

**New York State Net Zero Energy
Residential New Construction Baseline Study**

Final Appendix

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Appendix A. Net Zero Energy (NZE) Pre-Construction Phase Market Metrics and Indicators

The team collected and analyzed data from multiple sources for estimates of four pre-construction phase market metrics, which the team divided into 16 measurable market indicators. Nine are quantitative indicators and seven are qualitative indicators. Table A-1 lists the metrics and indicators, the indicators types (quantitative or qualitative), and the sources used to collect indicator estimates.

Table A-1. NZE Pre-Construction Phase Market Metrics, Indicators, and Data Sources

| Market Metrics (MM) & Indicators (MI) | Type | Secondary Sources | Distributors | Training, Trade, & Professional Orgs | Building Inspectors | Architects, Builders & Developers | HVAC & Solar Contractors | HERS Raters | NZE Homebuyers | Non-NZE Homebuyers |
|--|--------------|-------------------|--------------|--------------------------------------|---------------------|-----------------------------------|--------------------------|-------------|----------------|--------------------|
| <i>MM1: Price, availability, and annual sales of NZE-needed technologies</i> | | | | | | | | | | |
| MI1a: Price per unit of NZE-needed technologies | Quantitative | X | X | | | | | | | |
| MI1b: Availability issues with NZE-needed technologies | Qualitative | | X | X | X | X | X | X | | |
| MI1c: Solutions used to overcome availability issues with NZE-needed technologies | Qualitative | | X | X | X | X | X | X | | |
| MI1d: Sales trends of NZE-needed technologies from distributors who service New York State | Quantitative | X | X | | | | | | | |
| <i>MM2/MI2: Major upstream market adoption barriers for NZE-needed technologies</i> | Qualitative | X | X | X | X | X | X | X | | |
| <i>MM3: Number and type of NZE-related trainings, certifications, and professional and trade organizations for NZE market actors in New York State</i> | | | | | | | | | | |
| MI3a: Number and types of organizations with some focus on NZE residential buildings and/or practices | Quantitative | X | | X | X | X | X | X | | |
| MI3b: Number and types of organizations with some focus on NZE residential buildings and/or practices that provide memberships | Quantitative | X | | X | X | X | X | X | | |

| Market Metrics (MM) & Indicators (MI) | Type | Secondary Sources | Distributors | Training, Trade, & Professional Orgs | Building Inspectors | Architects, Builders & Developers | HVAC & Solar Contractors | HERS Raters | NZE Homebuyers | Non-NZE Homebuyers |
|--|--------------|-------------------|--------------|--------------------------------------|---------------------|-----------------------------------|--------------------------|-------------|----------------|--------------------|
| MI3c: Number and types of NZE-related trainings provided by organizations in the past two years with some focus on NZE residential buildings and/or practices | Quantitative | X | | X | X | X | X | X | | |
| MI3d: Number and types of NZE-related certifications or credentials offered by organizations in the past two years with some focus NZE residential buildings and/or practices | Quantitative | X | | X | X | X | X | X | | |
| MI3e: Percentage of New York State NZE market actors who are aware and members of organizations with some focus on NZE residential buildings and/or practices in the past two years | Qualitative | | | | X | X | X | X | | |
| MI3f: Percentage of New York State NZE market actors who are aware of and who completed trainings in the past two years offered by organizations with some focus on NZE residential buildings and/or practices | Qualitative | | | | X | X | X | X | | |
| MI3g: Percentage of New York State NZE market actors who are aware of and who received a certification in the past two years provided by organizations with some focus on NZE residential buildings and/or practices | Qualitative | | | | X | X | X | X | | |
| <i>MM4: New York State NZE market actors' awareness of and experience with high-performance home labels and certifications</i> | | | | | | | | | | |
| MI4a: Number and list of high-performance home labels/certifications and certifying organizations | Quantitative | X | | | X | X | X | X | | |
| MI4b: Percentage of New York State NZE market actors aware of each high-performance home labels/certifications | Quantitative | X | | | X | X | X | X | X | X |
| MI4c: Percentage of New York State NZE market actors who have worked on or who own a home that received a high-performance home label/certification | Quantitative | X | | | X | X | X | X | X | X |

| Market Metrics (MM) & Indicators (MI) | Type | Secondary Sources | Distributors | Training, Trade, & Professional Orgs | Building Inspectors | Architects, Builders & Developers | HVAC & Solar Contractors | HERS Raters | NZE Homebuyers | Non-NZE Homebuyers |
|--|--------------|-------------------|--------------|--------------------------------------|---------------------|-----------------------------------|--------------------------|-------------|----------------|--------------------|
| MI4d: High-performance home labels/certifications selected by New York State NZE market actors as the best that communicates the value and features of NZE homes | Quantitative | | | | X | X | X | X | | |

A.1. Price, Availability, and Annual Sales of NZE-Needed Technologies

The team divided this market metric into four measurable indicators.

1. Price per unit of NZE-needed technologies
2. Availability issues with NZE-needed technologies
3. Solutions used to overcome availability issues with NZE-needed technologies
4. Sales trends of NZE-needed technologies from distributors who service New York State

A.1.1. Price Per Unit of NZE-Needed Technologies

Quantitative Market Indicator Description and Estimates

This quantitative indicator is the average price and range of prices of 20 NZE-needed heating, air-conditioning, and ventilation (HVAC), insulation, water heating, window, and solar photovoltaic (PV) technologies from distributors that service New York State. Table A-2 presents the average price, range of prices, number of distributors that provided prices, and technical specifications for each technology.

Table A-2. Average Price of NZE-Needed Technologies from Distributors that Service New York State

| NZE Technology | # of Price Points | Average Price | Price Range | Specifications |
|---|-------------------|---------------|-------------------------|--|
| HVAC | | | | |
| HVAC Low-capacity Gas Furnace | 4 | \$996.55 | \$729.99 - \$1,192.20 | 40,000 BTU, 92% - 96% AFUE |
| Single Zone - Air source heat pump (ductless mini-splits) | 4 | \$1,415.21 | \$938.95 - \$1,913.00 | 12,000 - 18,000 BTU, 17.0 - 25.5 SEER |
| Tri-Zone - Air source heat pump (ductless mini-splits) | 4 | \$3,526.95 | \$3,239.95 - \$4,219.95 | 22,000 - 36,000 BTU total (9,000 - 12,000 BTU split), 18.0 - 22.0 SEER |

| NZE Technology | # of Price Points | Average Price | Price Range | Specifications |
|---|-------------------|---------------|---------------------------|---|
| Ground source heat pump (closed loop & open loop) | 5 | \$4,319.65 | \$2,870.00 - \$7,958.25 | 1.5 - 3.0 Ton, 2 Stage |
| High Efficiency Central Air Conditioners (CACs) | 4 | \$2,701.25 | \$1,788.00 - \$3,199.00 | 2.0 - 4.0 Ton, Split System, 18.0 - 19.0 SEER |
| Heat recovery ventilator (HRV) | 4 | \$935.78 | \$651.32 - \$1,324.49 | 100 - 200 CFM |
| Energy recovery ventilator (ERV) | 5 | \$935.60 | \$460.95 - \$1,595.75 | 56 - 200 CFM |
| Insulation | | | | |
| 6" Thick Insulated Concrete Form (ICFs) | 4 | \$20.91 | \$18.70 - \$22.35 | Standard 16 x 48 in |
| 8" Thick Insulated Concrete Form (ICFs) | 4 | \$21.50 | \$19.49 - \$23.10 | Standard 16 x 48 in |
| Zip Wall System | 4 | \$52.24 | \$47.46 - \$63.00 | (R6) 1 - 7/16th, 4 x 8 ft |
| Water Heating | | | | |
| Heat pump water heater (hybrid water heater) | 4 | \$1,343.75 | \$979.00 - \$1,599.00 | 50 - 80 Gallon, 2.45 - 3.0 Efficiency Factor, Hybrid Electric |
| Windows | | | | |
| Double Hung - Triple pane windows (triple-glazed) | 5 | \$406.50 | \$166.00 - \$560.70 | Frame size: 35 1/4" x 39 1/2", Triple Pane Low E Argon, 4 9/16" Jamb |
| Casement - Triple pane windows (triple-glazed) | 5 | \$451.50 | \$240.00 - \$599.15 | Frame size: 36" x 39 1/8", Triple Pane, Low E Argon, 4 9/16" Jamb |
| Solar PV Systems & Components | | | | |
| 4kW - Solar PV System | 4 | \$6,481.25 | \$5,637.99 - \$7,755.00 | 3,975 - 4,240 watt grid tie system with central inverter/microinverter/optimizers |
| 6kW - Solar PV System | 4 | \$9,592.58 | \$8,311.31 - \$10,950.00 | 5,300 - 6,360 watt grid tie system with central inverter/optimizers |
| 8kW - Solar PV System | 4 | \$13,404.65 | \$11,540.00 - \$15,415.00 | 7,950 - 8,480 watt grid tie system with central inverter/optimizers |
| 10kW - Solar PV System | 3 | \$17,365.00 | \$14,225.00 - \$19,020.00 | 10,260 - 10,600 watt grid tie system with central inverter/microinverter/optimizers |
| Solar Panel | 2 | \$537.09 | \$280.13 - \$794.04 | 265 watt, Polycrystalline |
| 4kW Power Inverter | 2 | \$2,560.12 | \$1,477.24 - \$3,643.00 | Grid tie |

| NZE Technology | # of Price Points | Average Price | Price Range | Specifications |
|--------------------|-------------------|---------------|-------------------------|----------------|
| 6kW Power Inverter | 2 | \$3,806.67 | \$2,999.34 - \$4,614.00 | Grid tie |

Methods Used and Recommendations for Future Studies

The team conducted web searches and worked with New York State Energy and Research Development Authority (NYSERDA) Low Rise New Construction (LRNC) staff members to create a list of specific NZE-needed HVAC, insulation, water heating, window, and solar PV technologies, and potential distributors who supply these technologies to New York State. The team searched distributor websites and called 18 distributors of each technology type to collect up to four price points for each specific technology, except for the 10-kW solar PV system and the individual solar PV system components; the team had difficulty finding four distributors that supply these specific technologies to New York State. The team computed the average price reported by the distributors for each technology.

The team recommends repeating this methodology for this indicator in future studies. To increase the number of price points for individual solar PV system components, the team recommends asking solar PV contractors which distributors they use to get individual components. In addition, the team recommends asking builders, HVAC contractors, and solar PV contractors the average price to install the NZE-needed technologies reported in Table A-2.

A.1.2. Availability Issues with NZE-Needed Technologies and Solutions Used to Overcome Availability Issues NZE-needed Technologies

Qualitative Market Indicator Description and Estimates

These two qualitative indicators are the availability issues New York State NZE market actors reported experiencing with types of NZE-needed technologies and the solutions they reported using to overcome the availability issues. Table A-3 shows the five technologies, issues, and solutions reported by market actors and the percentage of each market actor group who reported the issues and solutions. Interviewed market actors identified five types of NZE-needed technologies with availability issues, although most interviewed market actors did not report availability issues with any technologies.

Methods Used and Recommendations for Future Studies

The team asked New York State NZE market actors an open-ended question about NZE-needed technologies with which they experienced availability issues and the solutions they used for overcoming the availability issue (Table A-4). Interviewed market actors included distributors of NZE-needed technologies; training, trade, and professional organizations (TTP); building inspectors, architects, design-build firms, builders, developers, HVAC contractors, solar PV contractors, and Home Energy Rating

System (HERS) raters. The team categorized market actors' reported issues and solutions by NZE-needed technology type and calculated the percentage that mentioned each issue and solution.

The team recommends asking close-ended questions in future studies to obtain quantitative estimates of NZE-needed technology availability issues and solutions. The first close-ended question should ask whether market actors have experienced availability issues with the key NZE-needed technology types. The second close-ended question should ask what type of availability issue market actors experienced with each NZE-needed technology type, using categories like those in Table A-3 as answer options. The third close-ended question should ask what market actors did to overcome the availability issue with each NZE-needed technology type, using categories similar to those in Table A-3 as answer options.

Table A-3. Percentage of New York State NZE Market Actors Reporting Availability Issues and Implemented Solutions for NZE-needed Technologies (Multiple Responses Allowed)

| Technology | Availability Issues Reported | Solutions Implemented | Distributors | Training, Trade, Professional Organizations | Building Inspectors | Architects | Design-Build | Builders | Developers | HVAC Contractors | Solar PV Contractors | HERS Raters |
|---|--|--|--------------|---|---------------------|------------|--------------|----------|------------|------------------|----------------------|-------------|
| N | | | 4 | 5 | 4 | 3 | 4 | 5 | 1 | 5 | 7 | 5 |
| None mentioned | None mentioned | None mentioned | 25% | 60% | 100% | 67% | 75% | 80% | 100% | 100% | 100% | 80% |
| High efficiency HVAC components | Too many models and sizes to stock due to changing product codes, new annual models, and variety of sizes needed for NZE homes | Stock higher demand products, special order others | 25% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| | Few distributors, requires lots of time to find products | Hire subcontractor with knowledge of where to find products | 0% | 0% | 0% | 0% | 0% | 20% | 0% | 0% | 0% | 0% |
| Triple pane windows | Not made in U.S., imported from Europe | Plan ahead to wait longer (2-3 weeks) for delivery from Europe | 25% | 40% | 0% | 33% | 0% | 0% | 0% | 0% | 0% | 20% |
| High performance air sealing products (membranes and tapes) | U.S-made products do not perform as well as those imported from Europe | Plan ahead to wait longer (2-3 weeks) for delivery from Europe | 25% | 40% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Insulated concrete forms for walls | Not available locally, delivered from other parts of U.S. | Plan ahead to wait longer (2-3 weeks) for delivery | 0% | 0% | 0% | 0% | 25% | 0% | 0% | 0% | 0% | 0% |
| Solar PV system components | Limited availability locally, delivered from other parts of U.S. | Plan ahead to wait longer (2-3 weeks) for delivery | 25% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

Table A-4. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | Distributors | Training, Trade, Professional Organizations | Building Inspectors | Architects, Design-Build, Builders, and Developers | HVAC and Solar PV Contractors | HERS Raters |
|--|--------------|---|---------------------|--|-------------------------------|-------------|
| Interview or survey question number(s) | Q8 | Q32.3 | Q7-Q8 | Q28 | Q11 | Q11 |

A.1.3. Sales Trends of NZE-Needed Technologies

Quantitative Market Indicator Description and Estimates

This quantitative indicator is whether sales of key NZE-needed HVAC, insulation, window, and solar PV technologies increase, decrease or remain the same from the past year and the expected change next year as reported by distributors that service New York State. Table A-5 shows the type of distributor, the type of NZE-needed technology, the change in sales between 2014 and 2015, and the expected change in sales between 2015 and 2016. Each distributor reported an increase in sales between 2014 and 2015 except the distributor of solar components.

This is a quantitative indicator but because there are only four interviewed distributors that are not representative of the population of distributors that service New York State, the indicator estimates should not be generalized to the larger distributor market or used for statistical tests or comparisons.

Table A-5. Sales Trends of NZE-Needed Technologies Reported by Interviewed Distributors Who Service New York State

| Distributor Type (n) | NZE Technology Type | Change in Sales 2014-2015 | Expected Change in Sales 2015-2016 |
|----------------------|--|---------------------------|------------------------------------|
| HVAC (1) | High efficiency HVAC | Increase | Increase |
| Windows (1) | Triple pane windows | Increase | Increase |
| Insulation (1) | High performance insulation and air & weather sealing products | Increase | Increase |
| Solar (1) | Solar PV components | Decrease | Increase |
| | Solar thermal components | Same | Same |

Methods Used and Recommendations for Future Studies

The team was unable to find up-to-date industry data for sales of NZE-needed technologies - number of units sold, shipped, or manufactured - from the U.S. Energy Information Administration, trade associations like the International Ground Source Heat Pump Association, or market research companies such as Dodge Data & Analytics. Even if the team found these data, it would have been very challenging to parse out how many of the sold or manufactured technologies went to New York State and were for new NZE homes. Given these challenges, NYSERDA asked the team to make this market indicator a low priority and test asking a question to distributors about sales trends of key NZE-needed technologies.

