Moving to All-Electric Residential New Construction Programs

Nick Jones, Eversource
Richard Faesy, Energy Futures Group

ABSTRACT

The buildings and construction sector accounts for a significant 37% of global greenhouse gas emissions (UNEP 2023). To mitigate these emissions, policymakers and energy efficiency programs need to adopt the latest electrification technologies to curb emissions in the building sector. Residential New Construction (RNC) programs provide some of the greatest opportunities for emissions reductions in the portfolio for energy efficiency programs.

RNC typically serves as the flagship demand-side management (DSM) program, leading the way for other programs. As we move towards electrification and away from gas, RNC programs can increase awareness of the electrification concept, emphasize the benefits, educate consumers, stakeholders, and decision-makers, and hold up new electric homes as the pinnacle of homeownership.

This paper provides a short survey of existing all-electric RNC programs and focuses on Connecticut's recent experience transitioning from an all-fuels to an all-electric RNC program. We present Connecticut's all-electric RNC program experience as a case study and share our findings and learnings from making the transition to an all-electric program.

Introduction

Residential new construction (RNC) programs have historically offered incentives and technical services to encourage the construction of efficient new buildings. These programs have generally either been fuel-blind--offering services to all new buildings in a jurisdiction regardless of fuel types used--or just served those projects using the fuel provided by the utility offering the program. However, as the electric grid becomes more renewable, policies in more progressive jurisdictions have been increasingly discouraging new construction that uses combustion fuels and instead have been encouraging all-electric new construction. With climate goals over the next 25 years aimed to phase out fossil fuels, buildings that last at least 100 years, and an increasingly renewable electric grid, RNC programs should align and support policies that encourage all-electric new construction.

Survey of RNC All-Electric Programs

Besides Connecticut, several states in the U.S. currently have energy efficiency programs that encourage all-electric residential new construction. The availability of programs varies by state and utility provider and is in transition as more jurisdictions consider moving to all-electric RNC offerings. Following are some examples of states that are already making this transition, as of July 2024:

- California: The California Energy Commission (CEC) offers incentives and rebates for all-electric RNC through programs such as the New Solar Homes Partnership (NSHP) and the California Advanced Homes Program (CAHP). These programs promote energy-efficient designs and technologies, including all-electric solutions. (California Electric Homes 2024)
- Massachusetts: The Sponsors of Mass Save are offering incentives up to $40,000 and technical assistance to support homeowners in the construction of new, all-electric homes. (Mass Save 2024)
- New York: The New York State Energy Research and Development Authority (NYSERDA) offers incentives and technical assistance for all-electric RNC projects. Starting in 2026, the installation of fossil fuel equipment is prohibited in new buildings up to seven stories before applying to all new construction in 2029 (with some exceptions). (NYSERDA 2024)
- Oregon: In Oregon, Energy Trust of Oregon offers incentives and technical support for all-electric residential new construction projects. This includes incentives for high-efficiency heat pumps, water heaters, and other electric appliances. (ETO 2024)
- Washington: In 2022 Washington became the first state in the country to mandate that most newly constructed commercial buildings and large multifamily buildings be all-electric. (Washington PBS 2022).
- Vermont: Efficiency Vermont offers incentives and technical assistance for all-electric RNC projects including a $1000 incentive bonus for all-electric homes. (EVT 2024)

While most of these states have a component of their RNC program that offers all-electric, few programs have made the full switch to only serving customers committed to all-electric in their residential construction projects. Connecticut is one of the first.

Connecticut's Greenhouse Gas and Electrification Policies

To understand the context in which Connecticut's RNC program made the transition to an all-electric program, it is important to be aware of the existing greenhouse gas and electrification policies in place. Connecticut has been actively pursuing policies to address greenhouse gas emissions and promote electrification, including the following key initiatives:

- Greenhouse Gas Reduction Targets
- Renewable Portfolio Standard (RPS)
- Conservation and Load Management (C&LM) Energy Efficiency Programs
- Electric Vehicle (EV) Incentives
- Transportation Electrification
- Climate Action Plan (CAP)

DEEP's Order and the Plans to Transition to an All-Electric RNC Program

These policies and initiatives demonstrate Connecticut's commitment to addressing climate change by reducing greenhouse gas emissions and promoting electrification across various sectors of the economy. With these policies in place, the Connecticut Department of

Energy and Environmental Protection (CT DEEP), in June 2022 issued a Conditions of Approval No.13 to the 2022 Conservation & Load Management Plan Update ("Plan"), which required the state's two major electric and natural gas utilities service companies[1] to transition the statewide RNC program from an all-fuels program to an all-electric program. (2022 DEEP COA) In response to the order from CT DEEP, the Companies, in their 2023 Plan Update committed to this transition and created an all-electric RNC program offering. This offering incentivized the electrification of space heating, water heating, appliances and cooking for all participants in the RNC program, and effectively eliminated incentives for fossil fuel combustion equipment for new housing. (2023 Plan Update)[2]

Anticipated Concerns

As the Companies stated in the 2023 Plan Update, there was considerable concern about the change in the program that would result in an end for support of fossil fuel projects in the RNC program. There was the legitimate fear that participation would drop precipitously, and that Connecticut's high-cost electricity would cause affordable housing residents to pay more to operate heat pumps and heat pump water heaters relative to natural gas. In addition, some consumers would likely miss gas cooking appliances and might not choose to participate in the RNC program as a result.

However, the biggest concern was with water heating in multifamily housing. Multifamily buildings were a major participant in the RNC program and many of the state subsidized and affordable housing projects were participants since they received credit for participating. Connecticut has also been working closely with Massachusetts in promoting and supporting a robust Passive House network. While most Passive House certified multifamily projects in Connecticut and Massachusetts were installing heat pumps for space conditioning, the vast majority were installing gas combustion water heaters. Since the new program would require participating projects to forgo all gas appliances, there has been the real concern that many designers, developers and builders who relied on gas for water heating might choose to no longer participate in the program.

