.

8. The most recent economic downturn was the COVID-19 pandemic hitting some parts of the offsite construction businesses hard. While there were signs before the pandemic that the off-site construction / technology company Katerra was struggling, the pandemic was the final straw.[16] Another prominent modular startup, Veev, appears to have been affected by the rapid

[13] Quint, Rose. 2015. US Government: Number of Builders Declined 50% between 2007-2012. National Association of Home Builders.

[14] U.S. Bureau of Labor Statistics, All Employees, Residential Building Construction [CES2023610001], retrieved from FRED, Federal Reserve Bank of St. Louis, accessed Dec. 15, 2024.

[15] Similarly, the average annual proportion of the nonfarm workforce devoted to residential construction in the period from 2011 through 2023 was only 84 percent of that from 2001 through 2010, a period that included both the boom of the mid-2000s and the bust of the latest 2000s. U.S. Bureau of Labor Statistics, All Employees, Residential Building Construction/All Employees, Total Nonfarm.

[16] Obando, Sebastian. 2021. What does Katerra's demise mean for the Contech and modular industries? Construction Drive.

rise in mortgage interest rates in 2022 which depressed home sales.

9. In January 2023, the U.S. Department of Housing and Urban Development's Office of Policy Development and Research (PD&R) released a research roadmap on offsite construction that outlines a series of research projects designed to facilitate the increased use and efficiency of off-site construction.[17] As part of this process, PD&R has funded an investigation of off-site construction in England, Japan and Sweden, which have been more successful than the U.S. in operationalizing the widespread production of homes in factories, as envisioned in Operation Breakthrough.[18] The final paper is expected shortly.

Background on Off-Site Construction in Vermont

Vermont has a long history of seeking to innovate and advance approaches to home construction. In more recent history, Vermont's approaches to creating Zero Energy Modular Homes, Tiny Homes, and Bio-Material Approaches all demonstrate Vermont's interest in modernizing how homes are constructed and how homes fit into the surrounding built and ecological environment.

As described in the survey results, most of the off-site construction businesses in Vermont are of fairly recent vintage and some are true start-ups. However, there are two large off-site construction facilities in Vermont that date back to the 1970s. One is Huntington Homes, one of the three volumetric modular manufacturers in New England with a 100,000 square foot facility in East Montpelier that produces about 65 to 80 modular homes per year. The second is an 83,150 square foot manufactured housing facility in Fair Haven that was operated by Skyline Corporation until its closing in 2011. At the time of its closing, the plant employed 78 people. Skyline attributed the closing to difficult economic conditions.[19] The town of Fair Haven has recently engaged a contractor to assess the condition of the facility with an eye to reopening it to produce modular homes.

The following is additional relevant history of off-site construction in Vermont:

- **Vermont Affordable Housing State Credit Program.** In 2011, an estimated 17 of Vermont's manufactured home communities experienced serious flooding, with 137 homes lost.[20] In response, the Vermont State Legislature increased the funding available under the Vermont State Affordable Housing Tax Credit program, administered by the Vermont Housing Finance

[17] Smith, Ryan, et al. 2023. Offsite Construction for Housing Research Roadmap. US. Department of Housing and Urban Development, Office of Policy Development and Research.

[18] Rekhi, Jagruti, et al. 2024. Offsite Construction: An International Perspective. US. Department of Housing and Urban Development, Office of Policy Development and Research EDGE Online Magazine.

[19] Derek Liebig. 2011. Skyline Closing. NYVTMedia.

[20] Freese, Alicia. 2013. Tropical Storm Irene: Mobile home parks slowly recovering, while state and nonprofits work to prevent future disasters. VTDigger.

Agency.[21] The expansion of the credit came with a set-aside for manufactured home replacement. VHFA placed a priority in the administration of the funding to develop Manufactured homes that meet Energy Star standards in addition to required HUD standards, with a preference for Zero Energy Modular homes.[22] The resulting homes purchased through the program have included a range of highly efficient manufactured homes and zero energy modular homes.

- **Vermod and Zero Energy Modular Homes.** The urgency to replace homes lost during Tropical Storm Irene drove state leaders to seek out local solutions to produce homes quickly. There was also a desire to create replacement homes that helped the state reach its energy goals as expressed in the statewide Comprehensive Energy Plan.[23] In response, Efficiency Vermont, the High Meadows Fund, and the Vermont Housing & Conservation Board launched the Modular Housing Innovation Project with the goal of designing 10 highly efficient model homes that could be used as a prototype for a production facility to replace homes lost from Irene.

  One participant, Steven Davis, founded VERMOD homes on the principles of the Modular Housing Innovation Project. VERMOD built Zero Energy Modular Homes in their facility in Wilder, quickly expanding in 2015. By 2020, VERMOD had produced over 100 homes that included solar panels, heat pumps, and high-quality windows. Energy and affordable housing funders tailored state and federal programs to make VERMODs more accessible, with homes that received public subsidies regularly selling for between $110,000 - $140,000. Homes were placed in a mix of owned land and as replacement units within manufactured home communities.

  While building homes off-site, VERMOD did not use the construction or manufacturing methodologies that define volumetric modular production. Unable to achieve the economies of scale that come with high volumes of home production, VERMOD shifted its focus in 2022-2023. They reduced staff and began intentionally reducing their manufacturing footprint, focusing on the development of a smaller number of homes. Instead of direct-to-consumer retail, VERMOD has adopted an approach of developing turnkey projects with the owners serving as development lead (identifying site, overseeing full development process). They are currently producing homes at a rate of 3 to 4 homes per year.

- **Recent experience with bulk purchases.** In recent years, several bulk purchases of homes produced off-site have been planned in Vermont. While not as large as the bulk purchase contemplated by the 2024 legislative proposal, these experiences nevertheless provide a base of experience for considering future expansion. The following is a brief overview:

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[21] Vermont State Statute, Affordable Housing Tax Credit. 32 V.S.A. § 5930u

[22] Vermont Housing Finance Agency. 2024 Vermont Qualified Allocation Plan.

[23] Kolodinsky, Jane, et al. 2017. Market Assessment for Energy Efficient Factory-Built Homes in Vermont. University of Vermont, Center for Rural Studies.

- **Mobile Home Infill Program**. In 2024, with funding from the state, the Vermont State Housing Agency (VSHA) did a bulk purchase of 30 single-wide manufactured homes, which are being passed on at just over cost to the consumer. The homes, which are highly energy-efficient (about half Net Zero Ready and half Energy Star) and average about 800 square feet are being sold to consumers at an average cost of $96,600. The state is paying for the necessary sitework (e.g., for utility hookups) which averages $30-$40,000 per unit. An additional 70 units are planned for purchase next year.

- **Stonecrop Meadows:** A developer, in partnership with Middlebury College, is using VHFA's Middle-Income Homeownership Development Program to place 36 new for-sale homes from Huntington Homes in the development. The purchase was conducted under a single contract between the developer and producer and is leveraging project scale to make the construction of the homes more affordable. While final numbers are still being compiled, a contact for the program reports that the project will likely save money over stick-built construction and produce homes that are higher in quality than the ones likely to have been produced on site. At the same time, the contact notes logistical challenges associated with the project, including the need to commit in advance to a narrow delivery window and to do substantial work on site to complete the homes.

- **Tri-Park Cooperative bulk purchase:** Tropical Storm Irene and subsequent weather events have threatened 26 homes in Vermont's largest manufactured home community, Tri-Park Cooperative in Brattleboro. The community has developed a master plan to relocate the at-risk lots in a floodway, which would include replacement of the older homes. The community and their development consultant have assembled public funding to conduct a bulk purchase of up to 26 new homes.

National & Regional Trends in Off-Site Construction Policy

With the dramatic rise of home prices in recent years and rising costs for construction labor and materials, interest is again growing in off-site construction. Multiple high-growth off-site initiatives have captured national attention, with varying degrees of sustained success. While several high-profile national start-ups like Katerra, Veev, and Modulous were unsuccessful, there is an emerging focus on incremental growth of more regionally focused off-site builders, which seems to be a safer strategy. The need for more energy efficient, and less costly homes continues to drive investment and focus on advancement of construction approaches.

Below are a few examples of initiatives across the country that Vermont may learn from.

Oregon: Investment in HOPE, a Modular Housing Development Fund, and Model Code

The state of Oregon has taken a three-pronged approach to encouraging more modular production throughout the state.

In 2022, the state of Oregon made a one-time $15 million investment in a non-profit manufactured home plant. The lead non-profit entity, St. Vincent de Paul Society of Lane County, created a new

non-profit called Housing Options Production Enterprise ("HOPE") Community Corporation as a separate 501(c)3. St. Vincent de Paul facilitated the acquisition and rehabilitation of an abandoned American Steel industrial building for use as a manufactured housing facility.[24] On July 1st, 2024, HOPE produced its first home and is producing homes they indicate will have sales prices starting between $70,000 - $110,000.[25] The directors of HOPE are targeting a production level of 2 homes per day by late 2024.

Following the investment that established HOPE, Oregon also established a $20 million Modular Housing Development Fund.[26] In November of 2023, Oregon Housing and Community Services (OHCS) made $5 million awards to each of four existing manufactures to expand manufacturing facilities. The awards were made to mix of urban and rural manufacturers. Uses included standardization of modular housing designs, technology upgrades to existing facilities, and expansions of manufacturing space. One of the plants is focused on producing affordable homes and all of the plants have promised to take steps to make homes available quickly in the event of a natural disaster.

To support investments in manufactured and modular housing, in February of 2024 Oregon also created a model code[27] for housing that does not fit neatly into the local or International Building Code. The model code provides a blueprint for local code administrators to prepare for new construction methods. The model code considers best practices for Mass Timber, Modular, Manufactured, and prefabricated homes.

Colorado's Proposition 123 and Innovative Housing Incentive Program Implementation

In 2022, the state of Colorado passed Proposition 123,[28] which increased the amount of funding available to finance Affordable Housing throughout the state. In the same year, the Legislature also required a portion of state affordable housing funding be dedicated to the Housing Innovative Housing Incentive Program.[29] Through a collaborative partnership between two primary funders of housing and economic development, awards from both pots of funding were given to eight modular housing manufacturers across the state. According to the Office of Economic Development and International Trade and the Colorado Housing Authority: "Both programs offer low-cost financing options for innovative housing manufacturing facilities, including panelized, tiny homes, kit homes,

[24] Houston, Henry. 2022. Going Mobile, Eugene Weekly.