The team conducted web searches and worked with NYSERDA LRNC staff members to create a list of specific NZE-needed HVAC, insulation, window, and solar PV technologies, and potential distributors who supply these technologies to New York State. The team interviewed one distributor of each technology type and asked whether their sales of the technologies increased, decreased, or remained the same over the past year, between 2014 and 2015, and whether they expected their sales to increase, decrease, or remain the

same over the next year, between 2015 and 2016 (see questions Q6 and Q7 in the distributor interview guide in Appendix D). The team reported responses to each question, by distributor.

The team recommends using one of three approaches for collecting data for sales trends of NZE-needed technologies in future studies.

1. Search for reliable and up-to-date industry data for annual sales, shipments, or units manufactured for each key NZE-needed technology. It will likely remain difficult to find state-level industry tracking data, but as sales of NZE-needed technologies continue to grow, national- and regional-level data should become more comprehensive and current. For example, organizations like Northeast Energy Efficiency Partnerships (NEEP), Consortium for Energy Efficiency (CEE), U.S. Environmental Protection Agency (EPA), and U.S. Department of Energy (DOE) monitor and track some energy efficient technologies, and may provide state-level estimates in the future.
2. Conduct a survey with a representative sample of distributors, including manufacturers with direct sales to contractors, that service New York State and use the same methods employed for this study to ask about sales trends of key NZE-needed technologies. Identifying distributors that service New York State will be challenging but this will likely provide the most reliable and valid estimate of sales trends of NZE-needed technologies in New York State.
3. Conduct a survey of the population of manufacturers of NZE-needed technologies and use the same methods employed for this study but ask about trends in units manufactured or shipped instead of trends in sales. It will be difficult to determine how many technologies went to New York State but identifying and interviewing manufacturers will likely be less challenging than distributors.

A.2. Major Upstream Market Barriers to Adopting NZE-Needed Technologies

Qualitative Market Indicator Description and Estimates

This qualitative indicator is the type of major upstream market barriers and challenges for adopting NZE-needed technologies reported by interviewed New York State NZE market actors. Table A-6 displays the technology adoption barriers, the types of technologies each barrier applies to, and the percentage of market actor groups who mentioned each barrier. The team identified 10 upstream market barriers from NZE studies and market actor interviews. This indicator is qualitative because the team asked market actors an open-ended question about barriers to adopting NZE-needed technologies.

Methods Used and Recommendations for Future Studies

The team performed a review of NZE studies and interviewed New York State NZE market actors to identify the types of major upstream barriers and challenges for adopting NZE-needed technologies (Table

A-7). The team asked an open-ended question about challenges for adopting NZE-needed technologies to distributors; training, trade, and professional organizations; building inspectors; architects; design-build firms; builders; developers; HVAC contractors; solar PV contractors; and, HERS raters. The team reported the percentage of each market actor group that reported each barrier.

The team recommends asking a close-ended question in future studies to make this a quantitative indicator. The question should ask about challenges for each key NZE-needed technology type and use the categories in Table A-6 as answer options, with an option for actors to specify other challenges.

Table A-6. Types of Major Upstream Market Barriers for Adoption of NZE-needed Technologies (Multiple Responses Allowed)

| NZE-Needed Technology Market Adoption Barriers | Technologies Mentioned | NZE Studies | Distributors | Training, Trade, Professional Organizations | Building Inspectors | Architects | Design-Build | Builders | Developers | HVAC Contractors | Solar PV Contractors | HERS Raters |
|---|---|-------------|--------------|---|---------------------|------------|--------------|----------|------------|------------------|----------------------|-------------|
| N | | 4 | 4 | 5 | 4 | 3 | 4 | 5 | 1 | 5 | 7 | 5 |
| None | None | 0% | 0% | 0% | 100% | 67% | 75% | 80% | 100% | 100% | 100% | 80% |
| Limited availability | Windows, HVAC components, Air Sealing products, Insulation products | 75% | 75% | 40% | 0% | 33% | 25% | 20% | 0% | 0% | 0% | 20% |
| High cost, low willingness to pay | HVAC systems, Solar PV components & systems, Windows, Insulation products | 75% | 100% | 80% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Limited marketing | HVAC, Insulation | 25% | 0% | 20% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Lack of contractor awareness | Unspecified | 25% | 0% | 40% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Lack of contractor experience | HVAC systems and components | 25% | 25% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Contractors' customers (homebuyers) lack understanding or have concerns | Energy management, HVAC, Solar PV | 25% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Inconsistent efficiency rating standards or building codes for products across municipalities | HVAC, Windows, Air Sealing | 0% | 50% | 20% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Limited enforcement of product standards in industry | Insulation products | 0% | 25% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Decreasing availability of tax incentives or financing options | HVAC, Solar PV | 0% | 50% | 40% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Lack of performance testing ratings on products | HVAC, Insulation, Windows | 25% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

Table A-7. NZE Market Actor Interview Guide Question Numbers and Secondary Sources Used for Market Indicator Estimates

| | Distributors | Training, Trade, Professional Organizations | Building Inspectors | Architects, Design-Build, Builders, Developers | HVAC & Solar PV Contractors | HERS Raters |
|--|--------------|---|---------------------|--|-----------------------------|-------------|
| Interview or survey question number(s) | Q8-Q9 | Q32.2-Q32.3 | Q7-Q8 | Q28-Q29 | Q11-Q12 | Q11- Q12 |
| Secondary Data Sources | | | | | | |
| Heschong Mahone Group (HMG) (2012), "Road to ZNE." http://www.energydataweb.com/cpucFiles/pdaDocs/849/PGE_Road_to_ZNE_Workplan_Final_051112.pdf | | | | | | |
| Abri Sustainable Design & Consulting (2007), "Challenges and Opportunities to Achieve 50% Energy Savings." http://www.affordablecomfort.org/sites/default/files/cmhc_nze_exisitng_henderson_full_2008_s60376_w_.pdf | | | | | | |
| TRC, RIA (2014), "Final Residential ZNE Market Characterization." http://www.calmac.org/publications/TRC_Res_ZNE_MC_Final_Report_CALMAC_PGE0351.01.pdf | | | | | | |
| NIST (National Institute of Standards and Technology) (2013), "Strategies to Achieve Net-Zero Energy Homes: A Framework for Future Guidelines." http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1140.pdf | | | | | | |

A.3. Number and Type of NZE-related Trainings, Certifications, and Professional and Trade Organizations for NZE Market Actors in New York State

The team divided this market metric into seven measurable market indicators.

1. Number and types of organizations with some focus on NZE residential buildings and/or practices
2. Number and types of organizations with some focus on NZE residential buildings and/or practices that provide memberships
3. Number and types of NZE-related trainings provided by organizations in the past two years with some focus on NZE residential buildings and/or practices
4. Number and types of NZE-related certifications or credentials offered by organizations in the past two years with some focus NZE residential buildings and/or practices
5. Percentage of New York State NZE market actors who are aware and members of organizations with some focus on NZE residential buildings and/or practices in the past two years
6. Percentage of New York State NZE market actors who are aware of and who completed trainings in the past two years offered by organizations with some focus on NZE residential buildings and/or practices
7. Percentage of New York State NZE market actors who are aware of and who received a certification in the past two years provided by organizations with some focus on NZE residential buildings and/or practices

A.3.1. Number and Types of Organizations with Some Focus on NZE Residential Buildings and/or Practices and that Provide Memberships; Number and Types of NZE-Related Trainings Provided by Organizations; Number and Types of NZE-Related Certifications and Credentials Offered by Organizations

Quantitative Market Indicator Description and Estimates

These four quantitative indicators are the number and type of training, trade, and professional organizations that have at least *some focus on NZE buildings, technologies, and/or practices*, the number of these organizations that provide memberships, the number and type of *NZE-related trainings* offered by these organizations either online or in the Northeast US, and the number and type of *NZE-related certifications and credentials* provided by these organizations (Table A-8). The team identified 58 total NZE-related organizations, 43 of which provide 165 NZE-related trainings, and 26 of which provide 41 NZE-related certifications and credentials.

Table A-8. Number and Type of Organizations, Trainings, and Certifications and Credentials Available to New York State NZE Market Actors in the Past Two Years That Have Some Focus on Residential NZE Buildings, Practices, or Technologies

| Organizations | Type | Offering Member-ships | Offering News/ Research | Offering Events | Training Courses* | | | Certifications/ Credentials | |
|---|-------------------|-----------------------|-------------------------|-----------------|---------------------------|------------------------------|-------------------|-----------------------------|---|
| | | | | | Offering Courses | Course Types | Number of Courses | Offering Certs. | Number and Title of Certs. |
| Total = 58 | Training (14) | 33 | 48 | 34 | 43 | Building Science & Design | 62 | 26 | 41 |
| | Trade (9) | | | | | Distributed Energy Resources | 22 | | |
| | Professional (26) | | | | | Energy Analytics & Audits | 32 | | |
| | Distributor (5) | | | | | Geothermal | 12 | | |
| | Government (4) | | | | | HVAC | 14 | | |
| | | | | | | Building Shell | 17 | | |
| | | | | | | Marketing & Sales | 6 | | |
| Air Conditioning Contractors of America (ACCA) | Professional | Yes | Yes | Yes | Yes | HVAC | 3 | Yes | Residential HVAC for Quality Installation Certification |
| | | | | | Energy Analytics & Audits | 1 | | | |
| Air Movement and Control Association (AMCA) | Trade | Yes | Yes | Yes | No | None | 0 | No | None |
| Air-Conditioning, Heating, and Refrigeration Institute (AHRI) | Trade | Yes | Yes | Yes | No | None | 0 | No | None |
| Alliance to Save Energy | Professional | Yes | Yes | No | No | None | 0 | No | None |

| Organizations | Type | Offering Member-ships | Offering News/ Research | Offering Events | Training Courses* | | | Certifications/ Credentials | |
|---|--------------|-----------------------|-------------------------|-----------------|-------------------|------------------------------|-------------------|-----------------------------|---|
| | | | | | Offering Courses | Course Types | Number of Courses | Offering Certs. | Number and Title of Certs. |
| AltE Store | Distributor | No | No | No | Yes | Distributed Energy Resources | 1 | No | None |
| | | | | | | Energy Analytics & Audits | 1 | | |
| American Institute of Architects (AIA) (NY Chapter) | Professional | Yes | Yes | Yes | Yes | Building Science & Design | 3 | No | None |
| | | | | | | Marketing & Sales | 1 | | |
| American Institute of Building Design (AIBD) | Professional | Yes | Yes | Yes | No | Outsourced/ Sponsored | 0 | Yes | National Council of Building Designer Certification |
| American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) | Professional | Yes | Yes | Yes | Yes | HVAC | 2 | Yes | High-Performance Building Design Professional Certification |
| | | | | | | Energy Analytics & Audits | 2 | | Building Energy Assessment Professional |
| | | | | | | Building Science & Design | 1 | | Building Energy Modeling Professional |
| Association of Energy Conservation Professionals (AECOP) | Professional | Yes | Yes | Yes | No | None | 0 | No | None |
| Association of Energy Engineers (AEE) | Professional | Yes | Yes | Yes | Yes | Distributed Energy Resources | 2 | Yes | Renewable Energy Professional |
| | | | | | | Energy Analytics & Audits | 1 | | Energy Efficiency Practitioner |

| Organizations | Type | Offering Member-ships | Offering News/ Research | Offering Events | Training Courses* | | | Certifications/ Credentials | |
|--|--------------|-----------------------|-------------------------|-----------------|-------------------|------------------------------|-------------------|-----------------------------|---|
| | | | | | Offering Courses | Course Types | Number of Courses | Offering Certs. | Number and Title of Certs. |
| Autodesk Inc. | Training | No | No | No | Yes | Energy Analytics & Audits | 5 | Yes | Building Performance Analysis (BPA) Certificate |
| | | | | | | Building Science & Design | 2 | | |
| Build It Green | Professional | Yes | Yes | No | Yes | Building Science & Design | 2 | Yes | Green Building Professional Certification |
| Building Envelope Science Institute | Professional | Yes | Yes | No | Yes | Building Shell | 2 | No | None |
| Building Performance Contractor Association (BPCA) | Trade | Yes | Yes | No | Yes | HVAC | 1 | No | None |
| | | | | | | Energy Analytics & Audits | 1 | | |
| Building Performance Institute (BPI) | Training | No | Yes | No | Yes | Distributed Energy Resources | 5 | Yes | BPI Certified Energy Auditor |
| | | | | | | Building Science & Design | 1 | | BPI Certified Home Energy Professional |
| | | | | | | Geothermal | 1 | | BPI Certified Multifamily Building Professional |
| | | | | | | Energy Analytics & Audits | 1 | | BPI Certified Skilled Building Performance Professional |
| | | | | | | HVAC | 1 | | |
| Building Science Corporation | Training | No | Yes | No | Yes | Building Science & Design | 1 | No | None |
| BuildingGreen | Professional | No | Yes | No | No | None | 0 | No | None |
| CED GreenTech | Distributor | No | Yes | No | Yes | Distributed Energy Resources | 2 | No | None |
| Climate Master | Distributor | No | Yes | No | Yes | Geothermal | 2 | No | None |

| Organizations | Type | Offering Memberships | Offering News/ Research | Offering Events | Training Courses* | | | Certifications/ Credentials | |
|---|--------------|----------------------|-------------------------|-----------------|-------------------|------------------------------|-------------------|-----------------------------|---|
| | | | | | Offering Courses | Course Types | Number of Courses | Offering Certs. | Number and Title of Certs. |
| Earth Advantage | Training | No | Yes | No | Yes | Marketing & Sales | 4 | Yes | Sustainable Homes Professional |
| | | | | | | Building Science & Design | 2 | | |
| EcoVillage Ithaca | Training | No | Yes | Yes | Yes | Building Science & Design | 1 | No | None |
| Empire Clean Energy Supply | Distributor | No | No | No | Yes | Distributed Energy Resources | 1 | No | None |
| Energy & Environmental Building Alliance (EEBA) | Trade | No | No | Yes | Yes | Building Science & Design | 3 | No | None |
| | | | | | | Energy Analytics & Audits | 1 | | |
| Enterprise | Trade | No | Yes | No | No | None | 0 | No | None |
| FourSevenFive.com | Distributor | No | Yes | No | Yes | Building Science & Design | 1 | No | None |
| | | | | | | Building Shell | 1 | | |
| Geothermal Exchange Organization (GEO) (NY Chapter) | Professional | Yes | Yes | No | Yes | Building Science & Design | 1 | Yes | Certified GeoExchange Designer |
| | | | | | | Geothermal | 1 | | |
| Green Advantage | Professional | No | No | No | No | Outsourced/ Sponsored | 0 | Yes | GA Certified Associate GA Certified Practitioner |
| Green Building Initiative | Professional | Yes | No | No | Yes | Building Science & Design | 2 | No | None |
| Green Building Research Institute | Training | No | No | No | Yes | Building Science & Design | 3 | No | None |