History of Connecticut's Residential New Construction Program

Within the state of Connecticut, much work has been done by the statewide energy efficiency programs, DEEP, and others to transform the RNC market towards all-electric buildings. In looking at the current state of new construction activity in Connecticut, we can illustrate the market drivers, as well as the barriers and opportunities for market transformation for all-electric residential homes and dwellings. The information hereafter presents new construction activity and trends related to the electrification of new buildings both within, and outside of Connecticut.

[1] The two main electric & natural gas service providers in Connecticut are Eversource and Avangrid, with service territories in 165 of the state's 169 cities and towns. Hereinafter, they will be collectively referred to as the "Companies"

[2] Full details on the language included within the COA commitment can be found in the 2023 Plan Update.

Residential New Construction Trends in Connecticut

Over the last thirty-plus years, the RNC sector in Connecticut has seen volatility in the number of new residential housing permits issued. In 2005, new home permits in Connecticut peaked at 10,344 issued permits (CT DECD 2023). Over the next six consecutive years to follow, new home permits declined exponentially, until finally reaching an all-time low in 2011 after a four-year economic recession (*Figure 1*).

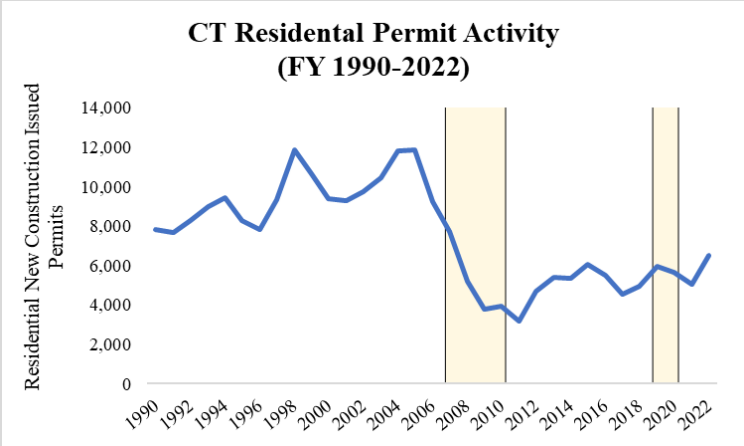

Figure 1. Connecticut residential permit activity, 1990-2022 (number of new permits). Yellow bars indicate periods of economic recession, as well as impact of COVID-19 on building permits. *Source*: CT DECD 2023.

Since 2011, the new construction housing market has continued to recover at a relatively slow pace. However, over the last ten-plus years, the nature and type of residential construction has changed rather drastically since that time. Among the most notable changes is the gradual shift towards multi-unit new construction in Connecticut (*Figure 2*).

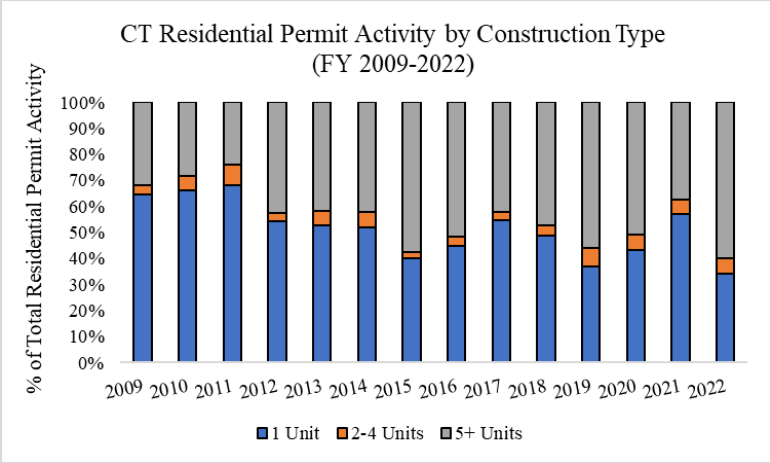

Figure 2. Connecticut residential permit activity, 2009 – 2022, by construction type: single family (1 unit), single-family attached (2-4 units) and multifamily (5+ units). *Source*: CT DECD 2023.

In a seven-year period between 2009-2016, construction of new five+ unit residential buildings represented an average of 38% of total permit activity. The subsequent seven-year period between 2016-2023 showed a notable shift, with new five+ unit residential buildings accounting for an average of 49% of total permit activity.

The exact reasons for this shift in permit activity can be attributed to a number of different factors including a significant housing shortage in the state (CHFA 2023), rising costs of land and materials (NAHB 2024), rising inflation and mortgage rates (Tracey 2023), and a demographic shift in preference towards rental rather than ownership opportunities (Simmons 2014). Addressing these issues is beyond the scope of this research. Instead, this data is intended to highlight trends seen within the residential new construction energy efficiency program in Connecticut.

Progressive federal policy has also driven market transformation for high-performance, all-electric buildings. The Inflation Reduction Act of 2022 has accelerated this transformation through an influx in federal spending on all-electric new construction. These market drivers have created a growing demand for all-electric new construction. In addition to the reduction in cost, this transformation has been driven by new net metering legislation, efficiency increases and reduction in the cost of PV technologies, better glazing characteristics, and an increase in the efficiency and reduction in the cost of mini-split heat pump technologies (Rosenbaum 2016). State housing policy enacted by the Connecticut Housing Finance Authority (CHFA) has helped accelerate these changes by awarding high-performance, all-electric buildings through state-funded tax credit programs.

