Pushing the Market: Measuring Market Effects in Residential New Construction

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ABSTRACT

Some program administrators (PAs) have concerns that the gross savings available in the Residential New Construction (RNC) market may diminish as code requirements increase and standard construction practices become more efficient. Quantifying market effects induced by RNC programs may more accurately and fully identify the savings attributable to those programs. This paper presents two similar evaluations from 2018: one in Massachusetts and one in Connecticut. These two separate studies quantified the impacts of code compliance trainings and traditional RNC incentive programs on the building practices found in new homes and identified substantial spillover savings from these RNC programs. This paper details the methods used to separately assess market effects for the two markets and compares the findings from the two studies.

The studies used Delphi panels to develop a hypothetical scenario in which the programs had been canceled at the end of 2011. The panelists estimated how much less efficient homes constructed after that point would have been without the programs. The results were compared to the program's gross savings to estimate a Net-to-Gross (NTG) ratio based on panelists' feedback about single-family and multifamily home efficiency. The successes and challenges of these programs and evaluations can inform other new construction programs looking for thoughtful ways to create lasting and far-reaching market impacts, including ways to measure market effects. This paper presents the results of these evaluations and the historical efforts of these programs as a framework for generating or identifying market effects in sectors that are facing diminishing savings opportunities.

Introduction and Background

Both the Massachusetts and Connecticut PAs have been supporting energy-efficient new construction practices through RNC incentive programs for years. These programs offer financial incentives to builders to offset the costs associated with building high efficiency RNC projects. The RNC programs in both states have undergone a variety of changes through the years, but both programs have promoted whole-house energy efficiency through incentive structures that revolve around modeled energy savings from Home Energy Rating System (HERS) ratings. In addition to financial incentives, both states offer code trainings and educational materials to code officials, builders, and other RNC market actors. Massachusetts does this through their Code Compliance Support Initiative (CCSI), while Connecticut offers these items under the umbrella of their RNC program. Below, we summarize some of the historical efforts and results of the programs in each state.

Massachusetts Program History

Massachusetts RNC programs began in 1991, with the Energy Crafted Homes (ECH) program, and transitioned to the ENERGY STAR Homes program in 1998. In 2007, the program's name was changed to the Massachusetts New Homes with ENERGY STAR program, and again to the Massachusetts Residential New Construction program in 2013.

From 2013 to 2017, the program offered two paths for participation – a tiered performance path and a prescriptive path. The tiered performance path offered four different incentive levels depending on the level of savings achieved by program participants. The prescriptive path offered incentives if specific thresholds were met by participants for mechanical equipment efficiency, air and duct leakage levels, and insulation levels.

Beginning in 2017, the program became solely performance based and now offers a blended savings approach and incentive structure based on the electric and fossil fuel savings that are achieved by program participants. The program currently requires that participants show a minimum of 5% savings compared to the baseline assumptions to be eligible for financial incentives.

Over the years, the program has steadily increased its program penetration rates and the number of HERS raters participating in the program. Program penetration rates have steadily grown: penetration rates were 1% in 1998, 11% in 2007, 26% in 2013, and 43% in 2016. Similarly, the number of HERS raters actively participating in the program has increased steadily. The program had one active HERS rater in 1998 and only two in 2007. The program then altered its strategy and opened the program to more raters. There were 46 active HERS raters in 2013 and 62 in 2016. Recent research in Massachusetts points to these programs driving the expansion of the HERS rater markets by helping create demand for their services (NMR 2017b).[1]

In addition to the RNC program, the Massachusetts PAs began offering code support through the CCSI in 2014. The CCSI offers classroom trainings, webinars, and individual support through a telephone help line and email for code officials, builders, and other market actors. As of June 2017, the CCSI had offered 69 classroom trainings and presentations and 20 webinars on the residential energy code.

Connecticut Program History

The Connecticut RNC program dates back to the 1990's and has continuously operated since then. The program started as a prescriptive incentive program, offering a menu of incentives for homes based on meeting various air sealing, mechanical equipment, and insulation requirements. Over time, the program has shifted to a whole-home approach to efficiency, where the incentive is based on the HERS index a participant home achieves.