| Organizations | Type | Offering Member-ships | Offering News/ Research | Offering Events | Training Courses* | | | Certifications/ Credentials | |
|---|--------------|-----------------------|-------------------------|-----------------|-------------------|------------------------------|-------------------|-----------------------------|---|
| | | | | | Offering Courses | Course Types | Number of Courses | Offering Certs. | Number and Title of Certs. |
| Greenbuild University | Training | No | No | No | Yes | Building Science & Design | 6 | No | None |
| | | | | | | Energy Analytics & Audits | 2 | | |
| GreenHome Institute | Professional | Yes | No | Yes | Yes | Building Science & Design | 1 | Yes | GreenHome Professional |
| Heatspring | Training | No | Yes | No | Yes | Building Science & Design | 3 | No | Courses offered for other organizations' certifications |
| | | | | | | Energy Analytics & Audits | 2 | | |
| | | | | | | HVAC | 1 | | |
| | | | | | | Distributed Energy Resources | 1 | | |
| High Performance Insulation Professionals (HPIP) | Professional | Yes | Yes | Yes | Yes | Building Shell | 3 | No | None |
| Hudson Valley Community College | Training | No | No | No | Yes | Distributed Energy Resources | 3 | Yes | Associate Degrees |
| | | | | | | Energy Analytics & Audits | 2 | | Courses offered for other organization's certifications |
| | | | | | | HVAC | 1 | | |
| | | | | | | Marketing & Sales | 1 | | |
| International Groundsource Heat Pump Association (IGSHPA) | Professional | Yes | Yes | Yes | Yes | Geothermal | 5 | Yes | Certified GeoExchange Designer |

| Organizations | Type | Offering Member-ships | Offering News/ Research | Offering Events | Training Courses* | | | Certifications/ Credentials | |
|--|--------------|-----------------------|-------------------------|-----------------|-------------------|------------------------------|-------------------|-----------------------------|--|
| | | | | | Offering Courses | Course Types | Number of Courses | Offering Certs. | Number and Title of Certs. |
| Living Future Institute | Professional | Yes | Yes | Yes | Yes | Building Science & Design | 9 | Yes | Living Future Accreditation |
| | | | | | | Building Shell | 2 | | |
| | | | | | | Energy Analytics & Audits | 5 | | |
| | | | | | | HVAC | 1 | | |
| National Association of Home Builders (NAHB) | Professional | Yes | Yes | Yes | Yes | Building Science & Design | 3 | Yes | Certified Green Professional |
| | | | | | | | | | Master Certified Green Professional |
| Northeast HERS Alliance (NEHERS) | Professional | Yes | Yes | No | Yes | Energy Analytics & Audits | Monthly Webinars | No | None |
| New York State Builders Association (NYSBA) | Professional | Yes | Yes | Yes | Yes | Building Science & Design | 2 | No | None |
| New York State Energy and Research Development Authority (NYSERDA) | Government | No | Yes | Yes | No | Outsourced/ Sponsored | 0 | Yes | NYSERDA Partners |
| North American Board of Certified Energy Practitioners (NABCEP) | Professional | Yes | Yes | Yes | Yes | Distributed Energy Resources | 5 | Yes | Solar Heating Installer Certification |
| | | | | | | Building Science | 1 | | PV Installation Professional |
| North American Technician Excellence | Training | No | Yes | No | No | Outsourced/ Sponsored | 0 | Yes | Professional Level HVAC Certifications |

| Organizations | Type | Offering Memberships | Offering News/ Research | Offering Events | Training Courses* | | | Certifications/ Credentials | |
|--|--------------|----------------------|-------------------------|-----------------|-------------------|------------------------------|-------------------|-----------------------------|---|
| | | | | | Offering Courses | Course Types | Number of Courses | Offering Certs. | Number and Title of Certs. |
| Northeast Energy Efficiency Partnerships (NEEP) | Trade | Yes | Yes | Yes | Yes | HVAC | 3 | No | None |
| | | | | | | Energy Analytics & Audits | 1 | | |
| Northeast Sustainable Energy Association (NESEA) | Professional | Yes | Yes | Yes | Yes | Building Science & Design | 5 | No | None |
| | | | | | | Energy Analytics & Audits | 2 | | |
| | | | | | | Building Shell | 1 | | |
| NY Solar Energy Society (NYSES) | Professional | Yes | Yes | Yes | Yes | Distributed Energy Resources | 1 | No | None |
| Passive House Academy | Training | No | Yes | Yes | Yes | Building Science & Design | 1 | Yes | Certified Passive House Tradesperson |
| | | | | | | Building Shell | 1 | | Certified Passive House Consultant & Designer |
| | | | | | | Energy Analytics & Audits | 1 | | |
| Passive House Institute U.S. (PHIUS) | Training | Yes | Yes | Yes | Yes | Building Science & Design | 1 | Yes | Passive House Consultant |
| | | | | | | Energy Analytics & Audits | 2 | | Passive House Builder |
| | | | | | | | | | Passive House Rater/ Verifier |
| Plumbing, Heating, Cooling Contractors Association (PHCC) (NY Chapter) | Trade | Yes | Yes | Yes | No | Outsourced/ Sponsored | 0 | No | None |
| RESNET | Professional | Yes | Yes | Yes | No | Outsourced/ Sponsored | 0 | Yes | HERS Rater |
| | | | | | | | | | HERS Provider |
| | | | | | | | | | Energy Smart Contractor |

| Organizations | Type | Offering Memberships | Offering News/ Research | Offering Events | Training Courses* | | | Certifications/ Credentials | |
|--|--------------|----------------------|-------------------------|-----------------|-------------------|------------------------------|-------------------|-----------------------------|---|
| | | | | | Offering Courses | Course Types | Number of Courses | Offering Certs. | Number and Title of Certs. |
| Rocky Mountain Institute (RMI) | Training | No | Yes | Yes | Yes | Energy Analytics & Audits | 1 | No | None |
| Roof Consultants Institute (RCI) Inc. | Professional | Yes | Yes | Yes | Yes | Building Shell | 7 | Yes | Registered Roof Consultant |
| | | | | | | | | | Registered Building Envelope Consultant |
| | | | | | | | | | Registered Exterior Wall Consultant |
| Solar Electric Power Association (SEPA) | Trade | Yes | Yes | No | Yes | Distributed Energy Resources | Monthly Webinars | No | None |
| Solar Energy Industries Association (SEIA) | Trade | Yes | Yes | Yes | No | None | 0 | No | None |
| U.S. Department of Energy (DOE) | Government | No | Yes | Yes | No | Outsourced/ Sponsored | 0 | No | None |
| EPA | Government | No | Yes | Yes | No | Outsourced/ Sponsored | 0 | Yes | ENERGY STAR Partner |
| | | | | | | | | | HVAC Quality Installation Training & Oversight Organization (H-QUITO) |
| U.S. Green Building Council (USGBC) Leadership in Energy & Environmental Design (LEED) | Government | No | Yes | Yes | No | Outsourced/ Sponsored | 0 | Yes | LEED Green Associate |
| | | | | | | | | | LEED AP |
| | | | | | | | | | LEED Green Rater |

| Organizations | Type | Offering Member-ships | Offering News/ Research | Offering Events | Training Courses* | | | Certifications/ Credentials | |
|--|--------------|-----------------------|-------------------------|-----------------|-------------------|--|-------------------|-----------------------------|--|
| | | | | | Offering Courses | Course Types | Number of Courses | Offering Certs. | Number and Title of Certs. |
| United Way of Long Island E3 Smart Build Training Center | Training | No | No | No | Yes | Recently opened, limited information available | | Yes | Recently opened, limited information available |
| Urban Green Council | Professional | No | Yes | Yes | Yes | Building Science & Design | 6 | Yes | Green Professional Certificate |
| Water Furnace | Distributor | No | Yes | No | Yes | Geothermal | 3 | No | None |
| | | | | | | HVAC | 1 | | |

* Trainings available to New York State market actors (offered online or in the Northeast).

Methods Used and Recommendations for Future Studies

The team conducted an extensive search for training, trade, and professional organizations *with at least some focus on NZE residential buildings, practices, and technologies* (Table A-8). The team included in its search national, northeast regional, and New York State local organizations and did not search of organizations with a focus in other regions or localities in the U.S. First, the team used its institutional knowledge of organizations to search each organization’s website for news, events, trainings, or certifications related to NZE residential buildings, technologies, and/or practices. Second, the team performed a web search for organizations using key words like “[market actor group] organization [in New York State/Northeast U.S./U.S.]” and searched each organization’s website for NZE-related news, events, trainings, and certifications. Third, the team asked interviewed building inspectors, architects, design-build firms, builders, property developers, HVAC contractors, solar PV contractors, and HERS raters about NZE-related organizations if they are aware of and are members of NZE-related organizations, and from which organizations they received training or certification (Table A-9). The team searched the websites of these organizations to verify that each provided NZE-related services.

The team categorized organizations and trainings by type. For organizations, the team used five categories: training organizations that mostly provide training classes, professional organizations for individual members of a profession, trade associations for businesses in an industry or trade, government organizations, and distributors. The team learned of several distributors that provided training to interviewed market actors and included these in Table A-8, but did not do an extensive search for distributors in the Northeast U.S. that provide trainings. The team focused its search efforts primarily on training, trade, and professional organizations. The team grouped the NZE-related training classes into seven categories based on the primary topic of the training: building science and design, distributed energy resources, energy analytics and audits, geothermal, HVAC, building shell, and marketing and sales. All of the trainings in these categories included at least some focus, and a few focused exclusively on NZE buildings, practices, or technologies. For the NZE-related certifications and credentials, the team provided the title of each as listed by the organizations that provide them. The team recommends using the same methodology in future studies to update the list.

Table A-9. NZE Market Actor Interview Guide Question Numbers and Secondary Sources Used for Market Indicator Estimates

| | Training, Trade, Professional Organizations | Building Inspectors | Architects, Design-Build, Builders, and Developers | HVAC and Solar PV Contractors | HERS Raters |
|---|---|---------------------|--|-------------------------------|-------------|
| Interview or survey question number(s) | Q11-Q14 | Q16-Q18 | Q46-Q51 | Q22-Q27 | Q20-Q25 |
| Secondary Data Sources | | | | | |
| Websites of the organizations listed in Table A-8 and other organizations for professions and trades of the interviewed market actor groups | | | | | |

A.3.2. Percentage of New York State NZE Market Actors Who are Aware of and Members of NZE-related Organizations, Who are Aware of and Received NZE-related Training, and Who are Aware of and Received a NZE-related Certification or Credential in the Past Two Years

Qualitative Market Indicator Description and Estimates

These three qualitative market indicators are the percentage of interviewed New York State NZE market actors who reported awareness of and membership with NZE-related organizations, the percentage who are aware of and received trainings from these organizations in the past two years, and the percentage who are aware of and received a certification or credential from these organizations in the past two years (Table A-10). The most common trainings and certifications reported by interviewed market actors are related to Passive House, LEED, and ENERGY STAR®.

These metrics are qualitative because the team asked market actors open-ended questions instead of providing a comprehensive list of answer choices in a close ended-question. The team had not completed its search of organizations at the time of the interviews and relied on interviewed market actors to identify some of the organizations.

Methods Used and Recommendations for Future Studies

The team asked interviewed building inspectors, architects, design-build firms, builders, property developers, HVAC contractors, solar PV contractors, and HERS raters about NZE-related organizations if they are aware of and are members of NZE-related organizations, and from which organizations they received training or certification (Table A-10). The team calculated the percentage of each market actor group that reported an organization, that reported being a member of an organization in the past two years, that reported awareness of trainings, that received a training in the past two years, that reported awareness of a certification or credential, and that received a certification or credential in the past two years (Table A-11). Interviewed market actors had difficulty recalling the names of training classes they or their employees took during the past two years but could provide the type of training and the organization that offered it.

The team recommends using the organizations listed in Table A-8 and Table A-10 to create close-ended interview questions in future studies. The team also recommends asking market actors about what organizations that provided their training instead of asking about specific types of training courses.

Table A-10. Percentage of Interviewed New York State NZE Market Actors Aware of, Members of, and Trained and Certified by NZE-related Organizations in the Past Two Years

| | Aware of Organization | Member of Organization | Aware of Training | Received Training | Aware of Certification | Received Certification |
|---|-----------------------|------------------------|-------------------|-------------------|------------------------|------------------------|
| Building Inspectors | 4 | 4 | 4 | 4 | 4 | 4 |
| International Code Council (ICC) | 50% | 25% | 50% | 25% | 0% | 0% |
| New England Building Officials Education Association (NEBOEA) | 50% | 25% | 50% | 25% | 0% | 0% |
| New York State Builders Association (NYSBA) | 25% | 25% | 0% | 0% | 0% | 0% |
| None | 0% | 25% | 0% | 50% | 100% | 100% |
| Architects | 3 | 3 | 3 | 3 | 3 | 3 |
| Passive House (PHIUS, PHI) | 67% | 67% | 67% | 67% | 67% | 67% |
| USGBC LEED | 33% | 33% | 33% | 33% | 0% | 0% |
| NYSERDA | 100% | N/A | 33% | 33% | 0% | 0% |
| EPA (ENERGY STAR) | 33% | N/A | 0% | 0% | 0% | 0% |
| American Institute of Architects (AIA) | 100% | 33% | 33% | 33% | 0% | 0% |
| NE Sustainable Energy Association (NESEA) | 33% | 0% | 33% | 33% | 0% | 0% |
| None | 0% | 0% | 0% | 0% | 33% | 33% |
| Design-Build | 4 | 4 | 4 | 4 | 4 | 4 |
| Passive House (PHIUS, PHI) | 50% | 50% | 50% | 50% | 25% | 25% |
| USGBC LEED | 75% | 25% | 0% | 0% | 0% | 0% |
| NYSERDA | 25% | N/A | 25% | 25% | 0% | 0% |
| National Association of Home Builders (NAHB) | 50% | 50% | 0% | 0% | 0% | 0% |
| NYS Geothermal | 25% | 25% | 0% | 0% | 0% | 0% |
| Manufacturers | 50% | N/A | 50% | 50% | 0% | 0% |
| Living Building Challenge | 25% | 0% | 0% | 0% | 0% | 0% |
| None | 0% | 0% | 0% | 0% | 75% | 75% |

| | Aware of Organization | Member of Organization | Aware of Training | Received Training | Aware of Certification | Received Certification |
|---|-----------------------|------------------------|-------------------|-------------------|------------------------|------------------------|
| Builders | 6 | 6 | 4 | 4 | 5 | 5 |
| Passive House (PHIUS, PHI) | 50% | 33% | 50% | 50% | 40% | 40% |
| USGBC LEED | 33% | 17% | 0% | 0% | 0% | 0% |
| NYSERDA | 100% | 0% | 0% | 0% | 0% | 0% |
| EPA (ENERGY STAR) | 33% | N/A | 0% | 0% | 0% | 0% |
| American Institute of Architects (AIA) | 17% | 0% | 0% | 0% | 0% | 0% |
| Other firms/raters who provide NZE education | 17% | N/A | 25% | 25% | 0% | 0% |
| NE Sustainable Energy Association (NESEA) | 17% | 0% | 0% | 0% | 0% | 0% |
| RESNET | 17% | 0% | 25% | 25% | 20% | 20% |
| Building Performance Institute (BPI) | 17% | N/A | 25% | 25% | 20% | 20% |
| Building Science Corporation | 17% | 0% | 0% | 0% | 0% | 0% |
| None | 33% | 33% | 50% | 50% | 40% | 40% |
| Developer | 1 | 1 | 1 | 1 | 1 | 1 |
| Passive House (PHIUS, PHI) | 100% | 0% | 0% | 0% | 0% | 0% |
| EPA (ENERGY STAR) | 100% | N/A | 100% | 100% | 100% | 100% |
| None | 0% | 100% | 0% | 0% | 0% | 0% |
| HVAC Contractors | 5 | 5 | 5 | 5 | 5 | 5 |
| Passive House (PHIUS, PHI) | 20% | 0% | 40% | 0% | 40% | 0% |
| NYSERDA | 20% | N/A | 20% | 20% | 0% | 0% |
| EPA (ENERGY STAR) | 20% | N/A | 20% | 20% | 20% | 20% |
| National Association of Home Builders (NAHB) | 20% | 0% | 20% | 20% | 20% | 0% |
| Building Performance Institute (BPI) | 40% | N/A | 40% | 40% | 40% | 40% |
| Building Science Corporation | 20% | 0% | 20% | 25% | 20% | 0% |
| International Ground Source Heat Pump Association | 40% | 20% | 40% | 40% | 40% | 40% |
| Association of Energy Engineers | 20% | 20% | 20% | 20% | 20% | 20% |
| Air Conditioning Contractors of America | 40% | 40% | 20% | 20% | 20% | 20% |