[25] The Jefferson Exchange Team. 2024. Eugene-based HOPE Community Corporation cranks out first manufactured home. Jefferson Public Radio.

[26] Oregon Housing and Community Services. Modular Housing Development Fund. State of Oregon.

[27] Oregon Department of Land Conservation and Development. Prefabricated and Modular Model Code. State of Oregon.

[28] Colorado Office of Economic Development and International Trade (OEDIT). February 13, 2024. Creating Housing and Jobs: Polis Administration announces Modular Housing Loans to Create Up to 4,755 Housing Units Per Year. Colorado Governor's Office State Agency.

[29] Colorado Office of Economic Development and International Trade (OEDIT). Innovative Housing Incentive Program. Colorado Governor's Office State Agency.

and offsite 3D-printed homes. The awards will support three Colorado-based housing manufacturers that also participated in the IHIP grant program, two Colorado startups, and three companies successfully recruited from out of state. Collectively, the companies are projected to create 1,280 jobs." [30]

Quebec's focus on Volumetric Modular Housing in their Housing Strategy

Construction trends in North America have historically crossed borders. Construction methodology and material advancements tend to be shared between Canada and the United States, in particular. For decades, Canada has been a critical source of building materials for United States homebuilders. Canada produced an estimated 31% of the doors and windows imported into the United States.[31] Meanwhile, Canadian softwood lumber accounts for 85% of the imported lumber used for construction in the United States.[32] In recent years, Canada has dramatically increased the volume of both panelized and modular approaches to building.[33] Multiple Vermont builders reached as part of this project indicated some of the earliest panelized construction materials came from Canada. To further support expanding the modular industry, Quebec has centered investments in modular construction in their push to add 500,000 homes to the province by 2034.[34]

Quebec has created a competitive, financially incentivized competition of modular builders, architects, and construction managers through a request for proposals. Teams were tasked with developing strategies to deliver as many high-quality homes as possible within an 18-month period. Teams were required to map out the entire development process, from site control to completion of fully finished units ready for occupancy. One of the participants interviewed for this report opined that the competition has increased collaboration among design, production, and construction professionals. Teams will be selected for inclusion in a catalog of available designs/products made available through the initiative. Local leaders and developers will be able to select designs from the catalog and sign up for bulk purchase contracts, with a priority for areas that have adopted land use regulations to make the developments possible. Financial subsidies will be available for construction of the homes, and the efficiency of repeatable design and bulk purchasing is expected to lessen the amount of public subsidy required. The outcome will be "volumetric housing neighborhoods."

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[30] See Feb. 13, 2024 press release from the Colorado Office of Economic Development & International Trade.

[31] Government of Canada. Submitted on August 18, 2022 to the U.S. Department of Transportation. Comments by the Government of Canada to The U.S. Department of Transportation.

[32] Strong, Alex. 2024. U.S. Must Resume Negotiations with Canada on Lumber Trade Deal. National Association of Home Builders.

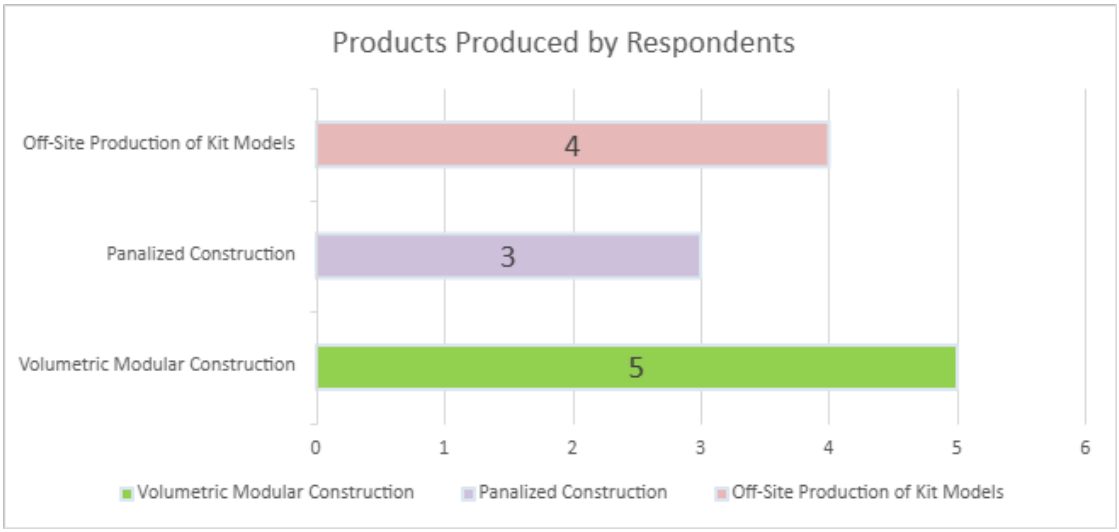
[33] Mitchell, Craig; Blackbox Offsite Solutions Ltd. October, 2021. The State of Prefabrication in Canada. Forestry Innovation Investment.

[34] Bleasby, John. August 26, 2024. Quebec's new housing strategy promotes volumetric modular solutions. Construction Connect, Daily Commercial News.

Survey & Interview Results

A survey of off-site construction firms located in Vermont, or that serve Vermont in the summer of 2024, netted 10 respondents. Appendix A includes the survey questions used, while Appendix B includes the standard interview questions asked of interviewees.

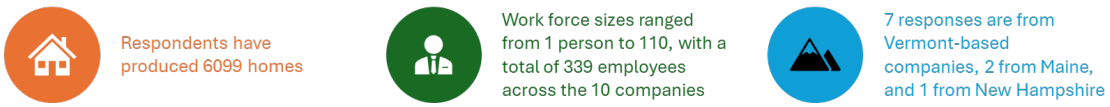
Figure 4: Products produced by respondents.



Who responded to the survey?

As shown in Figure 4, Respondents to the survey produced homes through off-site construction using three methods: kit models, panelized construction, and volumetric modular construction. Material use also varied by producers, with emerging products like biomaterials (straw panels) and mass timber represented in the responses. As noted in Figure 5, the responses came from companies with a wide range of histories and experience. Respondents range from start-ups in early development phases to a company founded in 1978. Collectively, the 10 respondents have created over 6,000 homes and employ over 300 people.

Figure 5: Summary of Survey Results



Survey Results

Off-Site Construction production includes a wide range of housing sizes and types. Survey respondents produce various housing types, including multifamily, stand-alone single-family homes, and ADUs. The size of the units produced ranges from 200 square feet (about twice the area

of an apartment bedroom) to 10,000 square feet. Five of the for-sale single-family home producers reported most homes fall between 900-1600 square feet. Multi-family rental home production focused on units around 1,000 square feet. While ADUs are typically smaller than full-sized homes, one respondent reflected that "800 square feet is the sweet spot for ADUs." This is about the same size as a single-wide manufactured home.

The finished product for manufacturers also varied. Below is a sample of responses summarizing product type:

- Complete turnkey homes with all finishes, including oversight of the foundation and on-site hook-ups.
- Kits that include nearly finished homes that can be assembled by a contractor on site.
- Unfinished "boxes" that require a contractor to fully install and finish.

Survey respondents provided information on the customization of homes (where purchasers select finishes or design aspects of the homes). Reinforcing what we learned in interviews discussed later in this report, the more customization that manufactures allow the greater the reduction in production efficiency. As a result, four of the manufacturers have developed product lines which offer multiple models that have different square feet, bedroom counts, and finishes to meet consumer demand. Providing options without offering a fully customizable design allows manufacturers to retain repeatable design efficiencies.

Manufacturers in the region are producing homes at lower costs than traditional building methods. Costs for off-site construction and modular home production are most effectively represented on a price per square foot basis. Respondents identified price per square foot costs ranging from $110 - $500 per square foot. Some of the reasons for the wide range include the following: Some respondents offer products that require additional finishes while others include a fully finished unit; some respondents include site costs while others do not. And the homes are being produced at various scales.

Survey respondents strive to meet a wide range of energy, climate, and design goals to meet public policy outcomes. Other potential policy outcome of modular and other off-site construction approaches is increased energy efficiency, adaptable accessibility, and decreased environmental footprint of home building. There are three sets of findings related to environmental, energy, and design policy outcomes:

- **Energy:** Six respondents shared the energy profile of their homes. One producer reached Energy Star efficiency, three producers are reaching net-zero or net-zero ready, while two producers are achieving passive house standards. Multiple producers also indicated that in addition to meeting Vermont's Residential Building Standards, they are also achieving Vermont's High Performance Home standards.

- **Environmental Footprint:** Multiple Vermont off-site and modular builders are part of an emerging movement to use bio-based materials for construction of homes. The bio-material movement is focused on the broader environmental footprint of a project. Use of bio-materials in building emerged as a decarbonization strategy in recent years. Vermont

organizations are at the center of regional efforts to produce bio-based building materials.[35] One of the survey respondents is using straw panelized construction sourced from local/regional farms. Another respondent is using mass timber products that could be sourced from regional forests in the future.

- **Accessibility:** One response came from a manufacturer of ADUs that are designed with unique features focused on accessibility. The Vermont-based manufacturer is producing homes for households "when faced with injury, disability, or chronic health complications" who have mobility and accessibility challenges.

Labor & material costs continue to present a challenge. When asked to describe key cost drivers, 20% of the survey respondents identified labor (and specifically "skilled trades") as a major cost contributor. Besides the direct cost of labor for manufacturing of building materials and homes, availability of willing builders (or "installers") that know how to perform on-site work for modular and panelized construction was also seen as a weakness in the market.

Responses suggested that some regulatory changes could positively impact their businesses and level of production.

While the survey questions did not focus on land-use regulations, the topic was raised in several responses. Respondents recommended or noted, among other things:

- "[A key constraint is] changes to building codes that make infill density prohibitive."
- "Review of Act 250"
- "Would like to see better regulation of private home construction."
- "[A key constraint is] code restrictions and variability."
- "[A key constraint is] varying building code enforcement/interpretation, permitting timelines, differing environmental rules/standard."