Up to 2015, the program offered two participation tracks – a tiered performance path and a prescriptive path. In 2013, the program began to shift away from the prescriptive path and focus more on whole-home performance-based savings. In 2015, the program stopped offering prescriptive incentives entirely and moved to a tiered, HERS-index based approach. Now, the program also requires homes to meet the Connecticut version of the Zero Energy Ready Home PV-ready Checklist if they are applying for higher tier incentive levels.

Beginning in 2013, the program added bonus incentives for homes that qualify for additional energy certifications and designations, such as DOE Challenge Homes, LEED, and the National Green Building Standard (NGBS). As of 2018, there were still bonus incentives available for achieving five certifications: ENERGY STAR Version 3.1, DOE Zero Energy Read Home, LEED, NGBS, or Passive House.

[1] Recent research in Connecticut also corroborates this result (NMR 2017c).

Program penetration rates have ebbed and flowed in Connecticut. The program penetration rate was 12% in 2007 and steadily grew to 29% in 2012, before dropping down to 19% in 2013. The penetration rate bounced back to 34% in 2014, only to drop again to 9% in 2015 and then rise to 15% in 2016.

Over the years, the program has provided trainings on RNC building practices and building codes. These trainings are sometimes run by the RNC program staff directly and, in other instances, the program coordinates with groups like the Home Builders Association and the American Institute of Architects to run trainings on behalf of the program.

The Studies

NMR Group (henceforth referred to as *the team)* completed two separate studies in 2018 to assess the NTG ratios associated with these programs (NMR 2018a, 2018b). The studies used the same methodology to assess the free-ridership, spillover, and market effects generated from these programs. Specifically, the studies used a Delphi panel method, where informed experts were asked to estimate how measure-level efficiencies would have changed in the absence of the programs. The remainder of this paper presents the details associated with this methodology, the findings from each evaluation, and insights into how other RNC programs may be able to generate market effects in the future.

Methodology

Delphi Panel

Both studies used a Delphi panel approach to estimate the effects of the programs on RNC building practices. The Delphi approach is an interactive and iterative process that relies on a panel of experts to develop a group judgment, often by obtaining responses via multiple rounds of questions. The Delphi technique is based on the principle that structured, closed-ended responses from experts, informed by the responses from their peers, may lead to more accurate results for particularly complex questions than unstructured responses without the benefit of that iterative feedback.[2]

The two separate Delphi panels consisted of various RNC industry experts. These included efficiency consultants and builders, national evaluation experts, program managers and implementers, and code officials. The team invited these market actors to participate in the Delphi panels using telephone and email recruitment. In total, the team selected 28 RNC industry experts to participate in the Delphi panels – 15 in Massachusetts and 13 in Connecticut.[3] The team classified most panelists as building efficiency consultants, either working in or out of Massachusetts and Connecticut. This category included HERS raters and other professionals that work closely with builders participating in the programs. Table 1 details the mix of Delphi panelists for each state.

[2] A comparable study in Massachusetts from 2014 found that some builders attributed their improving practices to code changes, even in instances when the code had either not changed, or the measures being discussed were not impacted by code updates (NMR 2014). This incongruity from self-reported responses suggested that a Delphi panel might provide better answers for these complex scenarios about the program's impacts on the market.

[3] Only one person participated in both panels.

Table 1. Delphi panel participants

Expert Type	Massachusetts	Connecticut
Building efficiency consultants and builders	7	5
Code officials	3	1
Program managers and implementers	1	4
National evaluation experts	1	3
Other (local and national efficiency experts)	3	--
Total	15	13

The team used a multi-round methodology to calculate a retrospective NTG ratio for the 2015 program year for Massachusetts and Connecticut. In the first two rounds, the team asked Delphi panelists to estimate what single-family measure-level efficiency values would have been for both program participant homes and non-program homes had the RNC programs (and CCSI in Massachusetts) ceased to exist after 2011. Each study included some research activities that are not directly comparable to the other due to differences in the markets, the programs, and the specific evaluation and research needs of the study sponsors. Some of these differences are detailed below.

- The Massachusetts study asked panelists about stretch code and non-stretch code homes separately.[4]
- The Massachusetts study included a third-round of the Delphi panel that was used to forecast NTG values for the 2019-2021 period.
- The Connecticut study asked panelists about the influence of the RNC program on multifamily housing units relative to the influence of the program on single-family homes.
- The Connecticut study asked panelists about the influence of the RNC program on solar photovoltaic installations and Zero Energy Ready construction practices.