Connecticut's EnergizeCT Residential New Construction Program

In Connecticut, one of the major catalysts for change in the residential new construction sector has been the work of the statewide initiative known as Energize Connecticut^{SM}. The initiative is funded through the Connecticut Energy Efficiency Fund ("Fund"), which was created in 1998 by Connecticut legislation to provide cost-effective electric energy efficiency and load management programs (EnergizeCT 2024)[3]. The Fund is supported by electric and natural gas ratepayers through a combined public benefits charge. The Fund is administered by Eversource and Avangrid ("the Companies"). In 2023 the work of the Energize Connecticut^{SM} RNC program helped Connecticut achieve $45.4 million in lifetime energy savings for consumers in a variety of segments, while reducing Connecticut's annual CO_2 emissions by 3,507 metric tons (EnergizeCT 2024).

Like many new construction energy efficiency programs throughout the country, the basic delivery model for the Connecticut RNC program has been centered around the Home Energy Rating System (HERS) index. As a group, Connecticut's new homes rank among the lowest (best) HERS index scores in the U.S. and in the top five states of HERS rated homes with solar. Much of this success is due to the Companies' support of market-based HERS raters and financial incentives to RNC program participants. This combination of tiered incentives (i.e., higher incentives for better performance) and technical support has been an effective combination in reaching builders and developers, which has served as the foundation for a

[3] The fund was expanded in 2005 to include natural gas programs, thus fully integrating electric and natural gas programs

continuing strong relationship that has helped transition these program participants from fossil fuels to all-electric buildings. The RNC program serves about one-quarter of the new residential construction activity annually, or about 1,500 housing units participating.

While there has been some change to the makeup of the RNC program over time, relevant program participation data shows that, on average, since 2015, about 71% of total annual program participation consists of multifamily projects[4] (*Figure 3*).

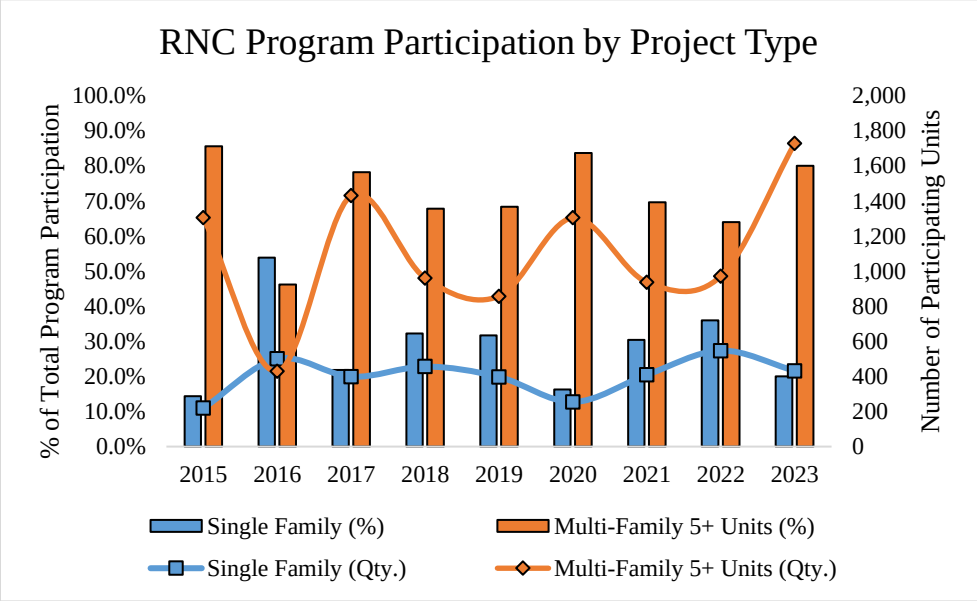

Figure 3. Connecticut Residential New Construction program participation statistics by project type FY 2015-2023. Bars represent % of program participation by unit type. Lines represent absolute quantities by unit type.

This trend in multifamily program participation seems to correspond to an increase in the number of multifamily permits being pulled in Connecticut annually. However, given the higher uptick in multifamily participation relative to permit data, this also suggests that the Connecticut RNC program has consistently had higher penetration rates on the multifamily side relative to single family new construction.

Transitioning to All-Electric

Starting on July 1, 2023, the RNC program transitioned from all-fuels to an all-electric program. As anticipated, there were a flurry of applications for projects planning on incorporating gas and propane in their future developments. And there remained the concern that builders would drop out altogether if they had to transition to all-electric in the future.

As shown in Figure 4, in the past, the majority of projects in the RNC program used natural gas for space heating. The RNC program has been offering incentives for all-electric

[4] Includes multifamily high-rise, and combines single family and single family attached (i.e. townhouse and condos) data into one classification under “single family”.

space and water heating, but it has only been in the last few years that the market has begun to build all-electric homes.

