Clean Energy Fund New Construction Program

Market Assessment and Single-Family Impact Evaluation – Year 1

Executive Summary

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1 Executive Summary

The New York State Energy Research and Development Authority (NYSERDA) developed the New Construction Program (NCP) to accelerate efficiency, renewables, and electrification of new or remodeled buildings and move the market closer to net-zero-energy (NZE)[1] or carbon-neutral performance. This executive summary documents evaluation findings and recommendations for the NCP.

1.1 NCP Market Indicator Assessment Objective and Approach

For the NCP, the Clean Energy Fund Investment Plan has established output and outcome metrics to track progress toward the Program's goals over time. The Market and Impact Evaluation Team examined the outcome metrics, which are metrics of change in the market that the Program is trying to achieve, and a select output metrics, which are metrics that track progress of the program activities. The team will repeat this research for NCP in near future to track changes over time in the examined indicators.

The team reviewed program documents and data, and deployed surveys targeting two populations: NCP participants and non-participants (i.e., owners/developers and design professionals). The surveys included questions on measures, design, incremental cost, decision-making, barriers to building above minimum code requirement, program satisfaction if participants, and exposure to NCP-sponsored training. Table 1-1 summarizes the survey data collection, which occurred from October 2021 to April 2022.

Table 1-1. Primary data collection summary (surveys, sampling unit=property)

Groups	Population (Source)	Number of Completed Surveys	Confidence/ Precision	Data Collection Approach
Single-family participant properties	2,529	41	90%/13%	Email & telephone survey
Multifamily participant properties	149	35	90%/12%	Same as above
Commercial participant properties	40	13	90%/18%	Same as above
Single-family non-participant properties	~32,000	22	90%/18%	Same as above
Multifamily non-participant properties	~4,000	37	90%/13%	Same as above
Commercial non-participant properties	~3,800	28	90%/15%	Same as above

The team also interviewed seven NCP partners and one Industrial Development Agency (IDA). Program partners promote the NCP and educate on construction above code. IDAs foster economic development in specific jurisdictions in NYS. The interviews focused on benefits and barriers to above-code construction, knowledge of NZE and carbon-neutral concepts, and how further to collaborate with the NCP.

[1] NZE performance or building is an energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy. Survey data was used to determine whether a property is NZE.

1.2 Impact Evaluation Objective and Approach

The incentives and technical support offered as part of the NCP span multifamily, single-family, and commercial sectors. Single-family was the focus of the impact effort undertaken in this phase of work. There were two objectives for the Single-Family Residential New Construction Impact Evaluation:

- **To evaluate Verified Gross Energy Savings (VGS).** VGS is the annualized evaluated gross energy savings based on electric (kWh) and fuel savings (MMBtu) at customer sites.
- **To calculate a Verified Gross Savings Realization Rate (VGSRR).** VGSRR is the ratio of the sum of evaluated savings divided by the sum of the program-reported savings.

The direct impacts evaluation approach included three activities. First, the team conducted a population check for the accurate transcription of modeled savings to the Scorecard savings reported to the NYS. Second, the team examined the baseline conditions used by the HERs raters and simulation models to verify they are appropriate for a sample of sites (103 electric, including 90 with gas), in turn indicating the modeled savings are or are not correct. If determined not to be correct, the evaluators made necessary adjustments to savings. Last, the team calibrated the as-built models with actual utility monthly billing data to account for operational differences in the home that would be expected to impact savings, with needed adjustments of the modeled savings using the ANSII/BPI-2400-S-2015 standard. Seventy-seven electric and 65 natural gas/propane single family participants were included in this analysis.

The results of these activities were combined to produce the VGS and VGSRR. The adjustment for mis applied baselines was removed from the calculation of an Alternative Prospective Realization Rate.