This paper does not discuss the methods or results associated with all of these items, though they are discussed in detail in the individual reports created for each study. The process for the first two Delphi panel rounds of surveying is summarized below. Figure 1, below, provides a graphical representation of the Delphi panel process from these evaluations; the Massachusetts evaluation followed this process, but there was also a third round of responses.

[4] In Massachusetts, certain municipalities have adopted what is known as the *stretch code*, a performance-based energy code that requires increased efficiency over the base energy code.

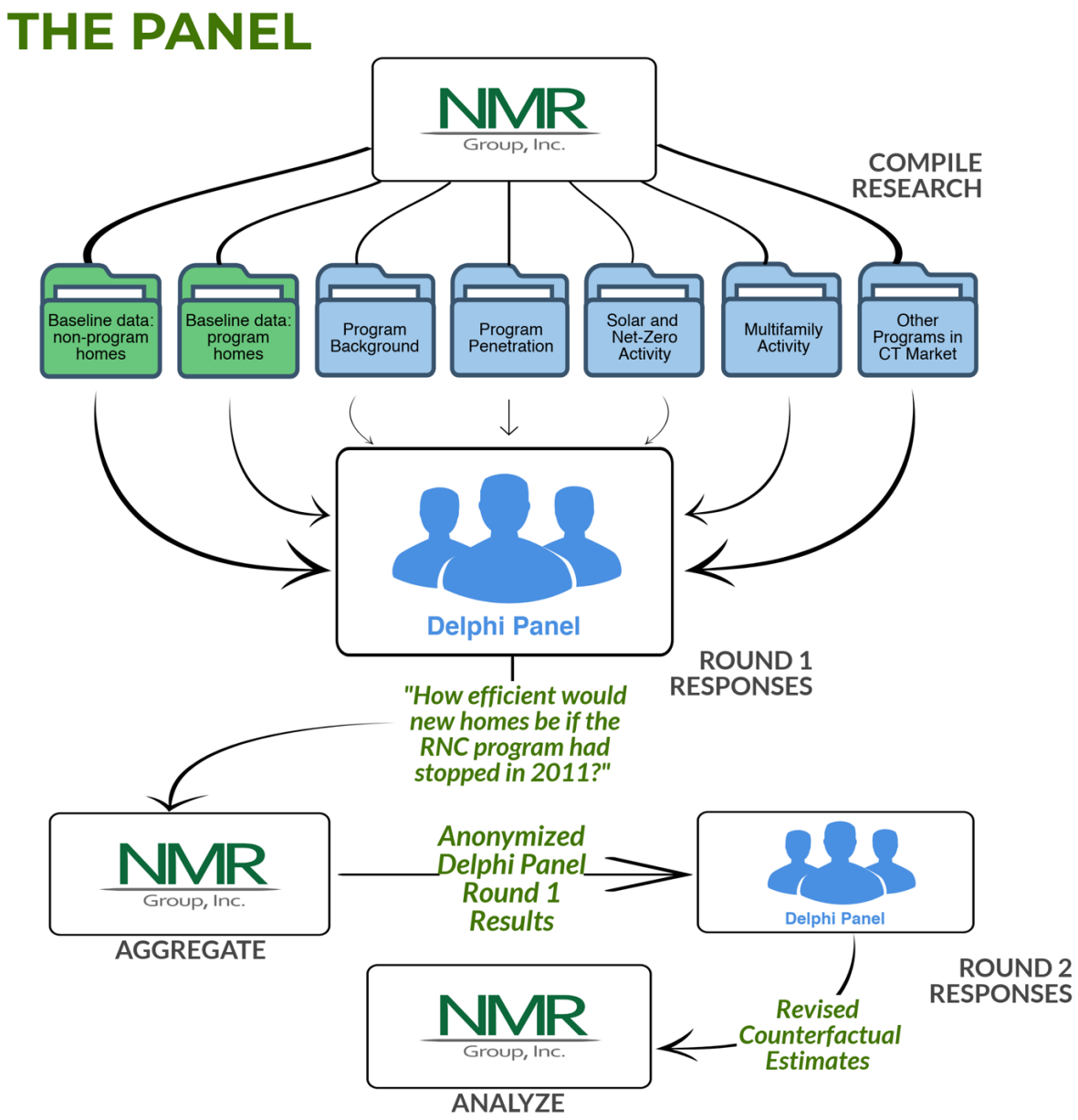

Figure 1. The Delphi panel process

Round 1 Delphi Panel Survey

In Round 1, the team provided the panelists in each study with extensive background information about the respective RNC markets they were being asked to assess. The team compiled the background information as part of multiple RNC baseline studies that had previously taken place in each state (NMR 2017a, 2017d). The information included, but was not limited to, the following:

- Program activities
- Program requirements
- Program penetration rates
- Measure-level code requirements over time
- Measure-level efficiencies over time for both program and non-program homes

During Round 1, the panelists reviewed the background information and a survey that detailed the measure-level efficiency values for both program and non-program homes. These team compiled these data as part of baseline studies that represented the 2015 RNC program years in each state. The team distributed the survey to panelists as an Excel spreadsheet in the form of a questionnaire, which allowed for a clear presentation of the information and detailed descriptions of what they were being asked to do. The measure-level efficiency values were divided into three tiers for each building component studied: 25% of most efficient homes, 25% of least efficient homes, and 50% of mid-range efficiency homes. The team asked the panelists to provide the mean energy-efficiency value for each tier and to redistribute the percentage of homes that they believed would fall into each tier in the absence of the programs. Additionally, each panelist provided the reasoning behind their decisions in an open-ended response for each building component. This process was done for both program and non-program homes in both states and was separated by stretch code and non-stretch code in Massachusetts. Figure 2 presents an example of the questionnaire that was used to estimate duct leakage efficiency levels in the absence of the program in Connecticut.

	Program Homes (single-family only)				
	2016				
Duct Leakage to Outside	% of Homes	Duct Leakage	Percent of Homes in Each Tier In Absence of Program	Average Duct Leakage in Each Tier In Absence of Program	You have not completed this section yet. Please fill in the blank blue cells.
Average Leakage to Outside (CFM25/100 ft^2 conditioned space)	100%	1.8			
High (poor) Duct Leakage Tier 2.4 to 9.2 CFM25/100 ft^2	25%	3.4			
Mid Duct Leakage Tier 1.0 to 2.4 CFM25/100 ft^2	50%	1.6			
Low Duct Leakage Tier 0.0 to 1.0 CFM25/100 ft^2	25%	0.6			
			0%		

Figure 2. Round 1 survey question example

Round 2 Delphi Panel Survey

In Round 2, the team customized the survey for each panelist in an Excel workbook. The team provided the panelists with actual values for each efficiency measure, the entire panel's average response, and the individual panelist's Round 1 response for program and non-program homes. The team also provided the panelists with the average efficiency values provided by panel participants, along with their reasoning.

The second-round survey asked the panelists to review the mean and anonymized individual responses of their fellow experts. Panelists could then decide to adjust their original response or keep it unchanged; the questionnaire also displayed how much their counterfactual estimates differed from the as-built, measure-level efficiency averages. The second round also included a calculated field that allowed the panelists to see what their overall average efficiency would be for all measures except for heating, cooling, and water heating equipment. The team included space for an open-ended response for each measure to allow panelists to explain the reasoning behind their decisions. Figure 3 shows an example of the second-round questionnaire for duct leakage in Connecticut.

Program Homes (single-family only)									
Duct Leakage Tiers (CFM25/100 sq. ft. of conditioned floor area)	Actual 2016 Values		All Panelists' Round 1 Responses in Absence of Program		Your Original Response in Absence of Program		Your New Response in Absence of Program		
	% of Homes	Duct Leakage	% of Homes	Duct Leakage	% of Homes	Duct Leakage	% of Homes	Duct Leakage	Comparison to Actual 2016 Values
High (poor) Duct Leakage Tier 2.4 to 9.2 CFM25/100 ft2	25%	3.4	52.0%	5.5	70.0%	7.0	60%	6.0	76% Higher (worse)
Mid Duct Leakage Tier 1.0 to 2.4 CFM25/100 ft2	50%	1.6	32.6%	2.0	20.0%	2.0	30%	2.0	25% Higher (worse)
Low Duct Leakage Tier 0.0 to 1.0 CFM25/100 ft2	25%	0.6	15.3%	0.8	10.0%	1.0	10%	1.0	67% Higher (worse)
Average Duct Leakage	1.8						100%	Your Round 2 overall average is: 4.3, which is 139% higher (worse) than the real world average.	