Demand for off-site construction products is high. In response, manufacturers are confident and planning production expansion. When asked to describe the demand for their products, each response indicated the market for off-site construction is steady and growing. A few summary statements from respondents about the market for their products included:

- "We are under-marketed and still solid, enthusiastic, and growing rapidly."
- "Super high. We are rushing to fulfill 20 backlogged orders."
- "Strong. Cost and buildability are key factors. 75+ units in design"
- "Unlimited"

Consistent with these responses, 7 of the 10 respondents indicated they plan to increase their production in the next 3 years.

Existing off-site manufacturers in Vermont are not heavy users or state or federal subsidies to expand their businesses. Five of the survey respondents indicated they had received state or federal subsidies, with five reporting no subsidies. Examples of public funding accessed by respondents included subsidized loans from the Vermont Economic Development Authority,

[35] MASS Design Group is hosting the Bio-based materials collective.

programing administered through state/regional Community Development Financial Institutions, United States Department of Agriculture Rural Development, and the U.S. Forest Service. One respondent also accessed philanthropic funding. Overall, however, it did not appear that respondents were heavy users of public subsidies.

Existing off-site manufacturers in Northern New England are open to expansion but need a better sense of both demand and incentives. As noted above, manufacturers generally have a positive outlook on the market for modular and other off-site construction approaches. When asked what incentives would enable the expansion of facilities for additional home production, reflections included the following:

- "Financial resources for expansion, business planning, and construction of off-site company endeavors."
- "Federal and state resources to assist in the design of developing a housing manufacturing facility in rural communities."
- "Development of regional value chain partners from manufacturing to assembly."
- "More focus on trades programs and getting more kids into the trades."
- "ADUs need deferred payment, or lower interest loans at the same level that multi-family is finances for developers."
- "[just] need the financing and builders to embrace."
- "[Would like to see] better incentives/funding for innovative designs and strategies."

Interview Qualitative Reflections

In addition to the survey, the authors conducted 6 interviews with survey respondents and others with knowledge of the field. The following are some of the reflections shared by respondents during interviews.

The opportunity to use volumetric modular construction is often foreclosed during a project's early design stages. Architects are engaged early in the development process and asked to meet aesthetic and site-specific considerations. Projects are often designed in advance of considering whether modular or other specific off-site construction approaches are appropriate. As a result, a building makes it through complex, and sometimes contentious public and funder vetting with a proposed form and aesthetic. It may then be impossible for a fully modular building to be considered because it would not be possible for a modular approach to meet the approved design. Without considering modular construction from the outset, siting and building orientation decisions early in the development process may make using model modular designs infeasible. One interviewee said, *"If you decide to go modular, it must be done at the earliest stage." Another suggested:* "there should be a requirement of every publicly funded building to have a modular construction perspective or advocate in the project as early as possible."

Repetition in design will lower development costs, create familiarity among contractors, and allow producers to scale up production. During interviews, interviewees noted the importance of having repetition in design in both single for-sale homes and multi-family rental home development. A number of New England manufacturers have well defined "product lines" of

models that can be produced repeatedly. Manufacturing thrives on the efficiencies of repeatability in production, with interviewees indicating that offering too much customization on a project or individual home basis could compromise both quantity and quality of the homes produced. One producer of modular homes, who specializes in economies of scale through volume production, indicated that they would not consider a request to build a single home, but they would consider a request for a bulk purchase of, say 50 homes. (This contrasts with some of the other interviewees who primarily do custom building through their modular factories.)

When asked how modular construction could have more of an impact on multifamily rental development, interviewees stated a potential path to efficiency is to create a baseline model of 6-8 units. A manufacturer could create multiple 6–8-unit models that can be reconfigured and combined into a single building, creating 30–50-unit buildings. One barrier to using this approach that interviewees identified was the potential that projects look similar. During local review processes, the visual appearance of a building often becomes a point of public contention. However, there may be opportunities to customize the exterior look with different finishes.

Modular and off-site construction projects face permitting, infrastructure, and site challenges that eat into potential cost savings and efficiencies. Interviewees repeatedly noted the high costs and challenges of preparing a site for the placement of off-site constructed homes. Discussions ranged from complexities in zoning that make it challenging to use efficient modular models to the high costs of infrastructure and contractors to finish the homes on site. Three of the interviewees estimated that a factory constructed volumetric box accounted for between 30-50% of the final costs of a home. The remaining costs include land, permitting, finishings, foundations, electrical/plumbing hook-ups, and the costs of the contractor to assemble or complete the home on site. Multiple interviewees highlighted the need for additional resources (grants and subsidized loans) for infrastructure and site work. Increasing the number of qualified installers and construction managers that prioritize becoming efficient in siting modular and other types of prefabricated kit homes could help ease some of the infrastructure and site costs. Installers and construction managers with more experience with a type of building product are more likely to identify and address site challenges before they cause costly delays or unexpected work.

Some site challenges are caused by regulatory barriers that make re-using a design repeatedly difficult. Examples of potential challenges include per-unit density, frontage, building height, setbacks, and material limitations within local land use regulation.

Analysis

Clarifying Vermont's Policy Objectives

In considering whether and if-so how to promote the use of off-site construction in Vermont, it will be important to identify the specific policy objectives that Vermont hopes to achieve through off-site construction. Potential policy objectives include:

1. **Lower Housing Costs** – Reducing housing costs is a key goal motivating Vermont's interest in off-site construction. Offsite construction is not always less expensive than stick-built housing, so to the extent that lower housing costs is a key motivator, it will be important to focus on

processes that achieve lower housing costs, such as the use of manufacturing principles to produce large volumes of housing that utilize simple, repeatable designs as well as financial structures (such as bulk purchases and equity investments) that provide Vermont with leverage to secure lower per-unit costs.

   a. Conceptually, there are two different types of cost reductions. One is a cost reduction achieved as part of a program to produce **permanently affordable homes at prices significantly below-market levels**. The second is a reduction in the costs of homes sold by developers **without deed restrictions** to moderate-income home purchasers.

   b. Vermont may also be interested in an increase in the **overall supply of housing**, regardless of the price point, as an increased supply of housing can help support economic growth and slow the rise in home prices. All things being equal, lower construction costs can help facilitate an increase in supply by making new construction more economically feasible.

2. **Economic and Workforce Development** – The off-site construction industry in Vermont is a source of economic activity. To the extent that off-site construction located in Vermont leads to an increase in housing construction in Vermont and/or produces housing installed outside of Vermont, its growth can lead to a net increase in Vermont's tax base and an important source of jobs for Vermont residents. As noted above, the Skyline manufactured housing facility in Fair Haven employed 78 individuals when it was shut down in 2011. Restarting the plant and operating it at its earlier volume could lead to the hiring of a similar number of individuals.

3. **Improved Energy Efficiency and Resilience to Natural Disasters** – These are important attributes of housing that help advance Vermont's Climate Action Plan and minimize damage associated with flooding and other natural disasters. Building homes centrally in factories can help to improve the uniformity of outcomes in these areas, but Vermont will need to find ways to encourage or require the housing being built through offsite construction to adhere to high standards of energy efficiency and disaster resilience.

There may be trade-offs involved in these policy objectives. For example, to directly advance economic and workforce development through off-site construction, it will be important for the off-site construction facility(ies) to be located in Vermont. However, the achievement of lower housing costs does not necessarily require that the homes be built in Vermont, and it is possible Vermont could achieve greater construction cost savings through housing built out-of-state. Similarly, the initial costs of homes built to higher energy-efficiency and resilience standards may be somewhat higher than the initial costs of homes built to lower standards, increasing construction costs, but those higher costs may be worth the investment for the benefits they produce in terms of reduced greenhouse gas emissions and damage during a disaster and the long-term savings associated with reduced energy use and the reduced need for future repairs.

The policy options in this paper assume that Vermont is interested in achieving all of these objectives, although not necessarily simultaneously. In other words, the paper focuses on options for lowering construction costs, even if some or all of the lower-cost homes are built outside of Vermont, and for growing Vermont's offsite construction industry, even if those homes are not all

affordable. This paper also assumes that Vermont is interested in energy-efficient and disaster-resilient homes, even if achievement of these goals increases initial construction costs somewhat.

Implications of Survey and Interviews for Achievement of Vermont's Policy Objectives

The discussion below draws on findings from the survey and interviews to highlight key considerations that will affect the ability of Vermont to achieve each of these policy objectives through off-site construction. Focusing first on lower housing costs, then economic and workforce development, and finally environmental objectives, this section describes how and to what extent off-site construction could contribute to the achievement of Vermont's policy objectives.

Lower Housing Costs

- Survey respondents and interviewees agree with the underlying literature that modular construction has the potential to be significantly less expensive than onsite construction.[36] The studies cited in this note suggest cost savings of 10-25% (in one) or 16% (in the other) for volumetric modular over stick-built housing but the actual degree of savings to the purchaser, if any, will depend significantly on how modular construction is implemented.

  Modular has certain built-in cost advantages over stick-built construction, including lower waste and faster construction (a home can be built in a factory in less than a week and installed onsite in a manner of days, though actual times will vary). Modular manufacturers that produce significant numbers of homes each year can also achieve some cost savings from buying materials in bulk. But volume production of standardized homes is needed for purchasers to achieve the highest cost savings. The purchaser of a single customized modular home may not experience any cost savings over stick-built housing. But if one purchases 30 or 50 identical homes, the design and engineering and other soft costs (e.g., customer interface) can be spread across all of the units, which is a significant savings, and factory owners may be willing to pass on more of their construction cost savings to win a competitive bid. If instead of one 50-unit order, one places an order for 50 (or 100 or 200) homes a year for 3 to 5 years, the manufacturer can potentially structure a dedicated production line to this product, which could yield further cost savings. The larger the volume, the more standardization, and the longer one can guarantee a manufacturer's pipeline, the greater the potential for cost savings.