| | Aware of Organization | Member of Organization | Aware of Training | Received Training | Aware of Certification | Received Certification |
|---|-----------------------|------------------------|-------------------|-------------------|------------------------|------------------------|
| American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) | 40% | 40% | 0% | 0% | 0% | 0% |
| Advanced Energy | 20% | 0% | 0% | 0% | 0% | 0% |
| Green Building Advisor | 20% | 20% | 0% | 0% | 0% | 0% |
| Home Performance Coalition | 20% | 20% | 0% | 0% | 0% | 0% |
| New York State Geothermal Association | 20% | 20% | 0% | 0% | 0% | 0% |
| WaterFurnace | 20% | N/A | 20% | 20% | 20% | 20% |
| None | 0% | 20% | 0% | 0% | 0% | 0% |
| Solar PV Contractors | 7 | 7 | 7 | 7 | 7 | 7 |
| Passive House (PHIUS, PHI) | 14% | 0% | 0% | 0% | 0% | 0% |
| USGBC LEED | 14% | 14% | 14% | 14% | 14% | 14% |
| NYSERDA | 14% | N/A | 0% | 0% | 0% | 0% |
| EPA (ENERGY STAR) | 14% | N/A | 14% | 14% | 14% | 14% |
| Building Performance Institute (BPI) | 29% | N/A | 29% | 14% | 0% | 0% |
| International Ground Source Heat Pump Association | 14% | 0% | 0% | 0% | 0% | 0% |
| AirTight Services | 14% | 0% | 14% | 14% | 0% | 0% |
| Association of Energy Engineers (AEE) | 14% | 0% | 14% | 14% | 0% | 0% |
| HeatSpring | 14% | N/A | 14% | 14% | 0% | 0% |
| North American Board of Certified Energy Professionals (NABCEP) | 29% | 14% | 29% | 29% | 29% | 29% |
| RESNET | 14% | 0% | 14% | 14% | 0% | 0% |
| SunPower | 14% | 0% | 14% | 14% | 14% | 14% |
| Northeast Sustainable Energy Association (NESEA) | 14% | 0% | 0% | 0% | 0% | 0% |
| New York State Solar Energy Industry Association (NYSEIA) | 14% | 14% | 0% | 0% | 0% | 0% |
| Solar Energy Industry Association (SEIA) | 14% | 14% | 0% | 0% | 0% | 0% |

| | Aware of Organization | Member of Organization | Aware of Training | Received Training | Aware of Certification | Received Certification |
|---|-----------------------|------------------------|-------------------|-------------------|------------------------|------------------------|
| Upstate New York Chapter of the US Green Building Council | 14% | 0% | 0% | 0% | 0% | 0% |
| None / Don't know | 14% | 57% | 14% | 29% | 14% | 43% |
| HERS Raters | 5 | 5 | 5 | 5 | 5 | 5 |
| Passive House (PHIUS, PHI) | 100% | 100% | 100% | 80% | 100% | 80% |
| USGBC LEED | 100% | 60% | 100% | 60% | 100% | 60% |
| Upstate New York Chapter of the US Green Building Council | 20% | N/A | 0% | 0% | 0% | 0% |
| EPA (ENERGY STAR) | 100% | N/A | 100% | 40% | 100% | 40% |
| National Green Building Standard (NGBS) | N/A | N/A | 20% | 20% | 20% | 20% |
| RESNET | 100% | 100% | 100% | 100% | 100% | 100% |
| Building Performance Contractor Association (BPCA) | 20% | 20% | 0% | 0% | 0% | 0% |
| Building Products of America (BPA) | 20% | 20% | 0% | 0% | 0% | 0% |
| NE Sustainable Energy Association (NESEA) | 20% | 0% | 0% | 0% | 0% | 0% |
| Building Performance Institute (BPI) | 100% | N/A | 100% | 40% | 100% | 40% |
| American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) | 20% | 20% | 20% | 0% | 0% | 0% |
| Rochester Home Builders Association | 20% | 20% | 20% | 20% | 0% | 0% |

Table A-11. NZE Market Actor Interview Guide Question Numbers and Secondary Sources Used for Market Indicator Estimates

| | Training, Trade, Professional Organizations | Building Inspectors | Architects, Design-Build, Builders, and Developers | HVAC and Solar PV Contractors | HERS Raters |
|---|---|---------------------|--|-------------------------------|-------------|
| Interview or survey question number(s) | Q11-Q14 | Q16-Q18 | Q46-Q51 | Q22-Q27 | Q20-Q25 |
| Secondary Data Sources | | | | | |
| Websites of the organizations listed in Table A-8 and other organizations for professions and trades of the interviewed market actor groups | | | | | |

A.4. New York State NZE Market Actors' Awareness of and Experience with High-Performance Home Labels and Certifications

The team divided this market metric into four measurable market indicators.

1. Number and list of high-performance home labels/certifications and certifying organizations
2. Percentage of New York State NZE market actors aware of each high-performance home labels/certifications
3. Percentage of New York State NZE market actors who have worked on or who own a home that received a high-performance home label/certification
4. High-performance home labels/certifications selected by New York State NZE market actors as the best that communicates the value and features of NZE homes

A.4.1. Number and List of High-Performance Home Labels/Certifications and Certifying Organizations

Quantitative Market Indicator Description and Estimates

This quantitative market indicator is the list and count of existing high-performance home labels and certifications, and the certifying organizations (Table A-12). Some of the organizations and labels have not been used in New York State but could expand there in the future.

Table A-12. Number and List of High-Performance Home Labels and Certifications, and Certifying Organizations

| Organization | Home Label/Certificate |
|---|--|
| N=15 | N=20 |
| American Lung Association | Healthy House ¹ |
| Build It Green | Greenpoint Rated Home ² |
| Building Performance Institute | Home Energy Score (with DOE) |
| Earth Advantage | Earth Advantage Home ³ |
| Enterprise | Green Communities Home |
| Green Building Initiative | Green Globes Home ⁴ |
| GreenHome Institute | Greenstar Home ¹ |
| Living Future Institute | Living Building Challenge Net Zero Energy Building |
| National Association of Home Builders (NAHB) | National Green Building Standard Home |
| New York City Office of Environmental Remediation | New York City Green Property Certification |

| Organization | Home Label/Certificate |
|--|-------------------------------|
| Passive House Academy or Passive House Institute (PHIUS) | Passive House |
| RESNET | Home Energy Rating |
| US Department of Energy (DOE) | Zero Energy Ready Home |
| | Home Energy Score (with BPI) |
| EPA | ENERGY STAR Certified Home |
| | Indoor airPLUS Qualified Home |
| USGBC | LEED Certified Home |
| | LEED Silver Home |
| | LEED Gold Home |
| | LEED Platinum Home |

- ¹ Based in the Upper Midwest but may expand to other regions in the future.
- ² Based primarily in California but may expand to other regions in the future.
- ³ Based in the Pacific Northwest but may expand to other regions in the future.
- ⁴ Primarily for commercial and government buildings but also includes low-rise, new construction multifamily buildings.

Methods Used and Recommendations for Future Studies

The team conducted a review of the literature, used its institutional knowledge, asked interviewed market actors, and performed web searches for identifying high performance home labels and certifications and certifying organizations (Table A-13). For the web searches, the team used keywords such as “high performance home,” “energy efficient home,” “healthy home,” “green home certifications or labels” and “zero energy home certifications or labels.” The team compiled a comprehensive list of labels/certifications and certifying organizations, and summed the numbers to calculate the counts of each. The team recommends updating the list of high-performance home labels/certifications and certifying organizations before each future study.

Table A-13. NZE Market Actor Interview Guide Question Numbers and Secondary Sources Used for Market Indicator Estimates

| | Building Inspectors | Architects, Design-Build, Builders, Developers | HVAC and Solar PV Contractors | HERS Raters |
|--|---------------------|--|-------------------------------|-------------|
| Interview or survey question number(s) | Q21-Q22 | Q52-Q53 | Q28-Q29 | Q26-Q27 |
| Secondary Sources | | | | |
| Websites of the organizations listed in Table A-12 and other organizations for professions and trades of the interviewed market actor groups | | | | |

A.4.2. Percentage of New York State Market Actors Aware of and the Percentage Who Worked On or Owns a Home that Received a High-Performance Home Label/Certifications

Quantitative Market Indicator Description and Estimates

These two quantitative market indicators are the percentage of interviewed New York State market actors who reported awareness of high-performance home labels/certifications and the percentage who reported working on a home or owning a home that received a label or certification. Table A-14 shows the percentages of interviewed market actors who reported awareness and experience with each high-performance home label/certification. Table A-15 shows the percentage of new NZE and Non-NZE homebuyers who reported awareness of and whether their home received a high-performance home label/certification; the team asked homebuyers a shorter list of the most common certifications/labels reported by the other market actors. The most common home labels reported are ENERGY STAR Homes, LEED Homes, Passive Houses, and HERS Certificates.

Methods Used and Recommendations for Future Studies

The team asked the interviewed non-homebuyer New York State NZE market actors (i.e. building inspectors, architects, design-build firms, builders, property developers, HVAC contractors, solar PV contractors, and HERS raters) if they are aware of each of the high-performance home labels/certifications the team identified through secondary research (see Section A.4.1) and asked those who reported awareness if they worked on a home that received the label/certification (Table A-16). The team calculated the percentage of market actors who reported awareness of and experience with the labels/certification out of the total number of market actors in each group.

For interviewed New York State NZE and Non-NZE homebuyers, the team compiled a shorter list of high-performance home labels/certifications about which to ask. These labels/certifications are the most common mentioned by the non-homebuyer market actors. The team asked the homebuyers if they are aware of and if their home received each of the labels/certifications, and calculated the percentage of those who reported awareness and those who reporting owning a certified home out of the total number of interviewed homebuyers.

The team recommends using the same methodology in future studies but possibly shortening the list of labels/certifications to include only those currently applicable to New York State, the Northeast, or the U.S. as a whole. Several of the market actors the team interviewed complained about the length of the list and a few skipped the interview question due to time constraints.

Table A-14. Percentage of New York State Market Actors Aware of and the Percentage Who Worked on a Home that Received a High-Performance Home Label/Certifications

| | Building Inspectors | | Architects | | Design-Build | | Builders | | Developer | | HVAC Contractors | | Solar PV Contractors | | HERS Raters | |
|---|---------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|------------------|----------------|----------------------|----------------|----------------|----------------|
| N | 4 | | 2 | | 4 | | 4 | | 1 | | 3 | | 6 | | 5 | |
| Home Label/Certificate | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home |
| ENERGY STAR Home label by the EPA | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 83% | 100% | 40% |
| LEED Home Certification by the USGBC | 50% | 0% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 67% | 67% | 100% | 67% | 80% | 40% |
| Passive House Certification by the Passive House Academy or Passive House Institute | 25% | 25% | 100% | 100% | 100% | 50% | 100% | 25% | 100% | 0% | 67% | 0% | 67% | 50% | 100% | 40% |
| Indoor airPLUS Qualified Home label by the EPA | 0% | 0% | 100% | 50% | 100% | 75% | 75% | 75% | 100% | 100% | 67% | 33% | 0% | 0% | 100% | 20% |
| Zero Energy Ready Home label by the DOE | 50% | 50% | 100% | 50% | 100% | 50% | 75% | 50% | 100% | 0% | 67% | 33% | 0% | 0% | 100% | 20% |

| | Building Inspectors | | Architects | | Design-Build | | Builders | | Developer | | HVAC Contractors | | Solar PV Contractors | | HERS Raters | |
|--|---------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|------------------|----------------|----------------------|----------------|----------------|----------------|
| N | 4 | | 2 | | 4 | | 4 | | 1 | | 3 | | 6 | | 5 | |
| Home Label/Certificate | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home |
| Home Energy Rating Certificate by RESNET | 25% | 0% | 100% | 50% | 50% | 50% | 100% | 50% | 100% | 100% | 100% | 67% | 33% | 17% | 100% | 100% |
| National Green Building Standard Home label by the National Association of Home Builders | 75% | 0% | 100% | 0% | 75% | 25% | 75% | 25% | 100% | 0% | 33% | 33% | 17% | 0% | 80% | 0% |
| Home Energy Score by the DOE and BPI | 50% | 0% | 100% | 100% | 75% | 75% | 50% | 25% | 100% | 0% | 33% | 0% | 17% | 17% | 100% | 100% |
| Living Building Challenge Net Zero Energy Building label by the Living Future Institute | 0% | 0% | 100% | 50% | 75% | 0% | 75% | 0% | 100% | 0% | 0% | 0% | 0% | 0% | 40% | 20% |
| Healthy House Home label by the American Lung Association | 25% | 0% | 50% | 0% | 50% | 0% | 75% | 25% | 0% | 0% | 67% | 33% | 0% | 0% | 20% | 20% |
| Green Communities Home label by Enterprise | 0% | 0% | 50% | 0% | 50% | 50% | 50% | 25% | 0% | 0% | 33% | 0% | 0% | 0% | 0% | 0% |

| | Building Inspectors | | Architects | | Design-Build | | Builders | | Developer | | HVAC Contractors | | Solar PV Contractors | | HERS Raters | |
|---|---------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|------------------|----------------|----------------------|----------------|----------------|----------------|
| N | 4 | | 2 | | 4 | | 4 | | 1 | | 3 | | 6 | | 5 | |
| Home Label/ Certificate | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home | Aware of label | Worked on home |
| Earth Advantage Home label by Earth Advantage | 0% | 0% | 100% | 0% | 25% | 0% | 25% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 20% | 20% |
| New York City Green Property Certification by the NYC Office of Environmental Remediation | 0% | 0% | 50% | 0% | 25% | 25% | 50% | 0% | 0% | 0% | 33% | 0% | 0% | 0% | 60% | 0% |
| Green Globes Home label by the Green Building Initiative | 0% | 0% | 50% | 0% | 25% | 0% | 25% | 25% | 0% | 0% | 33% | 0% | 0% | 0% | 0% | 0% |
| Greenpoint Rated Home label by Build It Green | 0% | 0% | 50% | 0% | 25% | 0% | 25% | 0% | 0% | 0% | 33% | 33% | 0% | 0% | 0% | 0% |
| Greenstar Home label by the GreenHome Institute | 0% | 0% | 50% | 0% | 25% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

Table A-15. Percentage of New York State NZE and Non-NZE Homebuyers Aware of and the Percentage Who Owns a Home that Received a High-Performance Home Label/Certifications

| | NZE Homebuyers | | | | Non-NZE Homebuyers | | | | | | | |
|---|----------------|----------------|----------------|----------------|--------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | 2015 | | Total | | EE Single Family | | Single Family | | Multifamily | | Total | |
| N | 7 | | 18 | | 58 | | 11 | | 3 | | 72 | |
| Label | Aware of label | Home has label | Aware of label | Home has label | Aware of label | Home has label | Aware of label | Home has label | Aware of label | Home has label | Aware of label | Home has label |
| ENERGY STAR Home label by the EPA | 71% | 14% | 72% | 27% | 76% | 41% | 73% | 18% | 33% | 0% | 74% | 36% |
| LEED Building Certification by the USGBC | 43% | 0% | 67% | 27% | 28% | 2% | 45% | 0% | 67% | 0% | 32% | 1% |
| Passive House Certification by the Passive House Academy or Passive House Institute | 29% | 0% | 44% | 0% | 5% | 0% | 27% | 0% | 0% | 0% | 8% | 0% |
| National Green Building Standard Home label | 14% | 0% | 39% | 0% | 28% | 2% | 9% | 0% | 0% | 0% | 24% | 1% |
| Home Energy Rating Certificate by RESNET | 43% | 14% | 33% | 17% | 47% | 0% | 9% | 0% | 0% | 0% | 39% | 0% |
| Home Energy Score by the DOE and BPI | 14% | 0% | 33% | 0% | 33% | 0% | 9% | 0% | 0% | 0% | 28% | 0% |
| Zero Energy Ready Home label by the DOE | 43% | 14% | 22% | 0% | 0% | 2% | 9% | 0% | 0% | 0% | 1% | 1% |
| NAHB Emerald Certification | 0% | 0% | 0% | 5% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Indoor airPLUS Qualified Home label by the EPA | 0% | 0% | 0% | 5% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

Table A-16. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | Building Inspectors | Architects, Design-Build, Builders, Developers | HVAC and Solar PV Contractors | HERS Raters | NZE Home-buyers | Non-NZE Home-buyers |
|--|---------------------|--|-------------------------------|-------------|-----------------|---------------------|
| Interview or survey question number(s) | Q21-Q22 | Q52-Q53 | Q28-Q29 | Q26-Q27 | Q4-Q5 | Q21, Q36 |

A.4.3. High-Performance Home Labels/Certifications Selected by New York State NZE Market Actors as the Best that Communicates the Value and Features of NZE Homes

Quantitative Market Indicator Description and Estimates

This quantitative market indicator is: which of the high-performance home labels/certifications do market actors think best communicates the value and features of an NZE home. Table A-17 shows the percentage of interviewed market actors who reported one label/certification from the list of labels/certifications that they think best communicates NZE home values and features. The most common labels reported by interviewed market actors are no label, Passive House labels, ENERGY STAR Home labels, and LEED Certified Home label.