The team also estimated indirect impacts leveraging surveys, the direct impact evaluation results, NYS Tax Parcel data and other data. Indirect savings account for efficient or clean energy features that were installed without a direct incentive but influenced by the NCP. The indirect savings methodology follows NYSERDA's indirect savings framework – a methodological approach for evaluating indirect savings.

1.3 Market Indicator Assessment Findings and Recommendations

Findings are based on data gathered on new construction properties completed from 2016 to mid-2021.[2]

[2] Most participant properties were accounted for in the Tax Parcel data, a database the team used to identify the non-participant sampling frame. Most of participant properties had an earlier construction completion date in the Tax Parcel data. Since the NCP requires additional activity (inspections and paperwork) after construction is complete, it is not surprising that the NCP completion dates lag the Tax Parcel data completion dates. Also, most participant properties mapped to Tax Parcel data show dates between 2016 and 2019. Thus, these years have been selected for the non-participant Tax Parcel sample frame ensuring the actual construction vintage of participant and non-participant properties are the same.

Finding 1: The program has significantly increased the penetration of the highest efficiency tier buildings compared to the non-participant population (15% of commercial participants compared to 4% of non-participants, and 32% of single-family home participants compared to 0% of non-participants), which includes those building with qualitatively better building components (including highest-efficiency envelope and highest efficiency mechanical systems, such as geothermal) and renewables. This performance tier points to the future as the program segues to promoting carbon neutral and low carbon designs. In addition to promoting the highest efficiency tier, NYSERDA's more typical participants perform better than the market. As an example, the average single-family home included in the impact analysis performed 14% and 35% better than code for modeled electric and gas use, respectively.

Policies relating to code and product standards are now shifting in favor of carbon neutral new construction. Regardless of the drivers of change, the New York City Local Law 154, passed in December 2021, stipulates that by 2024 all new buildings must be all-electric if less than seven stories or all-electric by mid-2027 if more than seven stories. Still, the adoption of carbon neutral construction as well as other efficient, electrification, energy storage and renewable technologies (other than lighting) is not widespread as reflected in the survey data. Thus, the current programmatic efforts focusing on incentivizing planning stages and carbon neutral projects are needed.

Note that the NCP philosophy is to focus on strategies that are ahead of building energy code advancement.

Finding 2: Financial barriers are key obstacles to building substantially above code. Across all sectors, participant and non-participant properties that incorporated energy efficiency, electrification and other clean energy measures were more expensive than similar developments built as minimally code compliant. The top three reported barriers to building substantially above code were the up-front cost of clean feature(s), followed by lack of available financing and lifetime savings that impact financial value proposition. These top three barriers were shared by both participants and non-participants. Participants also reported low satisfaction with the NCP incentives, suggesting those could be larger. Similarly, four of five interviewed program partners echoed the same message: the up-front cost or a perception that it costs much more to build an advanced clean energy building was a key barrier.

Non-participants suggested the program should offer more incentives, specifically "tax credits" or "lower property taxes." The Market and Impact Evaluation Team recognizes that NYSERDA cannot offer tax credits or lower property taxes. However, NYSERDA could work with entities that could offer a tax incentive. When the Market and Impact Evaluation Team interviewed a local IDA (an agency that encourages economic development), the Team learned that they 1) offer sales tax exemptions on constructions, 2) offer mortgage tax exemptions, and 3) are piloting different lower tax payment programs

to assess ways to encourage economic growth in their jurisdiction. The IDA contact noted that their agency is open to collaboration with NYSERDA.

a. **Recommendation:** Consider a more active partnership with state or regional economic development organizations and even NCP partners to educate owners/developers and design professionals of not only the NCP incentives but also other available incentives.

b. **NYSERDA Recommendation Response**: IMPLEMENTED/REJECTED – NYSERDA already markets their programs to IDAs through support of the New York State Economic Development Council events, meeting and IDA Trainings, as well as through other State Agencies advancing economic development including Empire State Development and Department of State. However, there are over 100 individual IDAs across the State, and they can only support commercial projects (i.e., not single family or multifamily projects). The New Construction Team also has established a significant network of channel partners throughout the State that actively promote programs and projects across all New Construction supported sectors.