- In addition to representing an important source of housing for Vermonters, manufactured housing provides a useful illustration of the benefits of large-scale production of standardized homes in factories. An analysis by the Joint Center for Housing Studies at Harvard University of national construction costs in 2020 found that a single-wide manufactured home costs about 47% as much to construct as a comparable single-family home, while a double-wide manufactured home costs about 64% as much to construct as a single-family home, and a CrossMod manufactured home (which is a manufactured home with added features built on

[36] Smith, Ryan; Rice, Talbot. 2015. Permanent Modular Construction: Process, Practice and Performance. Modular Building Institute, Off-Site Studies; and Karthik Subramanya, Sharareh Kermanshachi, Behzad Rouhanizadeh. 2020 Modular Construction vs. Traditional Construction: A Comparative Study of Advantages and Limitations.

site- to make it look more like a stick-built home[37]) costs 80% as much to construct as a single-family home.[38] These costs include foundation, transportation and admin, but not land.

In June 2024, the average sales price of a new manufactured home in the Northeast (not including site work) was $78,600 for a single-wide and $152,900 for a double-wide home.[39] This includes "dealer setup costs," but excludes "taxes, land costs and on-site improvements."[40]

In considering these costs, it is important to recognize that Vermont may want to build homes that are more energy-efficient than the standard manufactured homes included in these cost estimates, and thus are somewhat more expensive to build. The homes purchased by the Vermont State Housing Agency through the Mobile Home Infill Program, which were highly energy efficient, cost an average of $94,600 and averaged 800 square feet, or about $118 per square foot.

- Modular homes produced in Vermont have somewhat higher costs than manufactured homes. For example, Huntington Homes has a line of pre-designed homes called TruHomes (see adjacent photo of a Mt. Tabor TruHome model) that is designed to produce a premium energy-efficient product at lower cost than their customized homes. Per their website, as of early November 2024, they offered four TruHome models; the least expensive model started at $395,700 for a 1,288 square foot home ($301 / sq foot) and the most expensive model started at $562,800 for a 2,132 square foot home

[37] For more information on CrossMod homes. see Strong. Symone 2024. "Clayton's CrossMod Homes Offer Attainable Housing Solution in U.S. Cities." BUILDER Magazine.

[38] Herbert, Christopher; Reed, Chadwick; Shen, James. July, 2023. Comparison of the Cost of Manufactured and Site-Built Homes. Joint Center for Housing Studies, Harvard University.

[39] U.S. Census Bureau, Average Sales Price of New Manufactured Homes by Region and Size of Home, retrieved from FRED, Federal Reserve Bank of St. Louis, accessed Dec. 15, 2024.

[40] Census Manufactured Housing Survey instrument.. The square footage of manufactured homes can vary; both the Joint Center and an earlier NAHB analysis summarized in the Joint Center's report assumed 1,215 square feet for single-wide homes, which works out to $65 per square foot, but it's possible the homes have grown smaller over time as costs have risen. In contrast to earlier analyses summarized in the Joint Center's report, which found the costs of double-wide construction to be only slightly higher on a per-square-foot basis as single-wide construction, the Joint Center's analysis finds they are 50% higher on a per square foot basis; they do not explain the discrepancy.

($264 / sq foot).[41] These prices are for a turnkey product that includes the work that a local contractor would do to complete the home, including a roof and full foundation, but not including site improvements like excavation, driveway, and septic.[42] They offer the same models at lower costs delivered and sealed, for completion by local contractors.

The Vermont manufacturer New Frameworks sells a range of ADUs (which they call Casitas; see adjacent photo) from 300 to 1,200 square feet. Per their website, as of early November 2024, the 300 square-foot unit cost $129,000 to $149,000 for a fully finished unit, while the 900 square-foot unit cost $299,000 to $319,000 for a fully finished unit; both are also available in kit form at a lower cost for completion by local builders.[43]

While benefitting from the lower costs associated with standardized designs, these homes are not designed specifically as low-cost homes and include many features that increase costs relative to manufactured homes, including pitched roofs, upgraded finishes, etc. They also are not produced in factories that have the same volume as manufactured homes.

- In considering the potential of off-site construction to lower costs, it is important to consider the extent to which additional construction is needed onsite to complete the home. In Huntington Homes' TruHome series, for example, the turnkey prices cited above are $70 to $90 a square foot higher than the prices for just the modules, delivery and sealing.[44] While some of this cost is for installing a foundation and connecting the utilities, which will be needed for any home produced offsite, other costs are for completing the construction onsite, including roofing and siding. In a manufactured home, by contrast, the roofing and siding are generally completed in the factory.

  One potential way to reduce costs while taking advantage of the design flexibility of modular housing is to engineer a modular product to minimize the amount of construction needed on

[41] Huntington Homes' website: Floorplans, accessed Nov. 10, 2024.

[42] Huntington Homes' website: Turnkey Options, accessed Nov. 10, 2024.

[43] New Frameworks' website: Casitas, accessed Nov. 10, 2024. In a subsequent website update, pricing has been removed and is now available on request. The 1,200 square foot home was not available as of the time the pricing noted above was ascertained from the website.

[44] Huntington Homes' website: Tru Home, accessed Nov. 12, 2024

site. This may or may not make sense for customized homes but may be feasible for volume production of a single or limited number of modular designs. An example of homes using this approach are the homes being produced by the modular company Vantem for the financial services group, NACA. While caution should be exercised in interpreting the cost estimates listed on the website as there appear to be some omitted costs, the approach is interesting to consider as a middle ground between manufactured housing and traditional modular. A home installation is shown in this video and the approach is further described here. A catalogue of designs for their affordable homes is available here. (Note: The videos are advertisements and include self-promoting statements, but may nevertheless be helpful for illustrating a product that is mostly finished in the factory.)

- There are opportunities for cost savings through off-site construction methods for a wide range of housing types, including single-family detached, duplexes, triplexes, quadruplexes, town homes, and multifamily housing. Multifamily is a somewhat more complicated context than the other housing types because one cannot just produce them in bulk the way one would the other housing types. Multifamily projects are larger and more costly and funders and project sponsors often have specialized needs. However, there are still ways to utilize modular housing cost-effectively in multifamily housing. First, it is essential that modular construction be contemplated from the beginning so the design can be optimized for modular housing. Second, it is important to standardize as much as possible about the interior of the buildings so that buildings can be assembled from standardized components, facilitating the achievements of economies of scale. As noted above, in Quebec, modular manufacturers are in the process of developing standardized designs in response to a government RFP outlining size and cost considerations; partnering nonprofits will then select the design they want for their site.

  In the U.S., the Cambridge–based design firm, Green Staxx, has developed a process for optimizing multifamily design for modular construction, and has begun working on some Vermont projects. Hopefully, there will be lessons from this experience that can form the foundation for future efforts to standardize the process of constructing multifamily buildings using offsite production methods. As with other forms of construction, the greatest cost savings for multifamily housing will come with the at-scale production of standardized modules.

- Among other benefits, modular construction is generally significantly faster to build than stick-built construction. In the multifamily context, this can mean that the projects are ready to occupy sooner, generating more rent revenue than a project on a slower timeline. Regardless of building type, the time on site is also substantially reduced, which can contribute to fewer disruptions for neighbors. The Minneapolis Housing authority chose modular construction for an infill project largely for this reason.[45] On the other hand, there is a learning curve involved in modular housing and contractors; among other challenges, rain penetration before a multifamily modular project is completed can cause significant damage and contractors need to take steps to prevent this.

[45] Local Housing Solutions. 2024. Affordable manufactured and modular housing strategies from Norwood, CO; Minneapolis, MN; and Halifax, MA. Abt Associates and NYU Furman Center, accessed Nov. 10, 2024.

- It is important to note that the costs of designing and constructing the physical structure represent only one component of the overall costs to the consumer. Other cost components include the costs associated with purchasing land, obtaining necessary permits, preparing the land for construction and laying a foundation, and the costs of installing roads, sidewalks and water, wastewater, and stormwater infrastructure. One of the interviewees described costs of $175,000 per unit for these costs for a single-family development in Vermont that significantly increased the costs to the consumer. While this example may be on the high side, it illustrates the need to combine cost savings in the construction of buildings (through off-site construction or other means) with other forms of cost savings in order to bring the costs down to consumers. Examples include building on publicly owned or donated land in order to reduce land costs, building more densely so that the costs of purchasing and entitling land and installing infrastructure can be amortized over a larger number of units, using public funds to cover the costs of the public infrastructure that serves the entire community, and providing developers with help navigating the state and local permitting processes to reduce the time and costs involved.

- One way to reduce the costs of installing public infrastructure is to place housing in infill settings, where roads and sidewalks have already been installed and water and wastewater infrastructure hookups are readily available. Often infill development of single-family or missing-middle housing is assumed to be more expensive than greenfield development since it is harder to achieve economies of scale in infill construction, but modular construction works quite well in an infill setting. To maximize economies of scale, there would still need to be a volume purchase of standardized homes, but they could be installed in infill settings throughout the state.

Economic and Workforce Development

- To advance the goals of economic and workforce development, the state may want to help the off-site construction industry in Vermont to grow, regardless of the market segment businesses are targeting. As Vermont considers its options in this area, it is important to keep the history of off-site construction in mind. Modular construction businesses are highly vulnerable to the economic dislocations of the macroeconomic environment and interest rates. Steps by the State to reduce this risk may be needed to help unlock private investment. Lowering the costs of expansion for off-site construction factories through subsidized financing may change the risk-reward calculus in ways that encourage new investment but does not necessarily prevent businesses from folding during an economic downturn. To maximize economic benefits for the state, it will be important to focus not only on stimulating but sustaining these businesses over the long term.

- As noted above, there is a learning curve for off-site construction. Traditional construction companies that want to transition to off-site construction may need help with business planning to develop and implement plans to introduce off-site construction into their business, either as a main product line or in conjunction with site-built construction. Existing off-site construction businesses may benefit from consulting to help them become more efficient and

sustainable.

- Creating or expanding an off-site housing construction factory (particularly but not limited to volumetric modular factories) involves significant cash outlays. Businesses may need help managing these expenses. Investing in automation can also be costly, even if it reduces construction costs overall, and businesses may need help defraying these upfront costs. While panelized construction has lower start-up costs than volumetric modular construction, these businesses could also benefit from assistance that enables them to expand their operations.