Methods Used and Recommendations for Future Studies

The asked interviewed building inspectors, architects, design-build firms, builders, property developers, HVAC contractors, solar PV contractors, and HERS raters which of the high-performance home labels/certifications (see Section A.4.2) best communicates to homebuyers the values and features specific to NZE homes (Table A-18). The team calculated the percentage who mentioned each label/certification or no labels/certifications. The team recommends using the same methodology in future studies.

Table A-17. High-Performance Home Labels/Certifications Selected by New York State NZE Market Actors as the Best that Communicates the Value and Features of NZE Homes

| Home Label Best at Communicating Value and Features of NZE Homes | Building Inspectors | Architects | Design-Build | Builders | Developer | HVAC Contractors | Solar PV Contractors | HERS Raters |
|---|---------------------|------------|--------------|----------|-----------|------------------|----------------------|-------------|
| N | 4 | 2 | 4 | 4 | 1 | 4 | 6 | 5 |
| None | 100% | 0% | 25% | 0% | 0% | 0% | 17% | 0% |
| Passive House Certification by the Passive House Academy or Passive House Institute US | 0% | 50% | 50% | 25% | 0% | 25% | 17% | 40% |
| ENERGY STAR Home label by the EPA | 0% | 50% | 25% | 0% | 0% | 25% | 17% | 0% |
| LEED Building Certification by the USGBC | 0% | 0% | 0% | 25% | 100% | 25% | 17% | 0% |
| Home Energy Rating Certificate by RESNET | 0% | 0% | 0% | 25% | 0% | 25% | 17% | 40% |
| Zero Energy Ready Home label by the DOE | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Indoor airPLUS Qualified Home label by the EP | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 20% |
| Home Energy Score by the DOE & BPI | 0% | 0% | 0% | 0% | 0% | 0% | 17% | 0% |
| Living Building Challenge Net Zero Energy Building label by the Living Future Institute | 0% | 0% | 0% | 25% | 0% | 0% | 0% | 0% |

Table A-18. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | Building Inspectors | Architects, Design-Build, Builders, Developers | HVAC and Solar PV Contractors | HERS Raters |
|--|---------------------|--|-------------------------------|-------------|
| Interview or survey question number(s) | Q23 | Q54 | Q30 | Q28 |

Appendix B. NZE Design and Construction Phase Market Metrics and Indicators

The team collected and analyzed data from multiple sources for estimates of four market metrics, which the team divided into 22 measurable market indicators. Eleven are quantitative indicators and eleven are qualitative indicators. Table B-1 lists the metrics and indicators, the indicators types (quantitative or qualitative), and the sources used to collect indicator estimates.

Table B-1. NZE Design & Construction Phase Market Metrics, Indicators, and Data Sources

| Market Metrics (MM) & Indicators (MI) | Type | Secondary Sources | Distributors | Training, Trade, & Professional Orgs | Building Inspectors | Architects, Builders & Developers | HVAC & Solar Contractors | HERS Raters | NZE Homebuyers | Non-NZE Homebuyers |
|---|--------------|-------------------|--------------|--------------------------------------|---------------------|-----------------------------------|--------------------------|-------------|----------------|--------------------|
| <i>MM1: Number of market actors working with NZE homes, and proportion of all residential market actors in New York State</i> | | | | | | | | | | |
| MI1a: Number of market actors who worked with new NZE homes completed in 2015 in New York State | Quantitative | X | | | X | X | X | X | | |
| MI1b: Number of market actors who worked with new NZE homes completed in 2015 or earlier in New York State | Quantitative | X | | | X | X | X | X | | |
| MI1c: Number of residential market actors in 2015 in New York State | Quantitative | X | | | | | | | | |
| MI1d: Proportion of residential actors in 2015 in New York State who worked on a new NZE home completed in 2015 | Quantitative | X | | | X | X | X | X | | |
| MI1e: Proportion of residential actors in 2015 in New York State who worked on a new NZE home completed in 2015 or earlier | Quantitative | X | | | X | X | X | X | | |
| <i>MM2: Characteristics and experience of market actors working with NZE homes</i> | | | | | | | | | | |
| MI2a: Interviewed New York State NZE market actors' firmographic characteristics | Quantitative | | X | X | X | X | X | X | | |
| MI2b: Number of new NZE and Non-NZE homes interviewed New York State NZE market actors worked on in 2015 | Quantitative | | | | X | X | X | X | | |

| Market Metrics (MM) & Indicators (MI) | Type | Secondary Sources | Distributors | Training, Trade, & Professional Orgs | Building Inspectors | Architects, Builders & Developers | HVAC & Solar Contractors | HERS Raters | NZE Homebuyers | Non-NZE Homebuyers |
|--|--------------|-------------------|--------------|--------------------------------------|---------------------|-----------------------------------|--------------------------|-------------|----------------|--------------------|
| MI2c: Percentage of all NZE homes built in New York State in 2015 that interviewed market actors worked on | Quantitative | X | | | | X | X | X | | |
| MI2d: Proportion of all homes interviewed New York State NZE market actors completed in 2015 that were new NZE homes | Quantitative | | | | X | X | X | X | | |
| MI2e: Interviewed New York State NZE market actors' average rating of their overall experience working on new NZE homes | Quantitative | | | | X | X | X | X | | |
| MI2f: Reasons for rating of overall experience with new NZE homes | Qualitative | | | | X | X | X | X | | |
| MI2g: Interviewed New York State NZE market actors' average rating of their experience working on new NZE code-built homes compared to their experience working on new Non-NZE homes | Quantitative | | | | X | X | X | X | | |
| MI2h: Reasons for rating of experience with new NZE vs. new Non-NZE code-built homes | Qualitative | | | | X | X | X | X | | |
| <i>MM3: Collaboration among New York State NZE design and construction market actors</i> | | | | | | | | | | |
| MI3a: Aspects of new NZE homes that require collaboration among New York State NZE design and construction market actors | Qualitative | | | | X | X | X | X | | |
| MI3b: When collaboration is required by New York State NZE design and construction market actors | Qualitative | | | | X | X | X | X | | |
| MI3c: Who New York State NZE design and construction market actors collaborate with on NZE projects | Qualitative | | | | X | X | X | X | | |
| MI3d: Why collaboration is important to New York State NZE design and construction market actors | Qualitative | | | | X | X | X | X | | |
| MI3f: How New York State NZE design and construction market actors collaborate | Qualitative | | | | X | X | X | X | | |
| <i>MM4: Major barriers to adopting NZE design and construction practices</i> | | | | | | | | | | |

| Market Metrics (MM) & Indicators (MI) | Type | Secondary Sources | Distributors | Training, Trade, & Professional Orgs | Building Inspectors | Architects, Builders & Developers | HVAC & Solar Contractors | HERS Raters | NZE Homebuyers | Non-NZE Homebuyers |
|--|-------------|-------------------|--------------|--------------------------------------|---------------------|-----------------------------------|--------------------------|-------------|----------------|--------------------|
| MI4a: Major technical barriers to adopting NZE design and construction practices | Qualitative | X | | | X | X | X | X | | |
| MI4b: Solutions for overcoming major technical barriers to adopting NZE design and construction practices | Qualitative | | | | X | X | X | X | | |
| MI4c: Major institutional barriers adopting NZE design and construction practices | Qualitative | X | | X | X | X | X | X | | |
| MI4d: Solutions for overcoming major institutional barriers adopting NZE design and construction practices | Qualitative | | | X | X | X | X | X | | |

B.1. Number of Market Actors Working with NZE Homes, and Proportion of All Market Actors in New York State

The team divided this metric into five measurable market indicators.

1. Number of market actors who worked with new NZE homes completed in 2015 in New York State
2. Number of market actors who worked with new NZE homes completed in 2015 or earlier in New York State
3. Number of residential market actors in 2015 in New York State
4. Proportion of residential actors in 2015 in New York State who worked on a new NZE home completed in 2015
5. Proportion of residential actors in 2015 in New York State who worked on a new NZE home completed in 2015 or earlier

B.1.1. Number of Market Actors Who Worked with New NZE Homes Completed in 2015 and in 2015 or Earlier in New York State; Number of Market Actors in New York State in 2015; Proportion of Market Actors in New York State in 2015 Who Worked on a NZE Home Completed in 2015 and in 2015 or Earlier

Quantitative Market Indicator Description and Estimates

Three of these five quantitative indicators are the count of building inspector offices, firms with architects, firms with builders, property development firms, HVAC contractor firms, solar PV firms, and HERS rater firms that completed a NZE home in 2015, that completed a NZE home in 2015 or earlier, and that were in business in New York State in 2015 (Table B-2). The other two of these five quantitative indicators are the proportion of all market actor's firms in New York State in 2015 that completed a NZE home in 2015 and the proportion that completed a NZE home in 2015 or earlier (Table B-2). Overall, NZE market actors comprised a small percentage of the New York State population of (residential) market actors.

Methods Used and Recommendations for Future Studies

The team collected counts of New York State market actor groups from multiple sources (Table B-3). Except for building inspector offices, the team collected counts of market actors from two or three sources in August 2015: Hoovers, InfoUSA, and a third source.

The total population counts include all market actor firms in New York State, including those that worked on non-residential projects and existing residential projects. The team was able to parse out from these counts how many architects, builders, and HVAC contractor firms worked on residential projects (vs. non-residential projects) based on national-level estimates; the team was unable to find this data for property developers, solar PV contractors and HERs raters. The team was also unable to parse out those who worked on new construction residential projects vs. existing building residential projects.

The count of market actors who worked on new NZE homes includes those who worked on NZE homes confirmed by the team and on NZE homes unconfirmed by the team. Unconfirmed new NZE homes are those reported by market actors in interviews or found by the team through web searches, and that the team was unable to verify whether the homes are actually NZE (see Section C.1 for methods the team used to estimate the number of NZE homes).

Building Inspector Offices: The team estimated the count of building inspector offices that worked on new NZE homes by counting the number towns and cities where NZE were built in 2015 or earlier. The team estimated the count of building inspector offices in New York State by counting the number of towns and cities with 1,000 or more residents according to the 2010 Census. The team identified building inspector offices in a sample of towns with 1,000 to 2,000 residents and did not identify building inspector offices in a sample of towns with fewer than 1,000 residents.

Table B-2. Number of New York State Market Actors Who Worked on a New NZE Home in 2015, and Proportion of All Market Actors in New York State

| | Offices of Building Inspectors | Architects & Design-Build (Designers) Firms | Builders & Design-Build (Builders) Firms | Property Developer Firms | HVAC Contractor Firms | Solar PV Contractor Firms | Energy Consulting and HERS Rater Firms |
|--|--------------------------------|---|--|--------------------------|-----------------------|---------------------------|--|
| NYS Total Population Estimates ¹ | | | | | | | |
| Hoovers | N/A | 4,160 | 3,325 | 368 | 2,662 | 157 | 262 |
| InfoUSA | N/A | 3,377 | 3,431 | 667 | 3,916 | 77 | 215 |
| Other Source ² | 894 | 942 | 3,000 | N/A | N/A | 152 | 42 |
| Average Total Population Size | 894 | 2,776 | 3,252 | 518 | 3,289 | 129 | 170 |
| Percent of Population Working in Residential Market ³ | 100% | 54% | 64% | N/A | 72% | N/A | N/A |
| Average Residential Population Size | 894 | 1,499 | 2,081 | 518 | 2,368 | 129 | 170 |
| Worked on confirmed NZE home in 2015 | 13 | 12 | 13 | 1 | 11 | 10 | 9 |
| Proportion of residential population | 1.5% | 0.8% | 0.6% | 0.2% | 0.5% | 7.8% | 5.3% |
| Worked on confirmed and unconfirmed NZE home in 2015 | 14 | 13 | 16 | 1 | 13 | 11 | 12 |
| Proportion of residential population | 1.6% | 0.9% | 0.8% | 0.2% | 0.5% | 8.5% | 7.1% |
| Worked on confirmed NZE home in 2015 or earlier | 20 | 14 | 15 | 2 | 16 | 15 | 11 |
| Proportion of residential population | 2.2% | 0.9% | 0.7% | 0.4% | 0.7% | 11.6% | 6.5% |
| Worked on confirmed and unconfirmed NZE home in 2015 or earlier | 24 | 15 | 21 | 2 | 20 | 16 | 14 |
| Proportion of residential population | 2.7% | 1.0% | 1.0% | 0.4% | 0.8% | 12.4% | 8.2% |

¹ Includes residential and non-residential market actors.

² Building inspectors: 2010 U.S. Census; Architects: NCARB & AIA, 2014; Builders: NYSBA, 2015; Solar PV Contractors: NYSERDA, 2015; HERS Raters: RESNET, 2015.

³ Building inspectors: assumed; Architects: AIA, 2015 (national estimate); Builders: NAHB & AGCA, 2015 (national estimate); Property Developers: not available; HVAC Contractors: U.S. BLS, 2010 (national estimate); Solar PV Contractors: not available; HERS Raters: not available.

Firms with Architects: The team included design-build firms in the count of firms with architects since these firms employed at least one architect. The team estimated the count of firms with architects that worked on new NZE homes through NYSERDA’s Comprehensive Residential Information System (CRIS) database, Passive House databases, interviews with market actors, and web searches of NZE homes and architectural firms. The team excluded from these counts the eight designers of new NZE homes who were also the buyers of their homes; these homebuyers reported that designing NZE homes is not part of their profession. The team estimated the count of firms with architects in New York State by computing the average count from three sources. The three sources include Hoovers (using SIC code 8712: Architectural Services), InfoUSA (using SIC codes 152109: Residential Designers; 152106: Designers; 871202: Architects; 871207: Architects & Builders Services; 871205: Architects and Engineers; 871209: Architectural Designers; 871213 Home Design & Planning Services), and the National Council and Architectural Registration Boards (NCARB, provided counts of architects) and American Institute of Architects (AIA, provided estimated number of architects per architect firm). The team estimated the percentage of architects who work on residential projects (vs. non-residential projects) from data from the AIA’s Architect Finder Database for 2015.