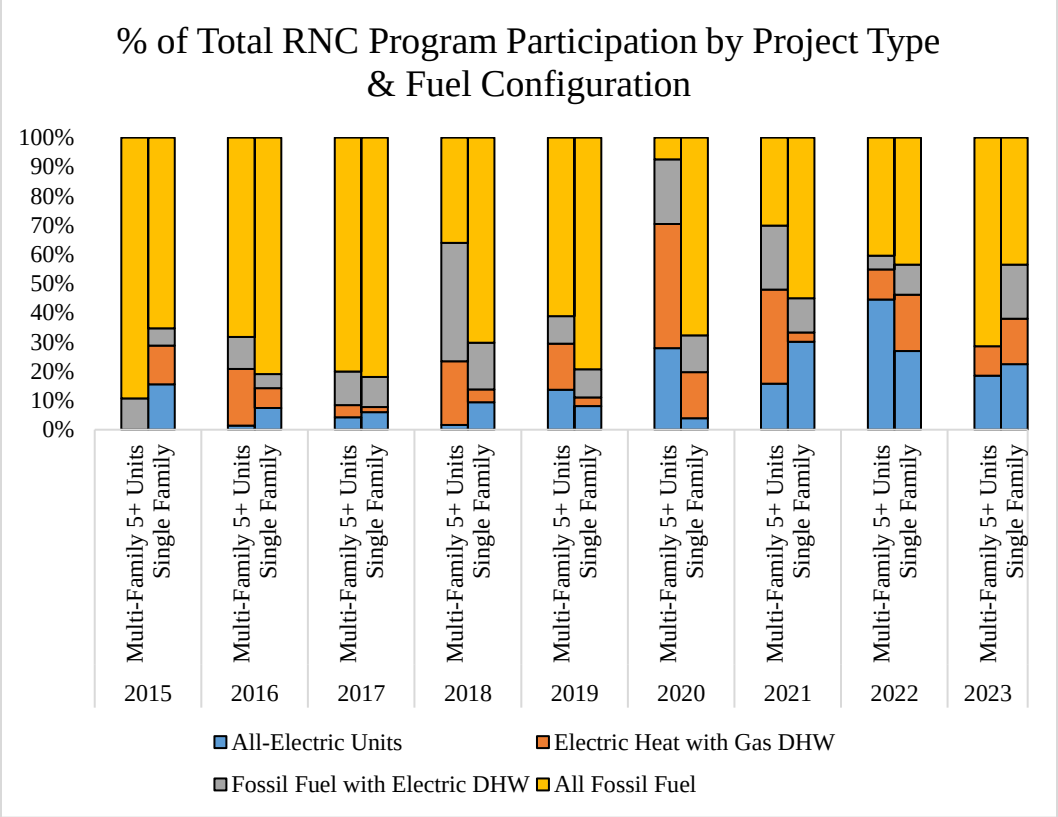

Figure 4. % of Total RNC Program Participation by Project Type & Fuel Configuration

RNC program incentives have been designed to solicit the attention of builders and developers to encourage them to switch to all-electric projects. For single family homes, these range up to $12,500 and for multifamily up to $3,500 per unit. There are also additional incentives for more efficient heat pumps and for earning certifications such as Passive House or DOE Zero Energy Ready Homes.

Single Family Trends

In recent years, a discernible trend towards all-electric single family new construction has become increasingly evident, particularly within the domain of single-family custom homes. Notably, in 2021, for the first time in the history of the new construction program in Connecticut, over half of all project completions by single family custom builders were all-electric, a significant departure from prior participation. Subsequent to this milestone, in 2023, 57.4% of all participating single family custom homes were constructed to all-electric standards, illustrating a steady trajectory towards electrification within this segment of the housing market. Concurrently, a similar trend has been observed among participating single-family spec and production

builders, albeit at a much more conservative pace[5]. An analysis of projects completed in the 2023 program year reveals a noteworthy increase in the adoption of all-electric configurations among single-family spec and production projects, rising from a mere 1.6% in 2021 to 12.4% in 2023 (*Figure 5*).

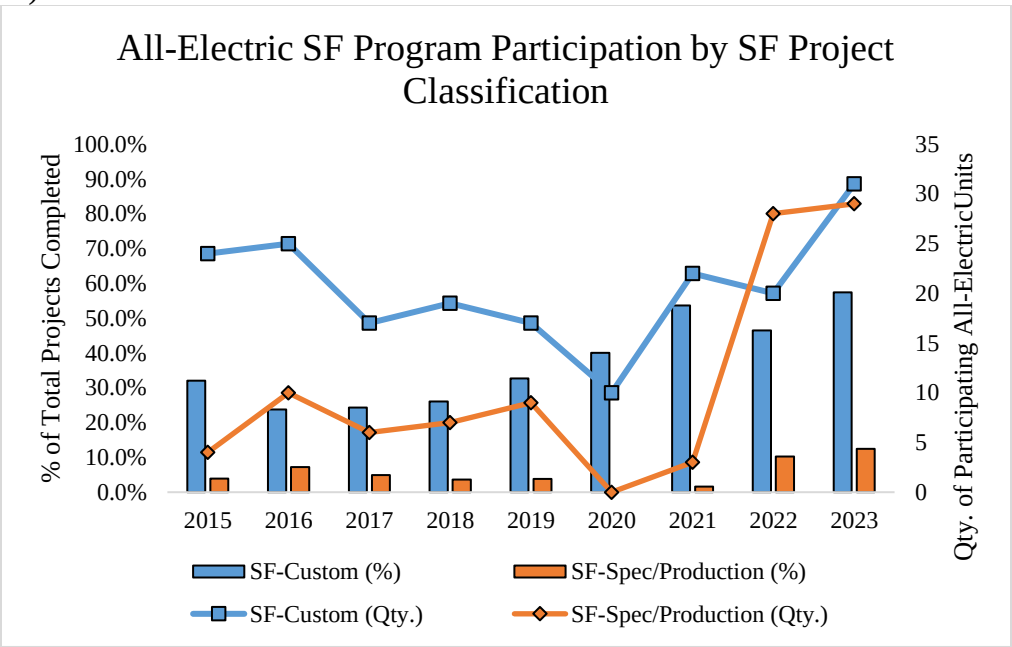

Figure 5. All-Electric Single Family Program Participation by Single Family Project Classification. Bars represent % of all-electric participation rates by total participation for each classification. Lines represent quantity of units participating by classification.

While this trend is certainly a positive trajectory for the single-family custom market, it admittedly does not paint a full picture for total volume of all-electric adoption. Since 2015, single family spec and production homes have accounted for about 75% of average annual single family program participation (*Figure 6*). The demand for new housing can be seen as one of the factors for the increase in total participation in the spec/production market. In Connecticut, demand for housing remains high, while housing inventory continues to remain low (Monk, 2023). This has created an opportunity for spec/production builders to step in to fill the gap in housing inventory. The modest uptick in single family spec & production homes represents a sizeable market for the RNC program as a whole.