Figure 3. Round 2 survey question example

Energy Models and Retrospective Savings Calculations

The team has compiled and built energy models using REM/Rate™ residential energy analysis software as part of the RNC baseline studies that have historically been conducted in Massachusetts and Connecticut. The models from the 2015 RNC baseline studies served as the foundation for the NTG analyses in these evaluations. The team used all of the non-program energy models and a sample of program energy models in each state to model the counterfactual measure-level energy-efficiency estimates developed by the Delphi panels. These altered models served as the energy models for the hypothetical, estimated scenarios, wherein the programs in each state had ceased to exist since 2011. The difference in consumption between the original models (those that reflected real world building practices) and the models of the hypothetical homes resulted in per-home net savings estimates, while the difference in consumption between the program's User Defined Reference Home (UDRH – the baseline against which the program claims savings for program homes) and each program home resulted in an estimate of home-level gross savings.

Net savings from program home models informed free-ridership values (i.e., the amount of savings that would have been achieved by program homes even without program participation). The team used net savings from the non-program home models to calculate spillover (i.e., the amount of savings in non-program homes that would not have been achieved without the program). The team then scaled up the average home-level savings values from the sampled energy models to represent the population of program and non-program homes in each state.

The team then calculated a net to gross ratio of savings using the following equation:

$$1 - Free\text{-}Ridership + Spillover = Net\ to\ Gross\ Ratio$$

Findings Summary

The team found that the Delphi panels in both states indicated comparable levels of influence from the programs on the new construction market. The consistency of findings across two separate studies enhances confidence in the results, particularly given that the panels were almost completely separate[5] and presented state specific information for each study. Both studies found that the programs had relatively high free-ridership rates (nearly 70%), but that they also influenced the market through

[5] Only one person was included in both studies.

substantial non-participant spillover (rates from over 50% to over 100%). The NTG values from each study are highly dependent on program penetration results due to the weighting scheme used to develop market-level estimates.[6] Table 2 presents the NTG values calculated for each study. Ultimately, the results from these studies indicate that these programs are using similar approaches to generate market effects, though differing participation rates result in quite different NTG results. Essentially, programs with limited participation can still result in strong impacts via non-participation spillover.

Table 2. 2015 RNC program net-to-gross values

NTG Inputs	Massachusetts	Connecticut
Free-ridership	67%	66%
Non-participant spillover	55%	125%
Net-to-Gross	88%	156%

For both states, Delphi panelists indicated that the programs had the largest influence on duct leakage, air infiltration, and insulation installation quality. Though panelists reasonably indicated that the programs have a larger impact on program homes than non-program homes, they also described effects on building practices beyond the confines of the programs, setting the stage for lasting market effects. In a hypothetical scenario where the program ceased to exist several years ago, Delphi panelists said that recently-built homes would have been substantially less efficient than they are now. Further description of key findings for each state can be seen below.

Key Findings for Massachusetts

The Delphi panelists reviewed how recently-built homes were constructed, based on the results of baseline studies in Massachusetts and analysis of RNC program home data. The team then asked panelists to consider how those homes would have been built in 2015 had the RNC program been discontinued at the end of 2011 and had the CCSI never been implemented. Unlike in Connecticut, Massachusetts has towns that are required to comply with the stretch code. Panelists considered homes built in stretch code and non-stretch code municipalities separately. In 2015, single-family homes in stretch code communities represented approximately 37% of single-family new construction in the state.

Based on Massachusetts Delphi panelist responses, a NTG value of 88% was estimated for the 2015 program. The team weighted stretch code and non-stretch code NTG values based on the relative proportion of single-family homes in these municipalities (37% stretch; 63% non-stretch). Stretch code homes displayed a far lower non-participant spillover ratio than non-stretch code homes due to the large difference in program penetration rates between the two populations (70% and 24%, respectively). In other words, while stretch code municipalities exhibit some non-participant spillover, the non-program population is small, which thereby minimizes the overall impacts.[7]

[6] The Connecticut results include single-family and multifamily housing units; the Massachusetts results only include single-family units. The Connecticut single-family NTG results were high and were based on inconsistent program penetration data. As a result, this paper presents results on the combined single-family and multifamily NTG values as they represent more conservative results. This is consistent with the recommendations from the Connecticut study to focus on the overall NTG values, rather than separate values for single-family and multifamily markets.