Firms with Builders: The team included design-build firms in the count of firms with builders since these firms employed at least one builder. The team estimated the count of firms with builders that worked on new NZE homes through NYSERDA’s CRIS database, Passive House databases, interviews with market actors, and web searches of NZE homes and home builder firms. The team excluded from these counts the six builders of NZE homes who were also the buyers of their homes; these homebuyers reported that building NZE homes is not part of their profession. The team estimated the count of firms with builders in New York State by computing the average count from three sources. The three sources include Hoovers (using Standard Industrial Classification (SIC) codes 152199: Single family housing new construction; 152201: Hotel and multifamily home construction), InfoUSA (using SIC codes 152112: Home builders; 154213: Building contractors; 871207: Architects & Builders Services), and an interview with the New York State Builders Association (NYSBA). The team estimated the percentage of builders who work on residential projects (vs. non-residential projects) from data from the National Association of Home Builders (NAHB) and Associated General Contractors of America (AGCA) for 2015.

Property Developer Firms: The team estimated the count of property developer that worked on new NZE homes through NYSERDA’s CRIS database, interviews with market actors, and web searches of NZE homes and property development firms. The team estimated the count of property developer firms in New York State by computing the average count from two sources. The two sources include Hoovers and InfoUSA (using SIC code 655202: Property Developers). The team was unable to find data regarding the percentages of property developers working in residential and non-residential sectors.

HVAC Contractor Firms: The team estimated the count of HVAC contractor firms that worked on new NZE homes through NYSERDA's CRIS database, recommendations from NYSERDA LRNC staff members, interviews with market actors, and web searches of NZE homes and HVAC contractor firms. The team estimated the count of HVAC contractor firms in New York State by computing the average count from two sources. The two sources include Hoovers (using SIC codes 17110401: Warm air heating and air conditioning contractor; 17110404: Sheet metal work 17110405: Ventilation and duct work contractor; 17619903: General electrical contractor) and InfoUSA (using SIC codes 171102: Heating contractors; 171120: Ventilating contractors; 171171 Air conditioning contractors and systems; 171198: Plumbing, heating, and air conditioning). The team estimated the percentage of builders who work on residential projects (vs. non-residential projects) from data from the U.S. Bureau of Labor Statistics for 2010.

Solar PV Contractor Firms: The team estimated the count of solar PV contractor firms that worked on new NZE homes through NYSERDA's CRIS database, recommendations from NYSERDA LRNC staff members, interviews with market actors, and web searches of NZE homes and solar PV contractor firms. The team estimated the count of solar PV contractor firms in New York State by computing the average count from three sources. The three sources include Hoovers (using SIC code 17110403: Solar energy contractor), InfoUSA (using SIC codes 171111: Contractor solar; 871139: Solar engineers; 874251: Solar heating consultants), and NYSERDA's list of approved solar contractors. The team was unable to find data regarding the percentages of solar PV contractors working in residential and non-residential sectors.

HERS Rater Firms: The team estimated the count of HERS rater firms that worked on new NZE homes through NYSERDA's CRIS database, RESNET, Passive House databases, interviews with market actors, and web searches of NZE homes. The team estimated the count of HERS rater firms in New York State by computing the average count from three sources. The three sources include Hoovers (using SIC code 87489904: Energy conservation consultant), InfoUSA (using SIC codes 653149: Energy raters; 874212: Energy consultants), and RESNET's list of certified HERS raters that service New York State. The team was unable to find data regarding the percentages of HERS raters and energy consultants working in residential and non-residential sectors.

The team recommends using the same methods in future studies and trying to identify a reliable count of the population of market actor firms in New York State that work in residential new construction (vs. residential, or all sectors).

Table B-3. NZE Market Actor Interview Guide Question Numbers and Secondary Sources Used for Market Indicator Estimates

| | Offices of Building Inspectors | Architects & Design-Build (Designers) Firms | Builders & Design-Build (Builders) Firms | Property Developer Firms | HVAC Contractor Firms | Solar PV Contractor Firms | HERS Rater Firms |
|--|--|--|---|--------------------------|---------------------------------|---------------------------|------------------|
| Interview or survey question number(s) | Q5-Q6 | Q4, Q23 | Q4, Q23 | Q4, Q23 | Q5-Q6 | Q5-Q6 | Q5-Q6 |
| Secondary sources for population estimates | Census (count of towns with 1,000 or more residents) | Hoovers | Hoovers | Hoovers | Hoovers | Hoovers | Hoovers |
| | | InfoUSA | InfoUSA | InfoUSA | InfoUSA | InfoUSA | InfoUSA |
| | | National Council of Architectural Registration Boards & American Institute of Architects | New York State Builders Association ; National Association of Home Builders | None | U.S. Bureau of Labor Statistics | NYSERDA Sun Contractors | RES-NET |

B.2. Characteristics and Experience of Market Actors Working on NZE Homes in New York State

The team divided this market metric into seven measurable indicators.

1. Interviewed New York State NZE market actors’ firmographic characteristics
2. Number of new NZE and Non-NZE homes interviewed New York State NZE market actors completing in 2015
3. Percentage of all NZE homes built in New York State in 2015 that interviewed market actors worked on.
4. Proportion of all homes interviewed New York State NZE market actors completed in 2015 that were new NZE homes
5. Interviewed New York State NZE market actors’ average rating of their overall experience working on new NZE homes
6. Reasons for rating of overall experience with new NZE homes
7. Interviewed New York State NZE market actors’ average rating of their experience working on new NZE code-built homes compared to their experience working on new Non-NZE homes
8. Reasons for rating of experience with new NZE vs. new Non-NZE code-built homes

B.2.1. New York State Interviewed NZE Market Actor Firmographic Characteristics

Quantitative Market Indicator Description and Estimates

This quantitative indicator is the percentage or averages of interviewed New York State NZE market actors' reported characteristics about their business. See below and Table B-4, Table B-5, and Table B-6 for the list of interviewed market actors and the firmographic characteristics the team collected.

Methods Used and Recommendations for Future Studies

To collect firmographic characteristics, the team divided interviewed market into four groups based on differences in the type of organizations: distributors of NZE-needed technologies that service New York State; NZE-related training, trade, and professional organizations with members in New York State; and, New York State NZE building inspectors, architects, design-build firms, builders, property developers, HVAC contractors, solar PV contractors, and HERS raters. The team asked interviewed market actors several questions about their business's characteristics (Table B-7).

Distributors: The team asked interviewed distributors of NZE-needed technology types open-ended questions about number of years in business, equipment types supplied, number of offices and employees in New York State, and territories they service (Table B-4). Since the team interviewed one distributor for each type of NZE-needed technology, the team reported the actual numbers and categories mentioned by each distributor instead of percentages of all distributors.

Training, Trade, and Professional Organizations: The team asked interviewed training, trade, and professional organizations about required memberships, number of members, change in membership, target audiences, types of services offered, and number of employees (Table B-5). Since the team interviewed five different types of organizations, the team reported the actual numbers and categories mentioned by each organization instead of percentages of all organizations.

Building Inspectors, Architects, Design-Build Firms, Builders, Property Developers, HVAC Contractors, Solar PV Contractors, and HERS Raters: The team asked all the other interviewed market actors about the following firmographic characteristics (Table B-6).

- Percentage of all projects that are residential: The team calculated the average percentage for each market actor group. The interview question is open-ended but the indicator is quantitative since market actors were required to report a percentage. Interviewed building inspectors could not answer this question.
- Percentage of all residential projects that are new construction (vs. existing buildings), single-family (vs. multifamily with 3 or more units), custom (vs. production or spec homes), and high performance (vs. built to code): The team calculated the average percentage reported by each

market actor group. The interview questions are open-ended but the indicators are quantitative since market actors were required to report a percentage. Interviewed building inspectors could not answer this question.

- Number of years in business and number of years working on NZE homes: The team computed the average years reported by each market actor group. Interviewed building inspectors could not answer these questions. The interview questions are open-ended but the indicators are quantitative since market actors were required to report a number.
- Number of offices, employees, and NZE-qualified employees in New York State: The team calculated the average numbers reported by each market actor group. The interview questions are open-ended but the indicators are quantitative since market actors were required to report a number.
- Number of market actors expecting more NZE homes in 2016: The team computed the percentage who reported they are expecting more NZE homes. The interview question is close-ended and the indicator is quantitative.
- Type of typical NZE customer: The team calculated the percentage of architects, design-build firms, builders, and property developers who reported that their typical NZE customer is a custom homebuyer, a spec homebuyer, a low-income or special needs homebuyer, or a market rate renter. The interview question is open-ended but the indicator is quantitative since market actors were required to provide one type.
- Types of primary and secondary services provided by market actors: The team reported types and counts of the primary and secondary services provided by market actor groups. The interview questions are close-ended and the indicator is quantitative.
- Service territories: The team calculated the percentage of interviewed market actors who reported providing services in each of the 10 economic regions of New York State. The interview question is open-ended but the indicator is quantitative since market actors were required to provide a county or economic region of New York State.

The team recommends using the same methodology in future studies.

Table B-4. Firmographic Characteristics of Interviewed Distributors of NZE-Needed Technologies that Service New York State

| Firmographics | HVAC | Window | Insulation | Solar |
|---|---|--|--|--|
| N | 1 | 1 | 1 | 1 |
| Total Years in Business | 83 Years | 13 Years | 22 Years | 13 Years |
| Equipment Types Supplied | HVAC, On-Demand Hot Water, Geothermal Systems | High Quality Windows, Air Sealing Products, Interior Finish Products | Structural Insulated Panels, Air Sealing and Insulation Products | Solar PV, Solar Thermal, Geothermal Components |
| Total Offices Inside NYS | 1 | 1 | 0 | 1 |
| Total Number of Employees in NYS Office | 30 | 15 | 0 | 4 |
| Total Offices Outside NYS | 1 | 3 | 1 | 0 |
| Service Territory | Northeastern New York State | Mid-Atlantic, Northeast, and Midwest | Northeast U.S. | Long Island, NY |

Table B-5. Firmographic Characteristics of Interviewed NZE-Related Training, Trade, and Professional Organizations

| Firmographics | NABCEP | IGSHPA | NYSBA | NESEA | NY Passive House |
|---|--------|----------|----------|----------|------------------|
| Required Membership | No | No | Yes | No | No |
| Number of Members | N/A | 5,000 | 3,000 | 1,500 | 260 |
| Change in Membership from Last Year | N/A | Decrease | Increase | Increase | Increase |
| Target Audience | | | | | |
| Manufacturers and Distributors | Yes | Yes | Yes | Yes | Yes |
| Building inspectors and planning officials | No | No | Yes | Yes | Yes |
| Architects | Yes | Yes | Yes | Yes | Yes |
| Builders/Developers | Yes | Yes | Yes | Yes | Yes |
| HVAC Contractors | Yes | Yes | Yes | Yes | Yes |
| Solar PV and other renewable generation contractors | Yes | Yes | No | Yes | No |
| Home energy raters and consultants | Yes | No | Yes | Yes | Yes |
| Real estate actors | No | No | Yes | No | Yes |
| Homeowners | No | No | No | No | Yes |

| Firmographics | NABCEP | IGSHPA | NYSBA | NESEA | NY Passive House |
|--|---------------|---------------|--------------|--------------|-------------------------|
| Types of Services Offered | | | | | |
| Trainings | Yes | Yes | Yes | Yes | Yes |
| Certifications | Yes | Yes | Yes | Yes | Yes |
| Industry/market research | Yes | Yes | Yes | Yes | Yes |
| Conferences & networking opportunities | Yes | Yes | Yes | Yes | Yes |
| Number of Employees | <10 | <10 | 3 | 12 | 1 |

Table B-6. Firmographic Characteristics of Interviewed New York State NZE Market Actors

| | Building Inspectors | Architects | Design-Build | Builders | Developers | HVAC Contractors | Solar Contractors | HERS Raters |
|--|---------------------|------------|--------------|----------|------------|------------------|-------------------|-------------|
| N | 4 | 3 | 4 | 6 | 1 | 5 | 7 | 5 |
| Average % Residential Projects | N/A | 77% | 92% | 100% | 100% | 73% | 68% | 98% |
| Average % New Construction (vs. Existing) | N/A | 23% | 85% | 68% | 100% | 52% | 15% | 64% |
| Average % Single-family (vs. Multifamily) | N/A | 92% | 55% | 78% | 0% | 88% | 84% | 48% |
| Average % Custom (vs. Production) | N/A | 100% | 58% | 83% | 0% | 80% | 97% | 24% |
| Average % High Performance (vs. Code-Built) | N/A | 90% | 98% | 98% | 100% | 75% | 30% | 23% |
| Average Years in business | N/A | 19.3 | 39.5 | 18.3 | 10 | 13 | 13 | 15 |
| Average Years working on NZE homes | N/A | 4 | 2 | 4.3 | 4 | 6 | 5 | 7 |
| Average Number of Offices in NYS | 1 | 1 | 1.3 | 1 | 1 | 1 | 1 | 1 |
| Average Number of Employees in NYS | 10 | 5.5 | 27.4 | 5.6 | 7 | 12 | 16 | 7 |
| Average Number of NZE-qualified employees | 7 | 4.7 | 7.3 | 3.8 | 1.0 | 10 | 8 | 4 |
| Average % Expecting more NZE homes next year | N/A | 100% | 100% | 67% | 100% | 60% | 71% | 100% |

| | Building Inspectors | Architects | Design-Build | Builders | Developers | HVAC Contractors | Solar Contractors | HERS Raters |
|---|--------------------------------|-----------------------------|-----------------------------|--------------------------|--------------------------|----------------------------------|--------------------------------------|------------------------------------|
| Typical NZE Customer Type | | | | | | | | |
| Custom homebuyer | N/A | 100% | 50% | 67% | 0% | N/A | N/A | N/A |
| Spec homebuyer | N/A | 0% | 50% | 17% | 0% | N/A | N/A | N/A |
| Low-income or special needs homebuyer or renter | N/A | 0% | 0% | 17% | 0% | N/A | N/A | N/A |
| Market rate renter | N/A | 0% | 0% | 0% | 100% | N/A | N/A | N/A |
| Primary Services | | | | | | | | |
| Service 1 (n) | Inspections and permitting (4) | Architecture and design (3) | Architecture and design (4) | Construction (6) | Property Development (1) | HVAC design and installation (5) | Solar PV design and installation (7) | Home energy audits and ratings (5) |
| Service 2 (n) | | | Construction (4) | Property Development (4) | | | | |
| Service 3 (n) | | | Property Development (4) | | | | | |
| Additional Services | | | | | | | | |
| Service 1 (n) | Zoning enforcement (1) | | HVAC (1), | | | Insulation and air sealing (1) | Lighting (2) | Consulting (4) |
| Service 2 (n) | | | NZE training (2) | | | Home Energy Audits (1) | Plumbing (2) | Architecture (1) |
| Service 3 (n) | | | Renewable Energy (1), | | | Plumbing (2) | Solar Thermal Water Heaters (1) | Home Label Certification (1) |
| Service 4 (n) | | | Energy Audits (1) | | | | Geothermal Heat Pumps (1) | NZE training (1) |

| | Building Inspectors | Architects | Design-Build | Builders | Developers | HVAC Contractors | Solar Contractors | HERS Raters |
|----------------------------|---------------------|------------|--------------|----------|------------|------------------|-------------------|-------------|
| Service Territories | | | | | | | | |
| Mid-Hudson | 25% | 67% | 25% | 50% | 0% | 40% | 43% | 60% |
| Long Island | 0% | 67% | 25% | 17% | 0% | 0% | 14% | 0% |
| New York City | 0% | 33% | 50% | 0% | 0% | 0% | 14% | 20% |
| Capital Region | 50% | 33% | 0% | 0% | 100% | 20% | 0% | 40% |
| Central | 0% | 0% | 0% | 0% | 0% | 20% | 14% | 20% |
| Southern Tier | 0% | 0% | 0% | 33% | 0% | 20% | 0% | 0% |
| Finger Lakes | 0% | 0% | 25% | 0% | 0% | 40% | 14% | 40% |
| Western | 25% | 0% | 25% | 0% | 0% | 40% | 29% | 20% |
| North Country | 0% | 0% | 0% | 0% | 0% | 20% | 0% | 0% |
| Mohawk Valley | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 20% |

Table B-7. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | Distributors | Training, Trade, Professional Organizations | Building Inspectors | Architects, Design-Build, Builders, Developers | HVAC and Solar PV Contractors | HERS Raters |
|--|--------------------|---|---------------------|--|-------------------------------|--------------------|
| Interview or survey question number(s) | Q1, Q4-Q5, Q13-Q16 | Q5-Q8 | Q5-Q7, Q24-Q26 | Q3-Q4, Q24, Q55-Q60 | Q2-Q4, Q7, Q31-Q35 | Q2-Q4, Q7, Q29-Q33 |

B.2.2. Interviewed Market Actors' Number of Reported NZE Homes and Total Homes, Percentage of All NZE Homes in New York State, and Proportion of Reported Total Homes that are NZE in 2015

Quantitative Market Indicator Description and Estimates

These three quantitative market indicators are the reported counts of new NZE homes and new total homes completed by New York State NZE market actors in 2015, the percentage of all NZE homes built in New York State in 2015 that market actors work on, and the proportion of all market actors' reported new homes that are NZE homes. Table B-8 displays the counts and proportions for each interviewed market actor group. NZE homes comprised between 19% and 86% of interviewed market actors' total single-family homes and between 0% and 100% of market actors' total multifamily units worked on in 2015.