[5] Spec homes are homes constructed entirely or almost entirely without input from a specific buyer where the builder or developer selects home features during construction.

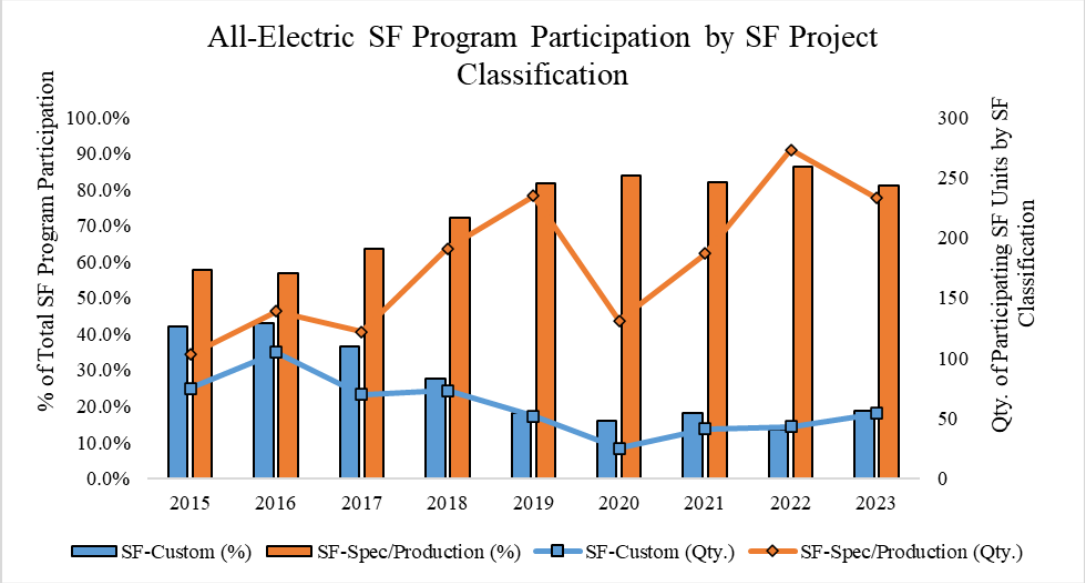

Figure 6. RNC Single Family Program Participation by Project Classification. Bars represent % of SF participation rates by total participation for each classification. Lines represent quantity of units participating by classification.

Multifamily Trends

Multifamily new construction accounts for a majority of participation within the RNC program as a whole. Over the period spanning from 2015 to 2023, multifamily apartment units have comprised an annual average of 73.6% of all units engaged in the RNC program (*Figure 3*). The participation rate of multifamily units has consistently exceeded 60% since 2016, underscoring the enduring prominence of multifamily developments within the program.

All-electric multifamily projects and fossil fuel-dependent projects achieve comparable HERS performance. However, within the multifamily sector there is a significant disparity in HERS scores. All-electric multifamily projects tend to achieve an approximate 10-point increase (worse performance) compared to the lower-scoring (better performance) multifamily projects that employ partial electrification (i.e., heat pumps with efficient natural gas domestic hot water systems). This is due primarily to the higher (worse) scoring electric storage tank water heaters typically installed in all-electric multifamily projects instead of the more efficient heat pump water heaters that are usually not installed due to cost, air volume space, and noise challenges.

Challenges and Opportunities

Single Family Housing

While single-family new construction represents a significant opportunity for building electrification, certain barriers exist which inhibit the ability to bring these projects to scale.

These barriers have been well documented[6], and on the single-family housing side are multivariate in nature.

Consumer & Contractor Preference. Professionals are comfortable with fossil fuel equipment and see no downsides to using it. Homeowners prefer gas equipment particularly for cooking and other aesthetic features such as fireplaces, and market actors know it. Customers have aesthetic concerns with lowest-cost heat pump space heating options. When natural gas is unavailable, builders will default to propane where builders often have multi-year contracts with suppliers.

Brand Loyalty. Many HVAC contractors choose to utilize systems or brands that have worked for them over the course of decades. These contractors choose systems that they can trust and thus have a certain brand loyalty towards specific systems. Some may have multi-year contractual obligations with propane suppliers.

Technical Concerns. Doubts persist about the ability of heat pumps to work effectively in extreme cold. Ductless heat pumps' most-cited advantage, room-by-room temperature control, is viewed as a downside by others.

Financial Considerations. Market actors do not see an economic case for choosing electrification. Some all-electric homebuyers would not recommend all-electric to others, often citing utility costs. Cheap natural gas challenges the business case for electrification.

Capacity of Electric Grid for Electrification. Some raise concerns that a high volume of all-electric homes could stress the grid.

The RNC program in Connecticut is feeling the impact of its transition to an all-electric program. Over the last year, the single-family spec and production market in the RNC program has started to gradually decline, with a marketable shift towards single family custom. Since the program transition to fully all-electric, retention of existing single-family spec/production builders has averaged around 53%. Many past program participants are choosing to simply opt out of the program. Despite these challenges, the discernible shift towards all-electric principles is unmistakable, even among this classification of builder. Of the 20 most active single-family spec and production builders in the program, 10 of those builders have enrolled in at least one all-electric home since the program transitioned over to a fully all-electric program on July 1, 2023. This indicates that the market is at least willing to explore the possibility for all-electric new construction. However, concerns surrounding single-family builder retention amidst the transition to all-electric standards are palpable, particularly regarding the potential loss of established participants. Notably, the departure of several highly efficient builders from the single-family spec market, many of whom were prominent ENERGY STAR™ affiliates, underscores the challenges inherent in facilitating widespread adoption within this segment. Persistent concerns remain regarding the sluggish uptake of all-electric standards among single-

[6] See for example ***CEO Beneficial Electrification Study, Electrifying Commercial Institutional Buildings – Electrifying Canada, MA Electrification Barriers Study. Ready to Upgrade: Barriers and Strategies for Residential Electrification***

family spec builders, necessitating concerted efforts to address existing barriers to expedite the transition process.