- Two interviewees identified worker shortages as a key obstacle to growth. To some extent, the problem is circular: a lack of housing supply makes it hard to attract the workers needed to build the housing needed to increase the housing supply. Offering the workers in an offsite construction facility lower-cost housing they can afford could break this cycle and facilitate the recruitment of this necessary construction workforce.

- One of the attractive features of off-site construction jobs is the fact that construction can happen year-round, rather than just during the warmer months. Off-site construction jobs can also be filled by people of any gender and by persons with disabilities, further expanding the potential workforce. Manufacturers may need help building on these advantages to market available jobs to additional workers. The state's workforce system may be an important partner in these efforts.

Improved Energy Efficiency and Resilience to Natural Disasters

- Policymakers seeking to increase the energy-efficiency of newly developed homes face a dilemma. The most effective approach is to raise minimum standards statewide, but this can also increase costs, leading to higher home prices. It is also difficult to educate individual home builders one at a time and supervise their output. While off-site builders similarly face higher costs for building energy-efficient homes, it is easier to implement standardized processes that lead to increased energy efficiency in a factory setting since the change can be introduced and implemented centrally. In addition, the introduction of energy-efficient construction techniques in the context of cost savings from volume purchases of offsite construction can help blunt the cost impact. Improved energy efficiency can also be achieved by replacing older, energy-inefficient homes (including older manufactured homes) with newer energy-efficient homes.

- Offsite construction can help reduce damage from natural disasters by facilitating the relocation of vulnerable families from flood-prone areas and by enabling families living in substandard housing to upgrade to safer buildings. The creation of a pipeline of homes for use in disaster recovery was an explicit focus of Oregon's modular housing investments.

Policy Options

The following are policy options for supporting the increased use of off-site construction in Vermont, focusing first on financial support options and then on other policy opportunities.

Policy Options

Financial Support Options

1. Bulk purchases / bulk purchase guarantees
2. Financial Support for starting or expanding an off-site construction facility in Vermont.
3. Other options for providing support for offsite construction

Other Policy Opportunities

1. Adoption of a statewide building code for offsite construction and acceptance of centralized building inspections
2. Help finding workers to enable plant expansion.
3. Requiring modular design be considered for each state-funded project.
4. Statewide, regional, or local pre-approved design plans for rental home development at a wide range of scales

Financial Support Options

Vermont does not have any specific financial incentives aimed at supporting the use of off-site construction in Vermont. The following are options to consider.

1. **Bulk purchases / bulk purchase guarantees**. Vermont has already begun to experiment with bulk purchases of homes produced through off-site construction, including a bulk-purchase of energy-efficient single-wide manufactured homes under VSHA's Mobile Home Infill Program and a bulk purchase of Huntington homes for an installation in Middlebury under VHFA's Middle-Income Homeownership Development Program. One policy option is to expand these bulk purchases to generate deeper cost savings. Since affordability is achieved in this model through economies of scale, rather than subsidies, this approach may have little or no long-term cost to the state. However, it does require that a state entity assume financial risk for the purchases, and the state may wish to add subsidy to further reduce the purchase costs of consumers. Depending on the levels of cost reduction achieved through this process, it could produce discounted homes that are priced at a low enough level to enable buyers to agree to permanent affordability. As discussed more fully below, a state guarantee for bulk purchases may be more efficient than a direct bulk purchase agreement in which the state takes legal possession of the homes.

The following are key factors to consider in designing and implementing such a policy.

a. **Volume**. As noted above, larger orders have the potential for larger cost savings due to the amortization of soft costs across larger numbers of units and the potential to capture more of the manufacturer's construction cost savings. With a large enough recurring order, manufacturers could even set up dedicated production lines, with opportunities for additional cost savings. The research indicated potential interest among several firms to consider expanding operations to accommodate bulk purchases by the state. An order of 100 homes a year might be enough to support a new factory (assuming the homes utilize two modules each) and 200 homes a year certainly would be. A commitment to repeated purchases over a 3-to (optimally) 5-year timeline would maximize opportunities for savings.

b. **Design**. To maximize opportunities for cost savings, it will be important to use simple repeatable home designs that can be manufactured at scale. The use of missing-middle housing types, such as duplexes, triplexes, and townhomes, has the advantage of reducing per-unit costs for land and infrastructure while achieving some cost-savings through shared walls. Potentially, a single module design could be utilized that could be configured in different ways on site to produce different housing types, but since Vermont likely has the need for each unit type, it may make better use of existing capacity to have one factory produce townhomes, another produce single-family and duplex homes, and another multifamily homes. Potentially, this could support both an expansion of capacity at existing factories and a new factory, such as the restarting of the Fair Haven facility.

   Over time, there could be value in developing a suite of different housing options – each purchased in bulk – that could be made available at different price points, such as: (a) single- and double-wide energy-efficient manufactured homes; (b) CrossMod homes that combine manufactured homes with pitched roofs and other site-built enhancements; (c) duplexes and/or triplexes; (d) townhomes; and (e) multifamily homes. With HUD recently modifying the HUD Code governing manufactured housing to allow multi-unit homes,[46] manufactured housing vendors may be able to produce several of the housing types on this list. (The adjacent photo shows one of the first manufactured housing duplexes built under the new rules, part of the Anthem line from Cavco.[47])

[46] U.S. Department of Housing and Urban Development. HUD No 24-233, September 11, 2024. HUD Updates Regulations to Lower Housing Costs and Build Safe and Affordable Manufactured Homes. HUD, Public Affairs.

[47] For more information on the Anthem line of manufactured housing duplexes, visit Cavco's website. This is the Cumberland model, which provides two residences, each 1,050 square feet.

c. **Last mile challenge**. Before making a bulk purchase, it will be important to develop a plan for how the homes get from the factory onto individual sites. One approach for single-family and missing middle homes is for a state body to engage in a bulk purchase or bulk purchase guarantee of a large volume of homes and have participating nonprofit partners be responsible for finding sites and buyers. Potentially, a small roster of professional contractors could be engaged to handle the completion of the homes onsite and other site work, achieving some efficiencies in these services through bulk purchasing as well. An alternative approach would be to find a professional contractor to oversee all of these responsibilities (including land identification and entitlement as well as site work) statewide.

d. **Multifamily housing**. As noted above, somewhat different processes are likely to be needed to integrate offsite construction into multifamily housing production. Two approaches for doing so are noted in the discussion above (a menu of standardized designs and working with consultants like Green Staxx that know how to optimize multifamily housing design for modular). Further work is needed to determine how best to build on Vermont's initial experience with multifamily modular construction to achieve greater cost savings through standardization across projects.

e. **Identifying land**. While the last mile challenge technically includes the identification and entitlement of land, it is important to highlight the need for creative solutions to expand the range of developable sites. As noted above, off-site construction could be a good solution for infill locations where there are opportunities to install additional units on existing properties. Offering a financial incentive for property owners to make their land available – such as $5,000 or $10,000 in cash plus a charitable deduction for the value of the land – might be helpful for convincing landowners to make land available, particularly if the state partner handles all the permitting. A similar approach could potentially induce landowners with large properties not in conservation to make land available for a home or duplex. Scattered sites are not efficient for stick-built homes, but work well for off-site construction, provided the sites are flat and easy to access. For multifamily housing, in which larger sites are needed in more centralized locations with access to public water and wastewater systems, publicly owned land could be a good option.

f. **Bulk purchase structure**. While a full discussion of the legal issues associated with bulk purchases is beyond the scope of this memo, it is important to note the difference between an actual bulk purchase agreement, in which a state body entering into a bulk purchase agreements takes possession of the homes, and a bulk purchase guarantee, in which the state body guarantees the partner that the homes will be purchased at a set price and over a set time period, but the state body never takes legal possession. In this approach, which is preferable as it avoids unnecessary legal transfers of title, the homes are purchased under the same arrangements that developers currently use to purchase homes from modular builders and the state guarantees that a minimum number of purchases will be achieved. There may be a need under this scenario to make credit available to participating developers to cover the initial payments to the modular manufacturer, with extensions of

credit repaid when the eventual property owner purchases the property.

g. **Financing of bulk purchases**. The entity making or guaranteeing the loan purchase will be assuming the risk that all of the purchased homes are sold to end users. Setting aside an amount equal to the total purchases outstanding for the year is certainly the easiest and safest way to finance these purchases, but there are other options that require significantly less cash to be available up front. Assume, for example, the state entity extends credit to nonprofit developer partners, who purchase the homes from the manufacturer and get repaid for the home costs plus a fee for their services by consumers. If a manufacturer builds an equal number of homes every month over the course of the year, which are then installed over a six-month installation period, the average time from completion of the homes to installation will be about four months.[48] Since builders typically only require a deposit (e.g. 10%) before building and not the full amount, with the balance due on completion, it may be possible to further reduce the amount of credit that needs to be extended at any given time. Both factors mean the amount of credit outstanding at any given time will be much less than the full guaranteed amount for the year. (Further analysis would be needed to more precisely estimate the average and maximum levels of credit outstanding, but it could average only one-quarter to one-half of the total amount of funding for the year's purchases.) This smaller amount could either be appropriated, loaned by the state or a state entity, or financed through a bond, with interest payments passed on to consumers or covered by annual appropriations.

h. **Planning processes**. As noted above, planning processes will be needed to identify home design(s), solve the last mile challenge, and develop an approach for maximizing cost savings in multifamily properties. There will also be a need to solicit competitive bids and select one or more vendors to supply the homes. While conceptually the planning processes could be initiated first, before financing is made available for bulk purchases, a simultaneous commitment of funding for the planning and financing of these purchases would give greater coherence and urgency to the planning efforts and secure more effective participation.