For reference, the team located and confirmed 47 single-family NZE homes and 159 multifamily NZE units, and 11 unconfirmed single-family NZE homes and three multifamily NZE units built in New York State in 2015. For counts and proportions of all NZE homes in New York State, see Sections C.1 and C.2.

Methods Used and Recommendations for Future Studies

The team asked each interviewed New York State NZE market actor, including architects, design-build firms, builders, property developers, HVAC contractors, solar PV contractors, and HERS raters, how many custom and production or spec single-family NZE homes and total homes, and how many multi-family NZE and total units and buildings they completed in 2015 (Table B-9). The team summed the reported counts for each group and divided sum of reported NZE homes completed in 2015 by the reported total number of homes to calculate the proportion of total homes that were NZE homes. If the interviewed market actors reported a range of homes, the team computed the average of the range. The team recommends using this methodology in future studies.

Table B-8. Number of NZE Homes, Total Homes, and Proportion of Total Homes that are NZE Homes in 2015 Reported by Interviewed New York State NZE Market Actors

| | Number of NZE homes in 2015 | | | | | | | Number of total homes in 2015 | | | % of actors' homes in 2015 that were NZE | | |
|----------------------------|-----------------------------|--------------------|-------|----------------------------------|-------------|-----------|-----------------------------------|-------------------------------|-------------|-----------|--|-------------|-----------|
| | Single Family | | | | Multifamily | | | Single Family | Multifamily | | Single Family | Multifamily | |
| | Custom | Spec or Production | Total | % of all NZE homes in NYS (n=58) | Units | Buildings | % of all NZE units in NYS (n=162) | Total | Units | Buildings | Total | Units | Buildings |
| Architects (n=3) | 19 | 0 | 19 | 33% | 0 | 0 | 0% | 22 | 0 | 0 | 86% | 0% | 0% |
| Design-Build (n=4) | 8 | 6 | 14 | 24% | 3 | 1 | 2% | 75 | 103 | 2 | 19% | 3% | 50% |
| Builders (n=6) | 35 | 2 | 37 | 64% | 18 | 5 | 11% | 47 | 20 | 6 | 79% | 90% | 83% |
| Developers (n=1) | 0 | 0 | 0 | 0% | 156 | 13 | 96% | 0 | 156 | 13 | 0% | 100% | 100% |
| HVAC Contractors (n=5) | N/A | N/A | 36 | 62% | 88 | 2 | 54% | 81 | 88 | 2 | 44% | 100% | 100% |
| Solar PV Contractors (n=5) | N/A | N/A | 30 | 52% | 9 | 2 | 6% | 72 | 377 | 20 | 42% | 24% | 10% |
| HERS Raters (n=5) | N/A | N/A | 21 | 36% | 156 | 13 | 96% | 56 | 635 | 20 | 38% | 25% | 65% |

Table B-9. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | Architects, Design-Build, Builders, Developers | HVAC and Solar PV Contractors | HERS Raters |
|--|--|-------------------------------|-------------|
| Interview or survey question number(s) | Q4, Q23 | Q5-Q6 | Q5-Q6 |

B.2.3. Average Rating of New York State Interviewed NZE Market Actors' Overall Experience with NZE Homes and Experience with NZE homes Compared to Non-NZE Code-Built Homes, and Reasons for Ratings

Quantitative and Qualitative Market Indicators Descriptions and Estimates

Two of these market indicators are quantitative and two are qualitative. The two quantitative indicators are the average ratings interviewed New York State NZE market actors provided for their overall experience working on new NZE homes and for their experience with NZE homes compared to Non-NZE code-built homes.¹ Two qualitative indicators are the types of reasons market actors gave for each of their two ratings. Table B-10 shows the average ratings and the percentage who mentioned each of the categories of reasons for their ratings for each interviewed market actor. Most interviewed market actors rated their experience with NZE as excellent compared to their experience with Non-NZE homes; most also rated their NZE homes as not much more difficult to work on than their Non-NZE homes.

Methods Used and Recommendations for Future Studies

For interviewed New York State NZE market actors' overall experience with new NZE homes, the team asked building inspectors, architects, design-build firms, builders, property developers, HVAC contractors, solar PV contractors, and HERS rates to rate their experience on a scale of 0 to 10, where 0 means very poor and 10 means excellent (Table B-11). The team calculated the average rating for each market actor group. For market actors' experience with new NZE homes compared to Non-NZE code-built homes, the team asked them rate their experience on a scale of 0 to 10, where 0 means NZE homes are not any more difficult than Non-NZE code-built homes and 10 means NZE homes are much more difficult than Non-NZE code-built homes. The team calculated the average rating for each market actor group. The team also asked interviewed market actors' open-ended questions about the reasons for why they provided each of their two ratings, coded the reported reasons into categories, and calculated the percentage who reported each category.

The team recommends using the same methodology in future studies, but asking close-ended questions about the reasons why market actors gave their ratings and using the categories in Table B-10 or answer choices (with the option for an "Other" answer choice). In addition, the team recommends continuing to use code-built homes as the baseline comparison since, in the future, market actors with experience primarily with code-built homes may begin building NZE homes and would be unable to compare their NZE experience with anything but code-built homes.

¹ The majority of market actors reported some experience with code-built homes and thus were able to answer questions comparing NZE homes to code-built homes.

Table B-10. Type of Experience Overall with NZE Homes and With NZE Homes Compared to Non-NZE Homes Reported by Interviewed New York State NZE Market Actors

| | Building Inspectors | Architects | Design-Build | Builders | Developer | HVAC Contractors | Solar PV Contractors | HERS Raters |
|---|---------------------|------------|--------------|----------|-----------|------------------|----------------------|-------------|
| Overall NZE Experience Average Rating (0=very poor, 10=excellent) | | | | | | | | |
| N | 4 | 2 | 4 | 5 | 1 | 5 | 7 | 5 |
| Overall NZE Experience | 10 | 10 | 10 | 9 | 10 | 9 | 8 | 8 |
| Range | (9-10) | (10) | (9-10) | (8-10) | (10) | (6-10) | (7-9) | (6-10) |
| Reasons for rating (multiple response allowed): | | | | | | | | |
| Liked the learning process | 25% | 100% | 25% | 40% | 100% | 60% | 71% | 40% |
| Provides distinction from competitors | 0% | 50% | 0% | 40% | 0% | 0% | 0% | 20% |
| Resulted in successful projects | 0% | 0% | 50% | 20% | 100% | 0% | 0% | 20% |
| High customer satisfaction | 0% | 0% | 0% | 0% | 0% | 40% | 14% | 0% |
| Required collaboration is time consuming and/or challenging | 0% | 0% | 0% | 0% | 0% | 20% | 14% | 20% |
| NZE is expensive | 0% | 0% | 0% | 0% | 0% | 0% | 14% | 0% |
| None | 75% | 0% | 25% | 0% | 0% | 0% | 0% | 0% |
| NZE Experience Compared to Non-NZE Experience Average Rating (0=NZE no more difficult, 10=NZE much more difficult) | | | | | | | | |
| N | 3 | 2 | 1 | 3 | 1 | 5 | 7 | 5 |
| Inspecting (range) | 1 (0-2) | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Design (range) | N/A | 2 (2-3) | 8 (8) | 3 (0-6) | 8 (8) | N/A | N/A | N/A |
| Build (range) | N/A | 0 | 10 (10) | 5 (0-8) | 6 (6) | N/A | N/A | N/A |
| Develop property (range) | N/A | 0 | 5 (5) | 3 (0-6) | 3 (3) | N/A | N/A | N/A |
| HVAC (range) | N/A | N/A | N/A | N/A | N/A | 5 (0-8) | N/A | N/A |
| Solar PV (range) | N/A | N/A | N/A | N/A | N/A | N/A | 1 (0-5) | N/A |
| HERS Rating (range) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 2 (0-7) |

| | Building Inspectors | Architects | Design-Build | Builders | Developer | HVAC Contractors | Solar PV Contractors | HERS Raters |
|---|---------------------|------------|--------------|----------|-----------|------------------|----------------------|-------------|
| Reasons for rating (multiple response allowed): | | | | | | | | |
| NZE is easier because of required advanced planning | 33% | 0% | 0% | 0% | 0% | 20% | 14% | 0% |
| NZE clients more challenging to work with | 0% | 50% | 100% | 0% | 0% | 0% | 0% | 0% |
| NZE requires a whole-building approach in design and construction | 0% | 50% | 0% | 67% | 0% | 0% | 0% | 0% |
| NZE requires lots more collaboration and education | 0% | 0% | 0% | 0% | 100% | 20% | 0% | 0% |
| NZE site layout and home orientation more difficult | 0% | 0% | 0% | 0% | 100% | | 0% | 0% |
| Performing job more challenging and time consuming on NZE homes | 33% | 0% | 0% | 0% | 0% | 80% | 29% | 40% |
| No difference | 33% | 0% | 0% | 33% | 0% | 20% | 57% | 60% |

Table B-11. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | Building Inspectors | Architects, Design-Build, Builders, Developers | HVAC and Solar PV Contractors | HERS Raters |
|--|---------------------|--|-------------------------------|-------------|
| Interview or survey question number(s) | Q9, Q14 | Q30, Q36 | Q13, Q21 | Q13, Q19 |

B.3. Collaboration Among New York State NZE Design and Construction Market Actors

The team divided this market metric into five measurable market indicators.

1. Aspects of new NZE homes that require collaboration among New York State NZE design and construction market actors
2. When collaboration is required by New York State NZE design and construction market actors
3. Who New York State NZE design and construction market actors collaborate with on NZE projects
4. Why collaboration is important to New York State NZE design and construction market actors
5. How New York State NZE design and construction market actors collaborate

Aspects of New NZE Homes Requiring Collaboration among New York State NZE Market Actors, When Collaboration Occurs, Who Collaborates, Why Collaboration is Important, and How Collaboration Occurs

Qualitative Market Indicator Description and Estimates

These five qualitative market indicators are the percentages of interviewed New York State NZE design and construction market actors who reported important aspects of NZE homes that require collaboration, when collaboration occurs, who they collaborate with, why collaboration is important, and how they collaborate (Table B-12). These indicators are qualitative because the team asked open-ended questions in the interviews with market actors. Interviewed market actors reported collaborating on most aspects of an NZE home.

Methods Used and Recommendations for Future Studies

The team asked interviewed New York State NZE architects, design-build firms, builders, property developers, HVAC contractors, solar PV contractors, and HERS raters open-ended questions about which aspects of new NZE homes require collaboration with other market actors, why collaboration is important, and how they typically collaborate (Table B-13). Based on market actors' answers to these questions, the team identified when collaboration is required and with whom market actors collaborate. The team coded the answers into categories and computed percentages of market actors who mentioned each category.

In future studies, the team recommends asking five separate close-ended questions, one for each metric, and using the categories in Table B-12 as answer options for each question (with an "Other" option included).

Table B-12. Aspects of New NZE Homes Requiring Collaboration among New York State NZE Market Actors, When Collaboration Occurs, Who Collaborates, Why Collaboration is Important, and How Collaboration Occurs

| | Architects | Design-Build | Builders | Developers | HVAC Contractors | Solar PV Contractors | HERS Raters |
|--|------------|--------------|----------|------------|------------------|----------------------|-------------|
| Collaborate on... | 3 | 4 | 6 | 1 | 5 | 7 | 5 |
| Designing Home | 33% | 50% | 100% | 100% | 60% | 71% | 60% |
| Building Home | 100% | 75% | 100% | 100% | 20% | 0% | 100% |
| Installing HVAC/Geothermal System | 100% | 100% | 100% | 100% | 80% | 43% | 60% |
| Installing Solar PV System | 67% | 50% | 50% | 0% | 0% | 100% | 60% |
| Installing Building Shell Measures | 67% | 100% | 83% | 0% | 20% | 14% | 60% |
| Inspections/Permitting | 33% | 50% | 33% | 100% | 0% | 0% | 0% |
| Performing HERS Rating or Consultation | 67% | 100% | 83% | 100% | 20% | 14% | 100% |
| Financing or Selling Home | 0% | 0% | 17% | 0% | 0% | 0% | 0% |
| Not required | 0% | 0% | 0% | 0% | 20% | 0% | 0% |
| Collaborate during... | 3 | 4 | 6 | 1 | 4 | 7 | 5 |
| Home Design | 33% | 50% | 100% | 100% | 75% | 71% | 100% |
| Home Construction | 100% | 75% | 100% | 100% | 25% | 0% | 100% |
| HVAC/Geothermal System Installation | 67% | 100% | 100% | 100% | 100% | 43% | 60% |
| Solar PV System Installation | 67% | 50% | 50% | 0% | 0% | 100% | 60% |
| Building Shell Measures Installation | 67% | 100% | 83% | 0% | 25% | 14% | 60% |
| Inspections/Permitting | 33% | 50% | 33% | 100% | 0% | 0% | 0% |
| HERS Rating or Consultation | 67% | 100% | 83% | 100% | 25% | 14% | 100% |
| Financing and Selling Home | 0% | 0% | 17% | 0% | 0% | 0% | 0% |
| Collaborate with... | 3 | 4 | 6 | 1 | 4 | 7 | 5 |
| Building inspector | 33% | 50% | 33% | 100% | 0% | 0% | 0% |
| Architect/Designer | 33% | 50% | 100% | 100% | 75% | 71% | 60% |
| Builder/Developer | 100% | 0% | 0% | 0% | 25% | 57% | 100% |

| | Architects | Design-Build | Builders | Developers | HVAC Contractors | Solar PV Contractors | HERS Raters |
|---|------------|--------------|----------|------------|------------------|----------------------|-------------|
| Engineer | 67% | 100% | 50% | 0% | 0% | 0% | 0% |
| HVAC Contractor | 67% | 100% | 100% | 100% | 0% | 43% | 60% |
| Solar PV Contractor | 67% | 50% | 50% | 0% | 0% | 0% | 60% |
| Building shell contractors | 67% | 100% | 83% | 0% | 25% | 43% | 60% |
| HERS Rater or Consultant | 67% | 100% | 83% | 100% | 25% | 14% | 0% |
| Homebuyer/owner | 33% | 50% | 50% | 0% | 75% | 14% | 20% |
| Financing or real estate institutions | 0% | 0% | 17% | 0% | 0% | 0% | 0% |
| Collaborated because... | 3 | 4 | 6 | 1 | 4 | 7 | 5 |
| Needed for successful NZE rating | 100% | 75% | 100% | 100% | 25% | 0% | 100% |
| Onsite training | 33% | 50% | 67% | 100% | 0% | 0% | 20% |
| Minimize mistakes and costs | 0% | 0% | 17% | 0% | 25% | 14% | 0% |
| Determine correct models and sizes of needed technologies | 67% | 50% | 33% | 0% | 50% | 71% | 60% |
| Keep project on timeline | 0% | 25% | 17% | 0% | 0% | 0% | 40% |
| Quality assurance of construction or installation | | | | | 25% | 43% | 100% |
| Collaborated by... | 3 | 4 | 6 | 1 | 4 | 7 | 5 |
| Design charrettes | 67% | 75% | 17% | 0% | 25% | 29% | 0% |
| As needed in-person meetings (on- or off-site) | 33% | 75% | 83% | 100% | 75% | 14% | 100% |
| Regularly scheduled in-person meetings (on- or off-site) | 67% | 50% | 67% | 0% | 0% | 0% | 40% |
| General meetings (unspecified) | 0% | 0% | 17% | 0% | 100% | 86% | 0% |
| Phone calls and/or emails | 0% | 25% | 17% | 100% | 75% | 43% | 100% |

Table B-13. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | Architects, Design-Build, Builders, Developers | HVAC and Solar PV Contractors | HERS Raters |
|--|---|--------------------------------------|--------------------|
| Interview or survey question number(s) | Q25-Q27 | Q8-Q10 | Q8-Q10 |

B.4. Major Barriers to Adopting NZE Design and Construction Practices and Solutions for Overcoming Barriers

The team divided this market metric into four measurable indicators.