[7] A similar Delphi study was conducted for the Massachusetts RNC program in 2014 (NMR 2014). At that time, participation rates were lower than at the time of the 2018 Massachusetts study, yielding a substantial non-participant spillover ratio (1.39) and a high overall NTG ratio (1.87). These results map closely to the 2018 Connecticut results, where modest participation rates still resulted in substantial non-participant spillover impacts.

The Massachusetts Delphi panelists indicated that new single-family homes would have been less efficient had the RNC program ceased to exist after 2011 and had the CCSI never been implemented. The Massachusetts panelists estimated that program homes for both stretch code and non-stretch code would experience larger drops in efficiency for the majority of efficiency measures compared to non-program homes. Panelists estimated minimal changes in efficiency for heating, cooling, and water heating equipment without the programs. Panelists provided measure-level net impact estimates for single-family homes and identified several key measures that have substantial program impacts, which Table 3 summarizes, below. Note that the outcomes for each measure are hypothetical, not certain.

Table 3. Massachusetts key measures affected by the RNC and CCSI programs

Ducts – In program homes, ducts would have been 68% (stretch) and 73% (non-stretch) leakier, while non-program homes would have been 46% (stretch) and 58% (non-stretch) leakier (leakage to the outside, CFM25 per 100 sq. ft. of conditioned floor area).
Air infiltration – Estimates showed a 28% (stretch) and 37% (non-stretch) reduction in efficiency for program homes. Non-program homes would have had a reduction of 36% (stretch) and 35% (non-stretch) in mean air infiltration levels (ACH50).
Efficient lighting – In program homes, the saturation of efficient lighting would have dropped by 20% (stretch) and 18% (non-stretch). For non-program homes, the saturation of efficient lighting would have dropped by 14% (stretch) and 13% (non-stretch).
Insulation installation quality – Insulation installation quality for stretch code homes would have been between 9% and 45% worse for each shell measure in program homes, but only between 9% and 17% worse in non-program homes. Similarly, in non-stretch code homes, panelists estimated a reduction in insulation installation grade between 22% and 59% for program homes, but only 6% to 22% in non-program homes.
Insulation R-values – R-values would only have been slightly worse for all four samples of homes in the absence of the programs. The most significant R-value reductions for all four samples of homes were conditioned foundation walls.
Heating, cooling, and water heating system – Rated efficiencies would have been marginally affected, but less efficient system types would have been installed.

Key Findings for Connecticut

Connecticut Delphi panelists perceived substantial net impacts from the program. The panelists' estimates yielded a NTG value of 156% for the program overall, combining single-family and multifamily results that were analyzed separately. The evaluation for Connecticut found that for single-family homes, a relatively high free-ridership rate of 68% was more than counterbalanced by an extremely high non-participant spillover rate of 233%, yielding an estimated NTG ratio of 265%. The panelists described moderate free-ridership among program participants, but in their assessment, this was outweighed by the program having created a pool of well-trained market actors whose knowledge had spread outside the confines of the program, resulting in substantial non-participant spillover. Multifamily estimates, which are based on adjustments factors rather than measure-level estimates, show an estimated NTG value of 60%. The program has a low single-family penetration rate (13%), but a much higher multifamily penetration rate (50%). This results in high non-participant spillover in single-family homes, but much less opportunity for spillover in the multifamily market.

Connecticut Delphi panelists provided rationales for their estimates about what the Connecticut market would look like in the hypothetical scenario that the RNC program ceased to exist several years ago. Similar to Massachusetts, Connecticut Delphi panelists estimated that homes would have been substantially less efficient than they are now. Without the program, measures such as duct leakage, air infiltration, and insulation installation quality would have been much less efficient than their current levels. Panelists provided measure-level net impact estimates for single-family homes and identified

several key measures that have substantial program impacts, which Table 4 summarizes. Note that the outcomes about each measure are hypothetical, not certain.