Finding 3: The program appears to be helping the decision-makers minimize incremental cost of efficient shell and HVAC systems. The participant property decision-makers claimed significantly lower incremental cost for the efficient shell and efficient HVAC system than non-participating property decision-makers. The reported incremental cost of these two efficiency solutions was generally 10%-12% for participant and 18%-23% for non-participant properties that incorporated these solutions.

a. **Recommendation:** Explore how the participant properties incorporated the efficient shell and highly efficient HVAC systems without paying more than 10-12% premium for those solutions and share insights to the wider market.

b. **NYSERDA Recommendation Response**: Implemented. NYSERDA has published successful case studies and solution sets, as well as cost and performance data in multiple venues. This includes the Buildings of Excellence website, which publishes and updates case studies, webinars and cost and performance data. NYSERDA also actively participates in the New Building Institute's National Getting to Zero database and shares information into the national dataset. The New Construction Team also has established a significant network of channel partners where carbon neutral and net zero energy projects are highlighted through: sponsorships of events such as New Buildings Institute Getting to Zero Forum, NESEA pro tours, and the NYS Green Building Conference; as well as though Gallery Talks, webinars and other events with organizations including Building Energy Exchange, Passive House Accelerator, and AIA.

Finding 4: A minority of design professionals are trained on integrated design. About half to two-thirds of non-participant properties across all sectors leveraged integrated design. This statistic is likely an over-estimate. Design professionals discussing non-participating projects (n=31) reported a low level of awareness of integrated design. About 38% reported being aware of integrated design, and among those that were aware, about one-third reported receiving training on integrated design. This means that less than one-tenth (7%) of surveyed design professionals who worked on non-participant properties received training on integrated design. Awareness was found to be higher for design professionals who worked on participant properties; 59% reported being aware of integrated design, with approximately 15% of surveyed participating design professionals received training on integrated design.

One group that did leverage integrated design more frequently was NZE/NZE-capable building design professionals. Nearly all NZE or NZE-capable[3] used integrated design. Key outcomes of integrated design are reduced incremental cost to achieve building performance, and improved building operational performance as related to comfort and energy costs. The higher use of integrated design in these best in class buildings implies that integrated design is useful when building NZE/ NZE-capable buildings. Note that these properties are a small subset of the above-code new construction market. Between 2016 and mid-2021, about 4% to 8% of the market were NZE/NZE-capable buildings that leveraged integrated design. Given this insight, the NCP program staff should re-think the target for this metric.

Furthermore, a minority (23%) of surveyed design professionals who worked on non-participating projects noted that integrated design leads to the incorporation of more ultra-efficient features. This finding is related to the fact that very few reported being trained on the integrated design.

Also note that the market is unlikely to be fully served by an integrated design model. Surveyed design professionals noted other contractual arrangements that could lead to integration of clean energy and energy efficiency features in construction, such as a retainage-based contractual arrangement in construction. One program partner involved extensively with the design community and familiar with integrated design noted that integrated design (and associated contracting) was an outdated concept and that the market is moving toward a more full-service type of design and build firm offerings.

a. **Recommendation:** In addition to encouraging an integrated design model, the program team should investigate adding intervention strategies that could work for those that leverage non-

[3] NZE-capable buildings are buildings that incorporated clean energy and/or efficiency measures and have been estimated to have achieved Energy Use Intensity (EUI) reduction of more than 15%. This definition may not follow other, stricter definitions.

integrated design contracting (such as design-bid-build) arrangements to encourage carbon-neutral and Net Zero Energy construction.

b. **NYSERDA Recommendation Responses**: Implemented. Good design practices can occur prior to bidding, and integrated project delivery can still occur in these contracting arrangements. The New Construction Team will continue to work with the market to explore design and construction practices that help reduce incremental costs, reduce construction time, and improve building operational performance related to health, comfort, resiliency, and productivity.