   Another way to plan ahead would be to issue formal Requests for Interest to (i) offsite manufacturers and (ii) firms that might be interested in handling the final construction and site work to determine who would be interested and initiate conversations about how the procurements should be structured. We already know from the interviews that manufacturers will want Vermont to make the program as simple as possible for them to navigate. There will be other good advice to come from manufacturers.

i. **Contingency plans for changes in housing economics.** Any investment by the state in offsite construction should consider how the investment will fare in the event that

[48] This assumes homes constructed in October and November are installed in May, homes constructed in December and January are installed in June, homes constructed in February and March are installed in July, homes constructed in April and May are installed in August, homes constructed in June and July are installed in September, and homes constructed in August and September are installed in October.

economic conditions change. As noted above, many offsite construction businesses have struggled to stay afloat during challenging economic times when residential demand dries up. From the manufacturer's perspective, long-term bulk purchase / bulk purchase guarantees provide an important protection from the risks of poor economic conditions, helping to facilitate continued operation when residential demand is otherwise poor. One of the frustrating things about dips in residential construction during downturns is that demand for housing still exists, but cannot be satisfied because of challenges in securing financing. To the extent that a bulk purchase agreement focuses on housing that rents or sells at below-market levels, this will be doubly true – there will continue to be a need / demand for the product given the large pent-up demand for homes at this price point. However, the state will want to have a contingency plan for how it would deal with the purchased inventory if private financing temporarily dries up or unemployment rises.

One option would be for VHFA to provide financing directly to homebuyers to make up for a lack of private financing. Another option could be to purchase the homes and store them until private financing is available again. Perhaps the state and the manufacturer could work out a plan for sharing the costs of this storage if needed to get through the challenging times. A third option would be to sell the units to higher-income households than the program would otherwise generally serve; these households may be able to purchase with cash or may be better able to afford the financing costs during challenging economic times.

Manufacturers may also want some opportunity to deal with unexpected increases in material costs during the course of a long-term contract. Potentially, a bulk purchase agreement could be written in a way that would allow costs to fluctuate up or down depending on an index related to materials costs.

2. **Financial support for starting or expanding an off-site construction facility in Vermont**. Rather than or in addition to a bulk purchase, the state could provide financial support for one or more manufacturers to start or expand a manufacturing plant. The following are some of the options and considerations involved in this process:

    a. **Costs**. A report from the Bipartisan Policy Center notes that manufacturers quoted $20 million as the minimum cost for starting a brand new volumetric modular plant.[49] Restarting the old Skyline facility in Fair Haven would likely cost significantly less as the building has already been constructed and some of the original equipment is still available. Expanding or increasing the automation of an existing volumetric modular plant would also likely cost substantially less than this amount. Other forms of modular construction, such as panelized construction, have lower start-up costs and do not require buildings with as much clear space as volumetric modular.

[49] Burnett, Kimberly, Lindsey Elam, Jeffrey Lubell and Mary Tingerthal. 2022. Using Economies of Scale to Produce Starter Homes: A Market-based Approach to Increasing the Supply of Entry-Level, Single Family Housing in States with Large Rural Populations. Washington, DC: Bipartisan Policy Center.

b. **Who should bear the costs?** The total cost of building or expanding a factory is different from the cost to the state for supporting this work. In many/most cases, a large portion of the costs will be financeable by the private sector. The following are some considerations involved in determining who should bear the costs.

   i. For a new factory construction or an expansion of a plant for a manufacturer that produces exclusively market-rate housing, the case for the state contributing in some way rests in (a) the economic development potential of the project – it will produce jobs or more jobs – and (b) the state's pressing need for housing, which the market is not filling. The state presumably already has financial assistance available to support new or expanded manufacturing and some additional assistance may be warranted to increase the overall housing supply. However, the case for substantial government investment is not as strong as it would be if there were other benefits to the state.

   ii. The state's interest in providing financing grows if the developer is willing to commit to providing some number of homes at below-market levels. For example, in exchange for a significant equity investment in a project by the state, an owner could agree to provide a certain number or percentage of units at a discounted price. The state could also seek priority access to factory-built homes for disaster recovery.

   iii. An owner promising to dedicate their output (or expanded output) exclusively to affordable housing might warrant the largest state investment.

c. **Mechanisms for providing financial support**

   i. **Provide Financing**. One option to support the establishment or expansion of an off-site construction factory is to provide direct financing or a loan guarantee for financing that a manufacturer secures from private sources. This could lower costs by reducing the interest rate of financing and change the financial calculus to make start-up or expansion feasible. Existing off-site construction manufacturers in New England have accessed state and federal programs. However, a review of existing state and federal programs found no programs that explicitly prioritize off-site construction manufacturers.

   Colorado provides an example of this approach. It has two loan programs – the Innovation Housing Incentive Program and Proposition 123 – that together have made $38 million in loans (for up to 10 years) to help existing offsite manufacturers expand existing facilities and (in the Proposition 123 loan program) to support factory construction by existing or new manufacturers who could get to scale quickly and working capital, inventory, raw materials, factory production deposits, and leased-facility deposits.[50] The Innovative Housing Incentive Program also includes payments to manufacturers for each unit

[50] Colorado Office of Economic Development and International Trade. 2024. Innovative Housing Manufacturer Financing Loan Program Comparison. Colorado Governor's Office State Agency, accessed Nov. 10, 2024.

produced (see discussion below).[51]

ii. **Make an equity investment**. A second option is to provide capital in the form of a grant that acts as an equity investment to support the establishment or expansion of an offsite construction factory. Oregon provides an example of this approach, making a $12 million investment in a manufactured housing plant operated by a nonprofit and a total of $20 million of investments in four modular plants. The nonprofit has a business plan to produce low-cost manufactured housing. Across the four modular grantees, the grants will contribute to an expected 200 additional market housing units per year, 500 additional ADUs per year and 700 affordable housing units per year.[52] In addition, the grantees have promised to prioritize housing for victims of natural disasters (including by maintaining a robust inventory onsite or surge capacity to increase production when needed) and in some cases affordable housing.

iii. Provide tax incentives or rebates for each unit produced. In addition to providing low-cost financing for plant expansion, Colorado provides grants for working capital and incentives of up to $6,000 per unit delivered, depending on whether the unit is affordable, built densely and the level of sustainability. Figure 6 shows the total incentives provided by Colorado for plant expansion. (New factories are eligible for the loan but not the working capital grant or financial incentives.)

Figure 6 - Incentives in the $40 million Innovative Housing Incentive Program

Funding mechanism	Lifetime limit per business
Working capital grant	$350,000 for businesses in non-Just Transition counties* $450,000 for businesses in Just Transition counties *Lifetime limit does not include $50,000 bonus for affordable housing production, detailed in Section 2 (c) below
Per-unit cash incentive	$1,000,000 for all eligible businesses
Factory loan	No more than $10 million will be loaned to any business

Source: Innovative Housing Incentive Program Guidelines, Updated May 2024.[53]

[51] Colorado Office of Economic Development and International Trade. May 15, 2024. Innovative Housing Incentive Program, Program Guidelines. Colorado Governor's Office State Agency, accessed Nov. 10, 2024.

[52] Rosas, Tanisha. May 30, 2024. Modular Housing Development Fund, Presentation for Housing Interim Committee on Housing and Homelessness. Oregon Housing and Community Services.

[53] Colorado Office of Economic Development and International Trade. May 15, 2024. Innovative Housing Incentive Program, Program Guidelines. Colorado Governor's Office State Agency, accessed Nov. 10, 2024.

d. **Bulk purchases / bulk purchase guarantees**. Whether structured as an outright purchase or the guarantee that partners will purchase the units, a long-term agreement for the bulk purchase of units produced through offsite construction may go a long way to facilitating the financing of an expansion of a plant needed to meet that order. In discussions of this concept in Washington state, a number of manufacturers and consultants said that they could take a long-term bulk purchase agreement to the bank to secure the financing they would need for an expansion of their operations or to start up a new plant.

e. **Other sources of funding**. In addition to state funding using one or more of the options noted above, or private funding based on a long-term bulk purchase agreement, there may be other funding sources available. For example, the federal New Markets Tax Credit (NMTC) finances investments that promote quality jobs in qualifying census tracts. The former Skyline plant is in a Zip Code eligible for these credits. If the project were to apply for and secure NMTCs from a Community Development Entity (CDE) that has been awarded an allocation, the credits could potentially supply roughly 20 to 25% of the costs needed to restart the plant. There are several CDEs that have allocations of NMTCs and serve Vermont, including Community Housing Capital, Evernorth, Mascoma Bank and TD Bank.[54]

   Other potential sources of funding include HUD's CDBG program and the remaining Inflation Reduction Act financing. Evernorth previously funded the construction of a panelized factory plant in New Hampshire using a combination of NMTCs alongside CDBG from the Vermont Department of Housing and Community Development. See Appendix C for a list of existing economic development programs.

f. **Risks of financing new factories or expanded production.** As discussed above with respect to bulk purchases, in considering whether to provide financing, and if so, in what form, it is important to keep the history of off-site construction in mind. Historically, off-site construction plants have struggled to survive challenging economic times, during which private investment in residential construction often dries up. Before extending financing, it would be prudent to have a plan in place for how the plant will survive such challenges, both as a way to facilitate repayment of any loans or ensure the state gets it money worth from a grant, but also as a way to ensure the business survives and jobs are preserved. The last thing anyone wants would be for state financing to facilitate the expansion of an existing successful business that then becomes more vulnerable to subsequent downturns because of its larger size.

   In terms of the state recovering its investment, loans are generally riskier than bulk purchase agreements since bulk purchase agreements protect the manufacturer during challenging economic times and loans do not. However, as noted above, with a bulk purchase agreement, the state would need to work through how to deal with purchased inventory during challenging economic times.

[54] U.S. Department of Treasury. October 16, 2024. NMTC Qualified Equity Investment Report. Community Development Financial Institutions (CDFI) Fund.