Table 4. Connecticut key measures affected by the RNC program

Ducts – In program homes, ducts may have been twice as leaky (102% worse), and one-third leakier (32% worse) in non-program homes (leakage to the outside, CFM25 per 100 sq. ft. of conditioned floor area).
Air infiltration – Air infiltration would have been 44% worse in program homes and 22% worse in non-program homes without the program (estimates of ACH50). As one national evaluator said, without the program, "leakage would increase in both groups due to lack of spillover effects."
Insulation installation quality – Typical insulation installation quality would have been over one-third worse for walls, ceilings, and floors (but no more than 5% worse in non-program homes).
Insulation R-values – The R-values would have only been modestly impacted without the program. For example, average ceiling R-value in program homes would have been 13% lower (worse) and 7% lower in non-program homes.
Heating, cooling, and water heating system – Rated efficiencies would have been marginally affected, but less efficient system types would have been installed.
Efficient lighting – The saturation of energy-efficient lighting would have been about 10% lower for both program and non-program homes without the program.
Solar PV – Solar adoption would have only been slightly affected. This scenario estimates 6% adoption, compared with the 8% of program and 7% of non-program homes that currently have solar panels installed. However, PV-readiness, particularly in program homes, would have been far less common (down from 94% to 50% in program homes) as it is a program requirement for higher-tier homes.
Net Zero Design – The number of net zero designs would likely have been about the same without the program; net zero homeowners and builders were reportedly driven by their own sustainability goals.
Overall multifamily market – Compared to single-family program homes, most panelists reported that the program achieves relatively similar efficiency results in multifamily homes. Without the program, this study estimates that multifamily program and non-program homes would have consumed about 7% and 8% more energy than they do now, respectively.

Conclusions

The findings from these studies can provide valuable insights for PAs with RNC programs in other jurisdictions that are seeking to identify market effects from their program efforts. As building codes continue to become more stringent, it is harder for programs to maintain the same level of savings over code and/or baseline construction practices. To the extent they identify previously unclaimed savings, these studies may offer PAs an opportunity to help justify the costs associated with implementing effective RNC programs. Additionally, these studies provide evaluators with a tool for quantifying hard-to-measure market effects, allowing them to more accurately and fully measure the savings attributable to RNC programs.

These studies show that well developed RNC and code programs can have considerable impacts on both the program participant and non-participant markets. The Delphi panelists from both studies portrayed the programs they were assessing as effective programs that have had significant impacts on their respective markets, particularly in terms of non-participant spillover, which resulted in large estimated net savings for non-program homes in both Massachusetts and Connecticut.

The team believes that the long and continued support of these programs, along with a focus on whole-house energy savings, has created a market that supports energy-efficient building practices. For example, the requirement of these RNC programs that participants work with certified HERS raters has likely led to a substantial amount of the non-participant spillover identified in these studies, given that HERS raters provide technical assistance that helps builders and contractors better understand and implement energy-efficient practices. As codes have become more stringent, they have also required

diagnostic testing for air and duct leakage, requiring market actors to improve their skills to meet test requirements. Moreover, many codes now offer options for performance-based compliance using a metric, such as the HERS index. Diagnostic testing and residential energy modeling are services typically provided by HERS raters. The fact that many HERS raters in both Massachusetts and Connecticut have been trained by the respective programs means that there is a larger pool of raters who can relay their knowledge of high efficiency building practices to non-participant market actors if they are working with a client for non-program purposes, such as code-required diagnostic testing or energy modeling. Through program activities such as trainings, requiring the use of HERS raters, and setting high efficiency standards for program homes, RNC programs appear to be able to improve the practices of a wide array of market actors, ultimately helping to shift their markets toward the mainstream adoption of energy-efficient practices. Of course, as programs develop and participation rates fluctuate, the NTG ratios will certainly fluctuate as well, particularly in terms of whether the program is driving savings mostly through program participation or more widely in the non-participant market.

The consistency of these results across evaluations should bolster confidence in the findings and the methods that were used to estimate net program impacts. The Delphi panelists from each study (only one expert served on both panels) ultimately came to similar conclusions. Most notably, the panelists indicated that the Massachusetts and Connecticut programs have significant influence on the efficiency of key measures, such air infiltration, duct leakage, and insulation installation quality in both program homes and non-participant homes, helping to improve the performance of market actors well outside the confines of the programs.

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