Multi-Family Barriers

While the goal has been electrification on the multifamily side, the fact remains that many of the most efficient multifamily projects have been those that are not fully electrified. As with single family homes, there are also a number of challenges moving to all-electric for multifamily projects.

Multifamily Domestic Hot Water. In-unit stand-alone tank heat pump water heaters aren't always the best solutions for small multifamily units. They remain expensive, hard to fit into a small apartment footprint, can be noisy, and are relatively untested in multifamily projects in Connecticut. Central and split water heating systems are expensive, untested, and unfamiliar. Additionally, electric water heating emerges as a significant determinant contributing to elevated source energy consumption (and HERS scores) within all-electric multifamily projects. While site energy use between gas and electric water heating is about the same, electricity costs and source energy consumption are quite a bit higher (ENERGYSTAR.gov 2024). This challenge has been acknowledged by PHIUS and several other organizations that are more concerned about source energy metrics. This has led to many of the most efficient Passive House certified multifamily projects utilizing gas tankless water heating systems. In fact, of the 889 Passive House certified[7] multifamily dwelling units in Connecticut, an astonishing 89% utilized gas as a fuel for domestic hot water loads (Figure 7).

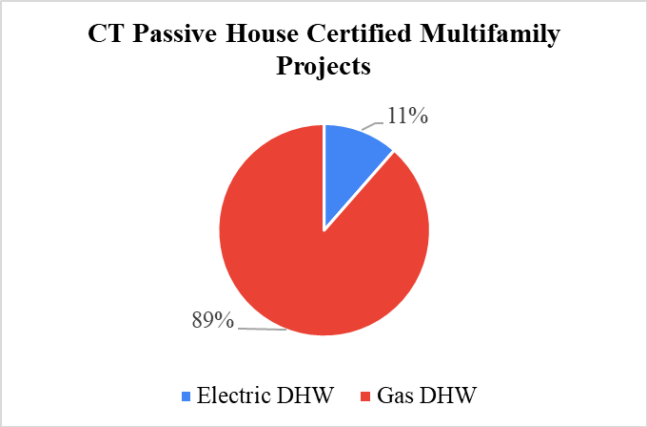

Figure 7. Connecticut Passive House Certified Multifamily Projects Water Heating (2024)

Electrical Infrastructure. Multifamily buildings may require electrical panel and wiring upgrades in both common areas and individual units in addition expensive utility service upgrades to power lines and transformers.

Energy and Cost Burdens. Electrification upgrades are often costly in terms of upfront expenses and may additionally increase ongoing energy costs in the case of some gas to electric

[7] Passive House certified implies the project was either design or final certification as accredited by PHIUS™

conversions. This may lead to disproportionate impacts on renters, many of whom are already dealing with high costs of living. Furthermore, in multifamily apartments, electricity is often individually metered per unit whereas fossil fuels are metered per building. This can result in a situation where electrification creates a cost transfer onto tenants, resulting in an increased cost of living (York et al. 2022).

Success Stories

CHFA Multifamily Affordable Housing

Analysis conducted by the Connecticut Housing Finance Authority has revealed a substantial deficit of approximately 92,500 affordable housing units (CHFA 2023). In response, there has been a notable upsurge in the development of multifamily affordable housing across Connecticut, with a significant proportion of these projects receiving state funding. A particularly noteworthy aspect of this trend lies in the successful coordination between utility energy efficiency programs and the CHFA, wherein the latter incentivizes low-income housing tax credit projects by awarding points in categories such as Sustainable Development and Energy Efficiency. Notably, projects embracing all-electric passive house design stand to accrue the highest number of points through CHFA's Qualified Allocation Plan (QAP) Standards. Consequently, there has been a proliferation of multifamily passive house projects, all of which are characterized by their affordability, state funding, and participation in utility efficiency programs. However, as shown in Figure 8, there is a conspicuous absence of multifamily affordable housing projects built to all-electric standards in recent years, underscoring the prevalence of gas water heating within affordable housing.