1.4 Impact Evaluation Findings and Recommendations

The table below summarizes the two impact adjustments made to the single-family new construction Scorecard savings and precisions that accompany each. The last row shows the final single-family VGS and VGSRR. The verified gross electric savings is 4,629 MWh and the gross natural gas/propane savings estimate is 125,121 MMBTU with verified gross realization rates of 76.5% and 84.9%, respectively. Precisions around the results are lower than anticipated due primarily to the baseline issue driving a wider variation of gross savings than anticipated.

Table 1-2: Summary of electric and natural gas/propane impact results

	Electric			Natural Gas / Propane		
Savings	kWh	Realization Rate	Precision (90% c.i.)	MMBTU	Realization Rate	Precision (90% c.i.)
Scorecard Savings	6,053,840	N/A	N/A	147,389	N/A	N/A
Model Calibration Adjustment/APRR	6,327,454	104.5%	±5.9%	166,284	112.8%	±10.7%
Baseline Adjusted Savings	4,629,265	76.5%	±26.5%	125,121	84.9%	±26.6%
Final VGS/VGSRR	4,629,265	76.5%	±26.5%	125,121	84.9%	±26.6%

In estimating the direct impacts, the team uncovered several areas of improvement and offers the following recommendations.

Finding 1: Scorecard savings are slightly overstated due to the extraction process. The current system of moving single-family savings from Salesforce to the Scorecard is automated to pull actual modeled savings that are input from REM/Rate and Ekotrope models. However, if no actual savings is present in Salesforce or if it has a zero (0) listed as the savings it, the program appears to extract and credit estimated savings into the Scorecard.

a. **Recommendation:** Moving forward, the Market and Impact Evaluation Team recommends revisiting the extraction process to ensure only actual savings are pulled from Salesforce when

projects are fully closed. The Market and Impact Evaluation Team's understanding is that this recommendation may already be underway at NYSERDA.

b. **NYSERDA Recommendation Response**: Implemented. This data extraction process has been revised.

Finding 2: Many single-family REM/Rate models from a single vendor incorrectly used 2010 code as the baseline for impacts reported in the Scorecard, which had a substantial effect on the realization rate. REM/Rate requires the selection of a User Defined Reference Home or UDR that reflects code at the time of permitting to produce program impacts. This baseline issue did not happen with the Ekotrope models. Note: Program team had terminated this vendor from the program due to performance issues directly related to their modeling ability prior to the evaluation work occurring and the issue was not noted in any other vendors models during this evaluation.

a) **Recommendation:** The Market and Impact Evaluation Team recommends NYSERDA regularly gather the baseline or references homes used for modeling and monitoring the correct application of code during its monthly program QA/QC activities, given its importance to accurate savings claims. This will make savings more auditable for NYSERDA and evaluators. This issue was observed with the use of REM/Rate where savings are dependent on the individual rater selecting the correct UDR to produce savings. If this issue is rectified (and verified), the Model Calibration Adjustment realization rate may be considered as an Alternative Prospective Realization Rate (APRR). This provisional realization rate can be applied to projects if Ekotrope is used for modeling and the baseline on the platform is verified as being of appropriate code,[4] or all REM/Rate models are confirmed to consistently use the appropriate UDR. Once these changes are implemented and it has been verified, the program can apply the APRR to projects occurring after the evaluation period. However, the APRR requires a re-evaluation of the provisional value within 18 months after the report filing date. The APRR realization rates available for use are: 104.5% for electric and112.8% for gas/propane.

b) **NYSERDA Recommendation Response**: Implemented. As noted in the report, this issue was limited to a single vendor who had been terminated from the program due to an inability to meet program quality requirements. The issue specifically arose after the new code went into effect, so it impacted a sub-set of their work. Since this is a market transformation program that in part

[4] Ekotrope models are run on an online platform where the baseline home can be uploaded a single time for use on all subsequent homes in the program by all raters.

works with the market to continually help improve the market's performance, there will always be a similar risk at each code change. Program team will continue to work with all vendors and builders to continue to improve market capacity and improve modeled and predicted results, as well as verified and M&V results.