3. **Other options for providing financial support for offsite construction.**

The following are some additional options to consider for providing financial support for offsite construction.

a. **Tax Credits / Rebates**. The prior section lists tax credits/rebates as an option for financing the expansion of a factory – in essence, it is a safer way to make a grant, parceling out payments as manufacturers produce units. But both tax credits and rebates could also be potentially used to encourage manufacturers to focus on producing lower-cost units for sale in the marketplace. For example, a policy could provide a manufacturer with the ability to secure payments of up to $10,000 per unit for units they produce that sell below a certain level, and up to $15,000 per unit for units that sell at an even lower level. The goal of such a policy would not be to offset losses by the manufacturer but rather to help make lower-cost units more profitable to them so that they have incentives to develop and prioritize lower-cost products. Right now, some manufacturers are prioritizing ski chalets because the individuals purchasing these units are more reliable purchasers and because the opportunities for profit are greater. If they could produce two or three smaller units for every larger unit and then earn additional profit on those units, they might conceivably have an incentive to develop and optimize their lines for production of lower-cost units.

b. **Support for Business Planning.** It is likely that Vermont will need multiple manufacturers to meet the demand for different housing types, including some combination of expanded operations by the existing manufacturers and new manufacturers. Some of those new manufacturers could be construction businesses that are already present in the state who choose to start an offsite construction business. To accelerate the growth of these businesses, planning grants could be helpful to enable businesses to study the options and determine whether and if so, how best to grow into this space. Existing offsite construction companies may also be able to benefit from business planning assistance – for example, to explore options for increased automation or development of new lower-cost products.

c. **Downturn protection**. Conceptually, one additional support that could be helpful for the offsite construction industry would be some form of protection against future economic or housing downturns. As noted above, there is invariably still demand for housing during these periods, but families struggle to get private financing. Since it is in the state's interest to see housing production continue during these downturns to meet the state's housing needs and continue employment of workers, the state could consider providing manufacturers with some form of protection during these periods. This could include, for example, an agreement to purchase a set number of homes at a discounted price during the downturn, financing for borrowers who cannot get private financing, or a loan to keep production going during the downturn, with homes stored until the market unfreezes. Bulk purchase agreements also function as downturn protection for manufacturers, but conceptually downturn protection could also be offered as a stand-alone product in order to encourage producers to increase their volume.

Other Policy Opportunities

There are a number of non-financial policy interventions or supports that Vermont could consider increasing the volume of projects utilizing off-site construction methodologies:

1. **Adoption of a statewide building code for offsite construction and acceptance of centralized building inspections**. Manufactured housing is governed by the national HUD code, which supersedes states and local building codes. All other forms of off-site construction are governed by state and local building codes. Local variation in building codes thus poses a significant problem for efforts to use at-scale manufacturing to achieve cost reductions, since achieving maximum cost savings requires that units be identical or mostly identical. There is a fair amount of variation in local building codes in Vermont; in addition, code interpretation can vary along with the nature and extent of the inspections process. To help facilitate at-scale off-site production of low-cost homes, it would be important to have a statewide building code for off-site construction in Vermont along with procedures for centralized building inspections at the factory level. The International Code Council (ICC) and the Modular Building Institute have developed offsite construction and inspection standards to promote greater standardization. In February 2024, Virginia became the first state to adopt these standards statewide.[55] Utah became the second state to adopt statewide ICC standards in March of 2024. As noted above, Oregon has taken a different approach by adopting a model code that encourages localities to adopt.

2. **Help finding workers to enable plant expansion.** Several of the interviewees underscored that shortages of workers were a substantial inhibitor of expanded operations. The issue, according to one interviewee, is not a lack of training but simply a lack of people willing to be trained. Part of the problem in attracting workers is the lack of affordable housing in Vermont; as noted above, Vermont ultimately may need to create housing it can offer as affordable homes to the off-site construction workers who will build the supply of housing Vermont needs to grow and meet its housing needs. There may also be steps Vermont can take through its workforce system to educate high school students about opportunities in the offsite construction industry and to recruit workers from out of state.

3. **Requiring modular design be considered for each state-funded project.** A cross section of construction managers, general contractors, funders, and manufacturers indicated that a "modular perspective" was often brought to the development team too late in the development process. An approach to addressing this issue could include public funders requiring that every publicly funded project include a modular consultant early in the design and pre-development process. Requiring a modular design to be considered in each project would introduce a new cost to each project. That cost would increase the developer's pre-construction costs.

4. **Statewide, regional, or local pre-approved design plans for rental home development at a wide range of scales.** Off-site construction thrives on repeatability of design and repetition in manufacturing. Vermont could consider a set of pre-approved building designs at different scales. For example, 4-unit, 8 unit, 12-unit, 24-unit, and 36-unit building designs as well as

[55] Modular Building Institute. 2024. The Commonwealth of Virginia Revolutionizes the Building Industry by Being the First State to Adopt ICC/MBI Off-Site Construction Standards, accessed Nov. 14, 2024.

single-family and duplex designs that were assured design approval if other permitting requirements are met. This would allow for manufacturing practices that produce those buildings at scale. Manufacturers interviewed agreed this approach would increase manufacturing efficiency and lower construction prices. Construction contractors would also become familiar with assembly and site needs for models – potentially reducing the less time and labor to finish buildings on site. Vermont has taken steps towards this approach through the Homes for All Toolkit,[56] which proposed municipalities pre-approve sets of building designs. Further efforts to adopt recommendations from Homes for All pre-approved designs could extend to a higher number of units (currently pre-approved plans are for between 1-4 units) and include further coordination with modular manufacturers to ensure modular products could be used to meet the model designs.

Next Steps for Vermont

Vermont will need to decide whether it wishes to move forward with the expanded use of offsite construction, and if so how and with what funding. Should Vermont decide to move forward, the following are steps to consider for operationalizing this approach.

Potential Next Steps

1. Review and confirm the state's policy objectives and priorities.
2. Develop a plan for using bulk purchases of homes produced through off-site construction to achieve lower construction costs for single-family and missing middle housing types.
3. Develop a plan for using offsite construction to achieve lower multifamily construction costs.
4. Consider issuing a formal Request for Information to get input from potential manufacturers about how best to achieve cost savings through a bulk purchase program.
5. Allocate funding to support bulk purchases.
6. Implement prioritization and incentives for using off site construction within existing funding programs.
7. Facilitate restarting the Fair Haven plant and support the expansion of other existing Vermont manufacturers.
8. Consider providing business planning support in the form of small grants and technical assistance to existing Vermont businesses seeking to develop or expand offsite construction businesses.
9. Consider adopting a state-wide building code for offsite construction and procedures for factory-level inspections and pre-approved designs.
10. Create a Northern New England working group that reaches across state lines and considers a regional market and shared approach.

[56] Vermont's Homes for All program.

1. **Review and confirm the state's policy objectives and priorities**. A number of potential policy objectives are outlined above. Leaders in Vermont should confirm if they want to pursue all of them or only some of them or to prioritize some objectives over others. Different actions may be needed to advance different specific objectives.

2. **Develop a plan for using bulk purchases of homes produced through off-site construction to achieve lower construction costs for single-family and missing middle housing types**. As described above, there is a compelling case for using bulk purchases or bulk purchase guarantees of one or more simple repeatable designs to achieve lower housing production costs for single-family and middle housing. A planning process is needed to identify the specific housing types to be targeted for bulk purchases, identify or develop specific home designs to be built, determine how lots will be identified and the units installed and completed and who will do this work, determine how families will be recruited to purchase the homes and who will do this work, determine the terms of sale, determine how the purchases will be financed, and determine how to address potential future disruptions in the housing market or broader economy. As part of this planning process, it would be important to engage potential developer partners to ensure they are ready, able, and willing to participate in the development pipeline and make effective use of the purchased units. It would also be useful to have discussions with potential manufacturers to determine how best to structure any future bulk purchase arrangement. Funding will be needed for the planning process to ensure it is comprehensive and inclusive of a wide range of stakeholders.

3. **Develop a plan for using offsite construction to achieve lower multifamily construction costs**. The multifamily development process is different enough from the construction and sales processes for for-sale homes that it merits its own planning process. In-depth discussions are needed among multifamily developers of affordable housing to determine how best to achieve greater standardization and how modular construction can help. The design discussion is likely to be more complicated here than in the single-family and middle-housing planning process. However, the last-mile problem does not exist on the multifamily side since there is an established process for identifying sites for multifamily construction, funding developers, and marketing units to families. This planning process would benefit from funding.

4. **Consider issuing a formal Request for Information to get input from potential manufacturers about how best to achieve cost savings through a bulk purchase program**. Manufacturers have a wealth of information about the practical realities of offsite construction. They may well have ideas about how to achieve cost savings that would be worth incorporating into a future bulk purchase or bulk purchase guarantee arrangement.

5. **Allocate funding to support bulk purchases.** Knowing that funding is available to support bulk purchases would add urgency to the planning process and secure wider and more effective participation of key players. Given the openness of existing manufacturers to consider expanding their operations, it may not be necessary to start with a large enough

bulk purchase to support an entire new plant (though the latter may ultimately yield the greatest cost savings). An incremental approach to volume, combined with the payment structure for modular, in which most of the payment is made on delivery, and the fact that the family's payment is made shortly thereafter, should reduce the amount of funding that is needed to launch a bulk purchase program.

6. **Implement prioritization and incentives for using off site construction within existing funding programs.** Even without an allocation of new funding, there are steps that could be taken to expand the use of offsite construction through shifts in Vermont's existing programs and funding. We recommend that the public entities administering housing and economic development funding review existing programs to identify administrative changes that would prioritize off-site construction. (See Appendix C for a list of economic development programs.) Key statewide and regional strategies or plans that direct housing and economic development investments could identify off-site construction as a priority investment area for existing programs. Potential administrative changes could include creating a requirement that modular designs be considered in awarded housing projects and creating a priority within existing economic development programs for offsite construction manufacturers seeking funding to expand their capacity or start a new plant. More direct outreach to manufacturers to connect with existing programming could also help connect available capital with opportunities to grow the industry in Vermont.

7. **Facilitate restarting of the Fair Haven plant and support the expansion of other existing Vermont manufacturers**. The former Skyline Plant in Fair Haven provides an important opportunity to advance the state's policy objectives through the restarting of a now closed housing manufacturing facility in Vermont. A planning process is already underway to assess the condition of the plant. Additional public and private funding will be needed to develop a plan for restarting the plant and attracting an operator. The plant will also require financing to update its equipment and have sufficient working capital to begin operations. In addition to the Fair Haven plant, Vermont has a number of existing businesses that could potentially benefit from assistance scaling up their operations. Further conversations with existing manufacturers are warranted to determine what type of expansion they would contemplate and what types of assistance they would need to scale and sustain their businesses.