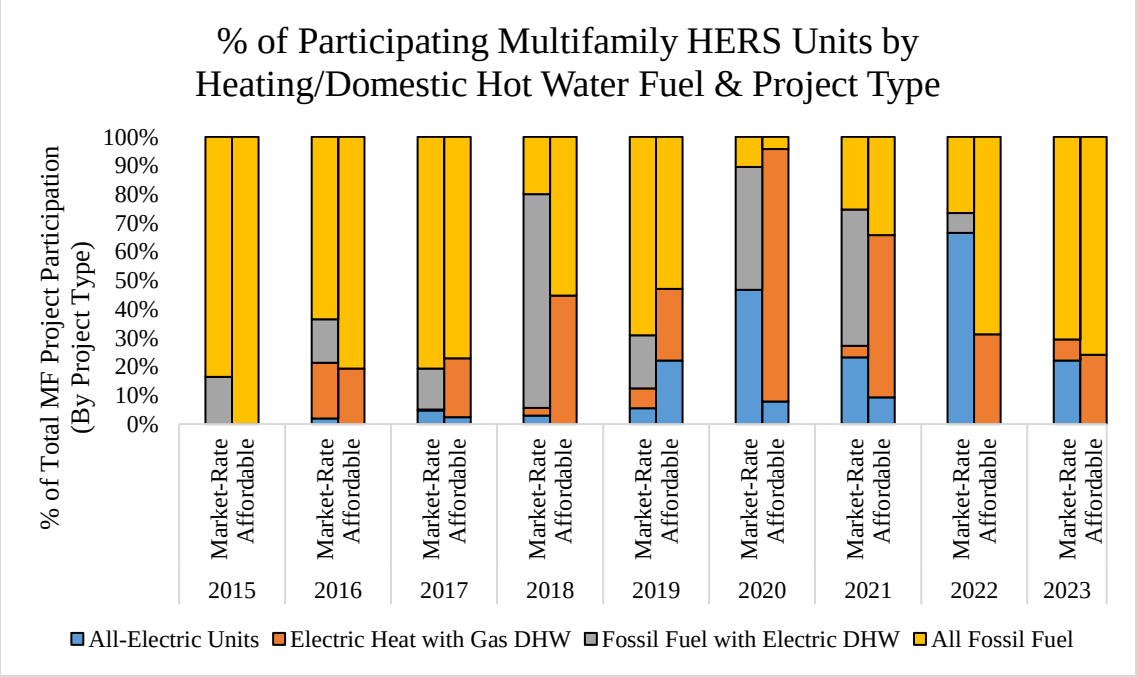

Figure 8. Percent of Participating Multifamily HERS Units by Heating/Domestic Hot Water Fuel & Project Type

Although a considerable number of market-rate multifamily developers have endeavored to adhere to all-electric standards, the performance of these units, as gauged by HERS index scores, consistently falls short of their affordable housing counterparts. This discrepancy is particularly pronounced in the context of domestic hot water provision within multifamily housing projects, underscoring the multifaceted challenges associated with all-electric configurations. Moreover, an examination of HERS index score data reveals a persistent disparity between multifamily affordable housing and market-rate projects (see Figure 9 below), with market-rate consistently exhibiting higher scores, indicative of their inferior performance despite shared challenges in achieving all-electric status.

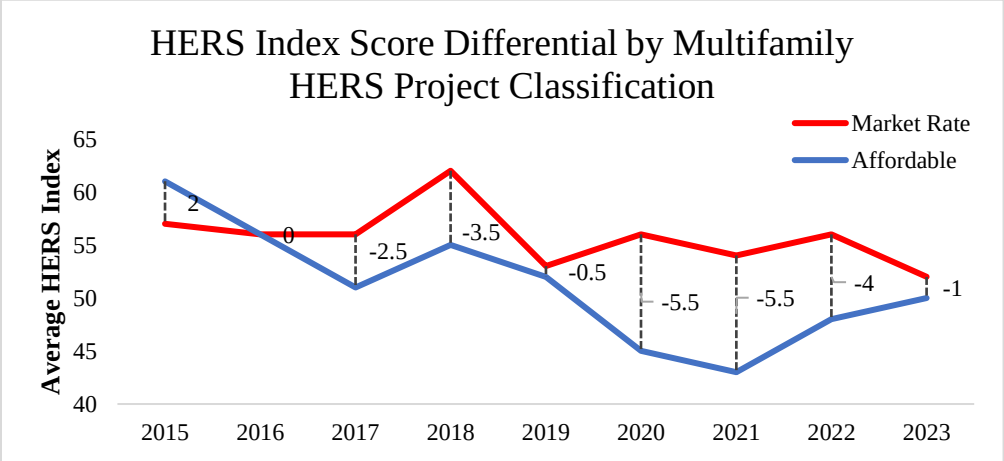

Figure 9. Multifamily HERS Index Score Differential by Project Classification

Habitat for Humanity: Single Family Affordable Housing

In 2017, representatives from the Companies presented to the Board of Directors of Hartford (CT) Habitat for Humanity, outlining the potential for net-zero home construction. Prior to this engagement, the Habitat team had been diligently constructing homes that adhered to ENERGY STAR™ standards, predominantly reliant on fossil fuel energy sources. Notably, the Board of Directors at the time expressed reservations regarding the incorporation of central air conditioning systems into these projects, as outlined in organizational guidelines.

Following the presentation in 2017, the Hartford Habitat team embarked on a transformative journey by undertaking the construction of their inaugural net-zero home. Leveraging volunteer labor for the majority of tasks, with regulated trades work being facilitated by subcontractors who generously volunteered their expertise, the team realized their vision of constructing a home built to all-electric standards supplemented by solar energy. Remarkably, the culmination of these efforts yielded a final HERS index of -1, a testament to the home's exceptional energy efficiency. The home garnered prestigious recognition in the form of a DOE Housing Innovation Award in the ensuing year, marking the commencement of Hartford Habitat for Humanity's steadfast commitment to constructing homes in accordance with DOE Zero Energy Ready Home standards, alongside adherence to the all-electric standards prescribed by the RNC program.

In 2023, the Habitat team achieved a significant milestone with the completion of the first phase of its net-zero subdivision, aptly named Rainbow Road. Comprising four all-electric net-zero homes, each boasting impressively low HERS index scores of 35 or less prior to the integration of renewable energy sources, Rainbow Road is a striking example of Habitat for Humanity's dedication to sustainable housing solutions. Notably, the team's exemplary achievements have been further underscored by their consecutive receipt of the DOE Housing Innovation Award's highest honors in the affordable housing category for four consecutive years.

Lessons Learned

- **Consumer Awareness & Demand** – Builders are hesitant to go all-electric because they are not seeing the market demand from buyers. Without greater consumer demand, it's difficult to effectively incentivize builders to commit to full electrification. Programs are needed to help educate consumers and create that demand.
- **Market Conditions** – Given current market conditions with high demand for housing and constrained supply, builders are not being required to change and innovate to sell their homes. Many builders are just taking the same product, building it over and over, and are able to sell before they even complete the home. Therefore, there is little need for them to build anything beyond what they have always built, because they continue to receive top dollar for it.
- **Water Heating** – Heat pump water heating poses some technical, perception, and cost challenges. For single-family homes, on-demand gas water heating is considered a desirable luxury for a lot of people. They'll never have to worry about running out of hot water as compared to heat pump water heaters which can have variable recovery times and efficiencies. For multifamily buildings, heat pump water heating technology and cost remains a challenge. Until the market can offer better solutions that allow for small-footprint, quiet, in-unit systems and less expensive split or central systems, many all-electric projects will continue to install conventional electric resistance tanks at lower efficiency but higher operating costs.
- **History of Electrification** – Electric heating still has a bad stigma from the expensive electric resistance days of the 1970s and past poor performance of heat pumps. This prior experience will require more consumer education to overcome.
- **Electric Costs** – With natural gas relatively inexpensive and electric rates some of the highest in the country, financial concerns make it challenging to convince consumers to go all-electric.
- **Decarbonization** – While some people are driven by a desire to help reduce their environmental impact through decarbonization, this is not the primary motivation for most, especially if it means higher costs.