Finding 3: Based on the savings from the sample of single-family models reviewed with appropriate baselines, appliances and lighting are driving much of the electric savings (74%). Appliances and lighting tend to be short-lived measures that are transient in nature.

a. **Recommendation:** The Market and Impact Evaluation Team recommends NYSERDA work with program vendors to review the end uses producing electric savings among recent single-family participants to see if electric savings continue to be driven by appliances and lighting. To the extent the NCP is intended to achieve long-term electric savings, pursuing more diverse savings that are directly integrated into the home will be more productive in achieving that goal.

b. **NYSERDA Recommendation Response**: Implemented. Since 2021, New Construction programs began to require significant envelope performance improvements beyond code, and are fossil fuel free buildings, and therefore significant electric savings are generated from space heating and cooling equipment, as well as domestic hot water heating equipment.

Finding 4: The current single-family program tracking system collects program savings, but not consumption of the treated homes.

a. **Recommendation**. As NYSERDA moves to an increased focus on NZE homes and greenhouse gas metrics, it might consider tracking the modeled base usage of homes in addition to savings. This would allow administrators to track program performance as savings as a percent of consumption for each fuel. This can be a valuable metric for the Single-Family NCP and those of a similar nature.

b. **NYSERDA Recommendation Response**: Pending. There are significant requirements already in place for compliance with program rules. Program participants routinely indicate that additional requirements would present undue burden and would likely impact their decision to participate in the programs. Program team will evaluate if there is a no effort way to collect additional baseline information in future modeling efforts, as appropriate.

Finding 5: In addition to direct savings, the program generated substantial indirect savings. These savings are market wide savings across all market sectors. To estimate indirect savings for the NCP, the Market and Impact Evaluation Team used the survey and program data inputs to determine the magnitude of the causal linkage between program activities and a market response. These linkages, along with other

findings, determined the gross interior area (GIA) constructed in New York with Advanced Clean Energy (ACE)[5] features that were influenced by the program (the influenced ACE GIA). The indirect savings are then estimated as the product the influenced ACE GIA and the average program savings per square foot.

Table 1-3 presents the indirect annual savings associated with projects with a Complete status in the Scorecard as of September 30, 2021. For reporting purposes, the indirect savings are allocated by program and market focus (market or low-moderate income (LMI)), proportional to the funding committed for that sub-program through September 30, 2021. Indirect savings reflects multiple NYSERDA activities (i.e., incentives, training, demonstration projects) and program funding was selected as the best proxy for holistic indirect program influence. The total indirect annual savings for all program activity from 2016 through September 2021 is the product of the funding committed in the time period of interest and the fuel specific Savings/Funding Ratio described in Table 1-3.

Table 1-3: Indirect savings from program activity in the period of interest

	Electric Savings	Units	Natural Gas / Propane Savings	Units
GIA contributing to indirect savings	595,651,909	Square feet	595,651,909	Square feet
Average annual savings/sq ft	0.35	kWh/sq ft	0.0037	MMBTU/ sq ft
Indirect annual savings, through Q3-2021	209,689	MWh	1,790,850	MMBTU
Committed Funding through Q3-2021	$80,812,284	$	$80,812,284	$
Savings/Funding Ratio	0.0026	MWh/$	.022	MMBTU/$

[5] ACE are any buildings built substantially above minimum code requirement. This would include all buildings that qualify for program participation: including but not limited to ENERGY STAR Homes and Multifamily, Passive House, Net Zero Energy performance