8. **Consider providing business planning support in the form of small grants and technical assistance to existing Vermont businesses seeking to develop or expand offsite construction businesses**. It can be difficult for small businesses to set aside time and money to investigate new lines of business. Even larger businesses may struggle to justify these expenditures when their existing business model is profitable. A small amount of funding could help encourage more companies to enter the offsite construction and facilitate the scaling of existing businesses. Grants or technical assistance for business and capital planning may also help existing businesses connect with existing state programs that could support their expansion.

9. **Consider adopting a state-wide building code for offsite construction and procedures for factory-level inspections and pre-approved designs** to facilitate at-scale production of homes off-site. The International Code Council has established model codes and toolkits for state local agencies to help eliminate regulatory and compliance redundancies.[57] As discussed in the report, Vermont could explore Virginia and Utah's adoption of ICC/MBI Standards 1200 and 1205 as an approach. Such code could establish clear standards for planning, design, manufacturing, and inspection requirements. The state should also consider a process for manufacturers to obtain pre-approval from a state agency for their housing designs so that homes to be built off-site can obtain design approval once and not have to go through separate design approval in each locality.

10. **Create a Northern New England working group that reaches across state lines and considers a regional market and shared approach.** A number of offsite manufacturers are already serving multiple states in New England. State funders and policy makers from Northern New England (specifically Vermont, Maine, and New Hampshire) would benefit from coordinating efforts to support the off-site construction industry in the region. For manufacturers, having a regional marketplace that has similarities in policy and funding resources will create efficiencies for doing business across state lines. An example starting place: The Housing Finance Agencies and Agencies of Commerce & Community Development for each participating state could start with quarterly meetings focused on how to support off-site construction in the region.

[57] International Code Council Off-Site Construction standards and toolkits

Appendix A: Survey Questions

Instructions and background:

A consortium of state funders seeks to document the off-site construction, modular, and manufactured home production initiatives serving Vermont's residential housing market. This survey welcomes responses from initiatives or businesses that are operational and/or in development and to be launched. If you own or are working on a business or initiative involving off-site construction, panelized, modular, modular ADU, or manufactured home production for installation in Vermont, we hope you will take some time to complete the survey below.

Responses will be summarized in a future report in a way that does not does not focus on individual responses.

VHFA will be following up with selected respondents for interviews.

1. Please identify the name of your company or initiative (Fillable)

2. When was your company or initiative founded? (Fillable)

3. Where is your company or initiative located? Please identify both town and state. (Fillable)

4. Please describe your service area and market, with particular attention to the regions within Vermont that you serve or are interested in serving. For example, notate if you serve a particular region of Vermont, multiple states, etc.

5. How many employees do you have?

6. How would you identify your product or business: (Selection, allow multiple, last one is fillable)
    a. Manufactured Housing of HUD-code homes
    b. Volumetric Modular Construction
    c. Panelized Construction
    d. Off-Site Production of Kit Models
    e. Other forms of prefabrication of homes
    f. Building Technologies and Materials Sector
    g. Other (Please Describe)

7. Please provide more details about the types of products and services you provide. What are the typical sizes of the homes you build? (blank fillable)

8. Are most of your homes fully customized or built according to a limited number of set designs? Y/N

9. Do you provide a finished home? Y/N

10. Do you provide kits or build components that go into a finished home? Y/N

11. Do you install and finish the homes on site yourself? Y/N

12. Who is your customer base? Please apply the percentage of your business that go through the following options:
    a. Individual homebuyers (purchase of new homes)
    b. Developers
    c. Individual homeowners seeking an Accessory Dwelling Unit
    d. Other

13. How many homes do you estimate your company/initiative has produced through off-site construction over its entire history?

14. How many homes built through off-site construction have you placed in the past 3 years?

15. How many homes does your current manufacturing capacity permit you to build per year using off-site construction?

16. How would you describe the demand for your product(s)?

17. Do you have plans to increase production in the next three years? If yes, please describe the steps you will take and the production levels you expect to achieve.

18. Please summarize the home sizes (square footage per home) and bedroom configurations (number of bedrooms) of the homes or ADUs you offer.

19. What are your current per square foot costs for construction from a typical unit, without consideration of site costs? (short fillable)

20. Do you have any comments about cost trends, access to materials, and labor?

21. What are the key constraints/barriers on you producing more homes? Please identify if your constraints are financial, regulatory, or market based. Also please clarify if these constraints are related to transient or fluctuating factors (such as mortgage interest rates) or long-standing issues.

22. Have you accessed state, federal, or local government funding for operational, planning or capital support in the past 5 years? If yes, please describe.

23. If you are producing any form of completed prefabricated home (e.g., volumetric modular or manufactured housing or other prefabricated), how would you describe the level of Energy Efficiency in your homes?
    a. Energy-Star
    b. Zero Energy or Net Zero
    c. Zero Energy or Net Zero Ready
    d. Passive House
    e. Other (please describe)

24. If you are producing kits or panels that are used in traditional residential construction projects, please describe the level of Energy Efficiency in your homes?
    a. Vermont Residential Building Standards minimum
    b. Vermont Residential Building Standards stretch
    c. Efficiency Vermont High Performance
    d. Zero Energy or Net Zero
    e. Zero Energy or Net Zero Ready
    f. Passive House
    g. Other (please describe)

25. Are there specific state and federal resources or policies you would like to see addressed? Examples could include financial resources for business planning or construction or expansion of an off-site factory, changes to state building codes or inspection processes, or support for more innovative or energy-efficient designs.

26. How confident are you in the health and strength of the market for off-site construction in Vermont in the next 3-5 years?
    a. Highly Confident
    b. Moderately Confident
    c. Uncertain
    d. Pessimistic

27. What is the basis for your assessment? (narrative)

28. Would you be open to being contacted by VHFA or a partner to discuss this topic?

29. If you have anything else to add, please do so here:

Appendix B: Interview Questions

Questions for Developers using Products:

- How many projects have you used off-site construction methods?
- Were the projects multifamily or single-family?
- For each project (or if they have done a lot for a handful of representative projects) how many units, and what was the configuration (e.g., how many stories; all one building or separate buildings, etc.
- Why types of methods were used (modular, panels, etc.)?
- From which manufacturer (name and location) did they buy the units? Did they have a good experience with the manufacturer?
- Were they 2D panels or 3D boxes (volumetric modular)?
- Were they difficult to install?
- Did they have any special training on how to install? Would it have been helpful to have special training? Would they be interested in further training if it were available about how to maximize the utility of modular housing?
- If they were multifamily developers, was the financing timeline difficult to manage (the units often require partial upfront payment before starting)? How did they cover the upfront costs?
- For multifamily developers of affordable housing, could they envision a world in which there are mostly standardized units built at scale that they would then adapt to fit their site, with a customized skin? This could allow for greater economies of scale and lower prices. How hard would it be to adapt to this model? What assistance would they want or need to manage the transition?
- For developers interested in workforce single-family homes, could they envision a world in which standardized homes of modest size are built at scale, with a few different exterior options? This could allow for greater economies of scale and lower prices. How hard would it be to adapt to this model?

- How would you describe the overall experience from a logistics standpoint?
- How would you describe the impact to the pace/timing of your project?
- How would you describe the impact to the cost of your project?
- What were the top benefits of using an off-site approach?
- What were the top drawbacks?
- Will you use off-site methods in the future?
- What do you see as the future of the off-site construction industry in Vermont?
- Are there rules, regulations, or policy barriers to using off-site construction approaches?
- Are there regulatory, funding, or policy supports you'd like to see in place?

Appendix C: Economic Development Programs

The table below identifies potential economic development programs and resources that could be targeted towards the off-site construction industry. The table identifies whether an investment could go directly into an off-site construction business (Y) or if the program is geared towards supporting infrastructure for business growth (N).

Program Name	Deployment Agency	Potential Impact	State/Federal	Direct Business impact
New Market Tax Credits	US Treasury – Deployed through regional Community Development Finance Agencies or Banks	Equity investment for expansion of manufacturing facilities. Some potential for bulk purchase for site-specific	Federal with local allocations	Y
Community Development Block Grants	Vermont Agency of Commerce and Community Development	Support of infrastructure needed to expand facilities	State	Y
Build 2 Scale	US Economic Development Administration	Operating and physical assets to expand businesses.	Federal	Y
Tax Increment Finance Districts	Vermont Economic Progress Council	Support of infrastructure needed to expand facilities.	State	N
Vermont Employment Growth Incentive	Vermont Agency of Commerce and Community Development	Provides cash payment for business recruitment, growth, expansion beyond a business's organic growth.	State	Y
Vermont Training Program	Vermont Agency of Commerce and Community Development	Pre-employment training, training for new hires, and existing workers. VTP grants may cover up to 50% of the training cost. Also supports connecting with students to promote future manufacturing employment pathways.	State	Y

Opportunity Zones	Private Market	Provides tax incentives for investors to support business in real estate, machinery, fixtures, or site improvements in designated areas.	Federal within State designated OZs	Y
Catalyst Program	Northern Borders Regional Commission	Infrastructure, energy, or workforce development for projects that demonstrate innovation.	Federal with Regional multi-state deployment	Y
Brownfields Properties Revitalization Fund	Northern Borders Regional Commission	Up to $250,000 for costs related to Brownfield remediation of a site with pre-existing environmental contamination.	Federal with Regional multi-state deployment	Y
Advanced Materials and Technologies Office (variety of funding)	Department of Energy	Mix of loan and grant programs focused on accelerating the adoption of innovative materials and manufacturing technologies for a strong and resilient energy sector.	Federal	Y
Industrial Efficiency & Decarbonization Office (variety of funding)	Department of Energy	Loans and grants for research, development, pilot-scale demonstrations, technical assistance, and workforce development to decarbonize industrial sector.	Federal	Y
Office of Manufacturing and Energy Supply Chains	Department of Energy	Loans and grants for workforce, manufacturing facility, and energy efficiency in manufacturing facilities.	Federal	Y
Small Business Administration 7a and 504 Program	Small Business Administration	Offered through Vermont based banks/credit unions – preferred rates and terms for operating or long-term financing.	State	Y
Vermont Economic Development Authority Programming	Vermont Economic Development Authority	Wide range of loan programs that serve businesses with physical assets, real estate, energy, and operational financing needs.	State	Y