Conclusion

Transitioning from a fossil fuel-based economy to a decarbonized all-electric future is challenging, but Connecticut's successes in the RNC program provide indications of hope. State programs and training focused on the design and construction communities have resulted in increasing uptake, especially in the affordable housing sector as policies align to encourage all-

electric construction. Trends for both single-family and multifamily all-electric construction are headed in the right direction, but challenges remain. Legacy projects enrolled in the efficiency programs using fossil fuels are completing, and those developers and builders will then need to be convinced to enroll in the new all-electric programs. Having early adopters of all-electric construction with both single-family and multifamily projects operating successfully in the market will help convince the laggards and skeptics to participate. While technological challenges with some aspects of all-electric construction--like multifamily water heating--remain, one of the biggest challenges in transitioning the Connecticut RNC program to all-electric will be convincing the market to demand and builders to construct these homes of the future. More work on driving demand, alleviating skeptics, and improving technology lie ahead, but Connecticut's RNC track record demonstrates the potential for a positive path forward.

References

2023 Plan Update. https://energizect.com/sites/default/files/documents/2023PlanUpdate_2022-2024PlanText_030123.pdf

California Electric Homes. https://www.energy.ca.gov/programs-and-topics/programs/california-electric-homes-program-calehp (accessed July 10, 2024)

CT DECD (Department of Economic and Community Development). CT Housing Information. 2023. http://www.ct.gov/ecd/cwp/view.asp?a=1106&q=250640(accessed Feb. 6, 2024).

CT Department of Energy and Environmental Protection (DEEP) Determination: 2023 Update to the 2022-2024 Conservation and Load Management Plan Conditions of Approval https://www.dpuc.state.ct.us/DEEPEnergy.nsf/c6c6d525f7cdd1168525797d0047c5bf/851c33d53287e6b3852589d700656afa/$FILE/05564011.pdf Attachment A: Schedule of Conditions of Approval, June 2022

CT Housing Finance Authority (CHFA). (2023). CHFA Housing Needs Assessment. Research, Marketing & Outreach Department. Rocky Hill, CT: State of CT.

Monk, G. (2023, Dec. 22). CT added more housing in 2023, but experts say it's not enough. CT Mirror, pp. 4-6.

EIA (Energy Information Association). Connecticut State Profile. Edited by U.S. Department of Energy. 2013. http://www.eia.gov/state/?sid=CT#tabs-2 (accessed Feb. 27, 2016)

EnergizeCT. Energy Efficiency Board 2015 Programs and Operations Report. Legislative Report, Energy Efficiency, New Britain, CT: CT Energy Efficiency Fund, 2016, 4-7.

ENERGYSTAR.Gov. 2024. The Difference Between Source and Site Energy. https://www.energystar.gov/buildings/benchmark/understand-metrics/source-site-difference#:~:text=Source%20Energy%20Accounts%20for%20Total,building%20has%20changed%20over%20time.

ETO (Energy Trust of Oregon). https://www.energytrust.org/residential/new-homes-solutions/ (accessed July 10, 2024).

EVT (Efficiency Vermont) https://www.efficiencyvermont.com/trade-partners/rebate-program-updates/residential-commercial-new-construction-update (accessed July 10, 2024).

Rosenbaum, M. "Zero Energy Homes." HeatSpring Zero Energy Home Course. NESEA, 2016.

U.S. DOE Building Energy Codes Program (BECP). (2023, Dec. 28). State Residential Site Energy Index by Code & State. Retrieved Feb. 14, 2024, from BECP Status of State Energy Code Adoption: https://public.tableau.com/app/profile/doebecp/viz/BECPStatusofStateEnergyCodeAdoption/ResidentialStateEnergyIndex_1

EnergizeCT. (2024). Energy Efficiency Board 2023 Programs & Operations Report. New Britain, CT: CT EEB. https://energizect.com/about

Home Innovation Research Labs. (2021). Costs & Other Implications of Electrification Policies on Residential New Construction. Upper Marlboro, MD: National Association of Home Builders (NAHB).

Mass Save All-Electric Homes. https://www.masssave.com/residential/programs-and-services/new-home-construction/all-electric-home (accessed July 10, 2024)

NMR Group, Inc. (2020). MA19R18: Residential New Construction Incremental Cost Update. The MA Electric & Gas Program Administrators. Boston: NMR Group.

NYSERDA (New York State Energy Research and Development Authority) Residential and Commercial New Construction. https://www.nyserda.ny.gov/All-Programs/New-Construction (accessed July 10, 2024).

Residential Energy Services Network (RESNET). (2021, May 01). HERS Index & Energy Codes. Retrieved from The HERS Index as a Performance Path to Building Energy Codes.

The Passive House Network. (2023). Safe at Home: How all-electric, multi-family Passive House buildings deliver comfortable, cost-effective climate resilience. New York, NY: PHN.

United Nations Environment Programme, & Yale Center for Ecosystems + Architecture (2023). Building Materials and the Climate: Constructing a New Future. https://wedocs.unep.org/20.500.11822/43293.

Washington PBS. https://crosscut.com/environment/2022/05/washington-first-state-require-all-electric-heating-new-buildings. May 2022.