1. Major technical barriers to adopting NZE design and construction practices
2. Solutions for overcoming major technical barriers to adopting NZE design and construction practices
3. Major institutional barriers adopting NZE design and construction practices
4. Solutions for overcoming major institutional barriers adopting NZE design and construction practices

B.4.1. Major Technical Barriers to Adopting NZE Design and Construction Practices and Solutions for Overcoming Barriers

Qualitative Market Indicator Description and Estimates

These two qualitative market indicators are the types of technical barriers and challenges New York State NZE market actors experienced on their new NZE home projects, and the proposed solutions for overcoming these barriers or challenges (Table B-14). Technical barriers and challenges are those interviewed market actors reported experiencing in regards to a specific aspect of designing or building an NZE home, or designing and installing NZE-needed technologies. These barriers and challenges are what a market actor who is new to NZE home design or construction would likely experience on their first NZE home(s). Interviewed market actors reported up to 15 technical barriers and solutions per market actor group. These indicators are qualitative because the team asked market actors open-ended interview questions.

Table B-14. Types of Major Technical Barriers to Adopting NZE Design and Construction Practices, and Solutions for Overcoming Barriers (Multiple Responses Allowed)

| Barriers | Solutions | NZE Studies | Building Inspectors | | | |
|--|---|-------------|---------------------|--------------|----------|-----------|
| N | | 3 | 4 | | | |
| Orienting building for maximum solar exposure | Collaborate with solar PV contractors and architects before construction begins | 67% | 25% | | | |
| Insufficient air exchanges due to tight envelope | Perform air exchange tests more frequently | 33% | 50% | | | |
| Choosing foam insulation products (open vs. closed foam) | Contact manufacturers about breathability of foam | 0% | 50% | | | |
| Window orientation and sizing | Collaborate with window manufacturers and architects before construction begins | 0% | 25% | | | |
| Barriers | Solutions | NZE Studies | Architects | Design-Build | Builders | Developer |
| N | | 3 | 3 | 4 | 6 | 1 |
| Orienting building for maximum solar exposure | Collaborate with inspector, solar PV contractor, and/or homebuyer | 67% | 67% | 25% | 17% | 100% |
| | Make adjustments during construction | | 67% | 25% | 0% | 100% |
| Predicting actual energy performance | Collaborate with HERS raters | 67% | 33% | 25% | 17% | 100% |
| | Training and experience | | 33% | 25% | 33% | 0% |
| | None | | 0% | 0% | 33% | 0% |
| Inconsistent enforcement of building requirements across jurisdictions | None | 33% | 67% | 25% | 33% | 0% |
| Integrating daylighting | Perform modeling to measure daylighting's effect on energy usage | 33% | 33% | 25% | 0% | 0% |
| Integrating and achieving other home certification requirements | Training and experience | 33% | 33% | 25% | 17% | 0% |
| Balancing indoor air quality with energy drivers for varying occupant expectations | Collaborate with HVAC contractor and HERS rater | 33% | 33% | 0% | 17% | 0% |

| Barriers | Solutions | NZE Studies | Architects | Design-Build | Builders | Developer |
|--|--|-------------|------------------|--------------|----------|-----------|
| N | | 3 | 3 | 4 | 6 | 1 |
| Ensuring higher quality construction | Training and experience | 33% | 0% | 25% | 33% | 0% |
| Property line minimum setbacks | Collaborate with inspector and/or homebuyer | 33% | 0% | 25% | 17% | 0% |
| Including fireplaces, gas appliances, or wood stoves | Discourage homebuyers from including it | 0% | 67% | 50% | 50% | 0% |
| | Include decorative fireplace | | 33% | 0% | 0% | 0% |
| | Design home to include gas appliances before construction begins | | 33% | 50% | 0% | 100% |
| Integrating complex geometry in floor plan | Discourage homebuyers from including complex geometry | 0% | 33% | 25% | 17% | 0% |
| Long project timelines and delays | Training and experience | 0% | 33% | 25% | 17% | 100% |
| Designing for duct chases | Include in design of home, collaborate with HVAC contractor | 0% | 33% | 25% | 17% | 0% |
| Designing for plumbing pipes | Design so that plumbing is not on south side of building | 0% | 33% | 25% | 0% | 0% |
| Moisture management | Adjust materials to ensure proper moisture levels | 0% | 0% | 25% | 17% | 0% |
| Limitations on allowable glazing areas | None | 33% | 0% | 0% | 0% | 0% |
| Barriers | Solutions | N | HVAC Contractors | | | |
| N | | 3 | 5 | | | |
| Designing and installing HVAC ducting | Work with designers and builders on adequate duct chases | 33% | 50% | | | |
| Designing system to achieve sufficient air exchanges | None mentioned | 33% | 20% | | | |
| Designing cost-effective systems | Higher incentives or tax rebates | 0% | 40% | | | |
| Installing/calibrating geothermal systems | Training and experience | 0% | 40% | | | |
| Long project timelines and delays | None | 0% | 40% | | | |

| Barriers | Solutions | N | HVAC Contractors |
|---|--|-------------|----------------------|
| N | | 3 | 5 |
| Need exact measurements, no “rule of thumb” calculations | Experience and training | 0% | 20% |
| Lots of trial and error, limited engineering support | Experience and training | 0% | 20% |
| Limited methods for ensuring indoor air quality is maintained | None | 33% | 0% |
| Barriers | Solutions | NZE Studies | Solar PV Contractors |
| N | | 3 | 7 |
| Orienting building for maximum solar exposure | Collaborate with designer | 67% | 57% |
| Predicting electrical needs, particularly of HVAC equipment | Collaborate with designer, builder, HVAC contractor, HERS rater, and homebuyer | 33% | 43% |
| Installing equipment on small roofs | Install equipment off the home | 33% | 29% |
| Predicting roof shading, no guarantee of long-term solar exposure | None | 33% | 29% |
| Designing cost-effective system | Collaboration with designer and builder to integrate system elements into design | 0% | 57% |
| | Training and experience | | 43% |
| Working around exhaust vents, dormers, and plumbing | Collaboration with designer and builder during design | 0% | 43% |
| Working with roof setbacks, regulations, and codes | Collaboration with designer, builder, and inspector during design | 0% | 29% |
| Restrictions on tree removal and array size | None | 0% | 29% |
| Mounting equipment on highly insulated roofs | Install equipment off the home | 0% | 14% |
| Orienting building for maximum solar exposure | Collaborate with designer, inspector, homebuyer | 67% | 40% |

| Barriers | Solutions | NZE Studies | HERS Raters |
|---|--|-------------|-------------|
| N | | 4 | 5 |
| Modeling software and protocol can omit features | Training and experience | 33% | 40% |
| Predicting actual energy performance | Collaboration, training, experience | 33% | 20% |
| Limited tools to measure energy performance | None | 33% | 20% |
| Modeling specific equipment types (HVAC, water heaters) | Training and experience | 0% | 20% |
| Modeling individual units in multifamily building | Training and experience; use whole building approach | 0% | 20% |
| Small homes more difficult to achieve NZE | Discourage homes smaller than 1,600 sq. ft. | 0% | 20% |

Methods Used and Recommendations for Future Studies

The team performed a review of the secondary literature and asked interviewed New York State NZE building inspectors, architects, design-build firms, builders, property developers, HVAC contractors, solar PV contractors, and HERS raters open-ended questions about what technical challenges they experienced during the design and construction of their NZE homes and how they overcame the challenges (Table B-15). The team coded responses into categories and calculated the percentage of studies and market actors that reported each category; the team reported technical barrier types and solutions by market actor group since the barriers and solutions are different across the groups. In future studies, the team recommends two close-ended questions, one for each metric, and using the categories in Table B-14 as answer options for each question (with an “Other” option included).

Table B-15. NZE Market Actor Interview Guide Question Numbers and Secondary Sources Used for Market Indicator Estimates

| | Building Inspectors | Architects, Design-Build, Builders, and Developers | HVAC and Solar PV Contractors | HERS Raters |
|---|----------------------------|---|--------------------------------------|--------------------|
| Interview or survey question number(s) | Q7, Q12-Q13 | Q28, Q32-Q35 | Q11, Q17-Q20 | Q11, Q17-Q18 |
| Secondary Sources | | | | |
| Abri Sustainable Design & Consulting (2007), “Approaching Net Zero Energy in Existing Housing.” http://www.affordablecomfort.org/sites/default/files/cmhc_nze_exisitng_henderson_full_2008_s60376_w_.pdf | | | | |
| U.S. DOE (2011), “Challenges and Opportunities to Achieve 50% Energy Savings.” http://energy.gov/sites/prod/files/2013/11/f5/ba_tech_roadmap_0.pdf | | | | |
| NIST (National Institute of Standards and Technology) (2013), “Strategies to Achieve Net-Zero Energy Homes: A Framework for Future Guidelines.” http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1140.pdf | | | | |

B.4.2. Major Institutional Barriers to Adopting NZE Design and Construction Practices and Solutions for Overcoming Barriers

Qualitative Market Indicator Description and Estimates

These two qualitative market indicators are the types of institutional barriers and challenges New York State NZE market actors experienced on their new NZE home projects, and the proposed solutions for overcoming these barriers or challenges (Table B-16). Institutional barriers and challenges are those which interviewed market actors reported encountering in the broader new construction home market. These reported barriers and challenges are what the market needs to address or overcome to facilitate wider and faster adoption of NZE home design and construction practices. Interviewed market actors reported up to 20 institutional barriers and solutions. These indicators are qualitative because the team asked market actors open-ended interview questions.

Table B-16. Types of Major Institutional Barriers to Adopting NZE Design and Construction Practices and Solutions for Overcoming Barriers (Multiple Responses Allowed)

| Barriers | Solutions | Secondary Sources | Training, Trade, Professional Organizations | Building Inspectors | Architects | Design-Build | Builders | Developers | HVAC Contractors | Solar PV Contractors | HERS Raters |
|--|--|-------------------|---|---------------------|------------|--------------|----------|------------|------------------|----------------------|-------------|
| N | | 4 | 5 | 4 | 3 | 4 | 6 | 1 | 5 | 7 | 5 |
| Limited number of market actors with knowledge, experience, training, credibility | Increase marketing and training | 100% | 100% | 50% | 100% | 100% | 100% | 100% | 100% | 57% | 80% |
| Limited number of homebuyers, low market demand | Increase marketing and improve marketing messages | 75% | 100% | 0% | 33% | 75% | 50% | 0% | 40% | 29% | 80% |
| Limited or low awareness of NZE homes, or value/benefits | Increase marketing and improve marketing messages | 75% | 100% | 0% | 67% | 75% | 50% | 0% | 60% | 29% | 60% |
| Resistance or inertia to changing/updating traditional design/construction practices | Incentivize trainings, increase homebuyer demand through marketing | 50% | 60% | 25% | 67% | 75% | 67% | 100% | 80% | 0% | 20% |
| Lack of NZE employee certifications or curriculum | Encourage development of NZE-specific certifications | 25% | 60% | 0% | 33% | 50% | 50% | 0% | 20% | 0% | 20% |
| Lack of best practices in industry | None | 25% | 20% | 0% | 33% | 25% | 17% | 100% | 60% | 14% | 20% |
| Lack of industry acceptance of performance measurement tools and software | None | 25% | 0% | 0% | 0% | 0% | 17% | 0% | 0% | 0% | 40% |
| Lack of uniform building codes/requirements across jurisdictions | None | 25% | 100% | 0% | 33% | 25% | 33% | 0% | 20% | 29% | 0% |

| Barriers | Solutions | Secondary Sources | Training, Trade, Professional Organizations | Building Inspectors | Architects | Design-Build | Builders | Developers | HVAC Contractors | Solar PV Contractors | HERS Raters |
|---|---|-------------------|---|---------------------|------------|--------------|----------|------------|------------------|----------------------|-------------|
| Codes and regulations not designed for NZE and work against NZE design/construction | Update codes and regulations | 25% | 80% | 25% | 67% | 25% | 33% | 100% | 20% | 43% | 20% |
| Misconceptions about tight buildings | Improve marketing messages; build more spec homes | 25% | 0% | 25% | 33% | 50% | 17% | 0% | 20% | 0% | 20% |
| Limited or low marketing of NZE homes and benefits | Increase marketing | 25% | 100% | 0% | 67% | 75% | 67% | 100% | 0% | 0% | 0% |
| Controlling or minimizing design/construction costs | Training and experience | 25% | 20% | 0% | 33% | 50% | 50% | 100% | 60% | 29% | 0% |
| Unwillingness of designers and builders to pay higher cost or incremental cost to design or build NZE homes | Improve marketing messages about NZE value and payback | 0% | 40% | 50% | 33% | 25% | 50% | 0% | 20% | 0% | 0% |
| Misconceptions over magnitude of higher costs | Appraisals comparing NZE and Non-NZE homes | 0% | 40% | 50% | 0% | 50% | 67% | 100% | 0% | 0% | 0% |
| NZE homes are for a niche market and are not widely available | Train/Encourage more market actors to build NZE homes, increase availability of NZE homes on the market | 0% | 20% | 25% | 66% | 25% | 17% | 0% | 0% | 0% | 20% |
| Competing tax credits and incentives | None | 0% | 0% | 0% | 0% | 25% | 33% | 0% | 40% | 43% | 20% |
| NZE customer expectations too high | Temper customer expectations during design | 0% | 0% | 0% | 100% | 75% | 50% | 0% | 0% | 0% | 0% |
| Limited loan products that factor in energy efficiency or renewable generation | Encourage energy efficiency mortgages and similar mortgage products | 0% | 0% | 0% | 0% | 25% | 17% | 0% | 0% | 17% | 0% |

| Barriers | Solutions | Secondary Sources | Training, Trade, Professional Organizations | Building Inspectors | Architects | Design-Build | Builders | Developers | HVAC Contractors | Solar PV Contractors | HERS Raters |
|--|---|-------------------|---|---------------------|------------|--------------|----------|------------|------------------|----------------------|-------------|
| Reluctance to hire HERS rater early in design/construction phase | Bring HERS raters onboard during design of home | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 40% |
| Current electrical grid not optimal for solar | None | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 43% | 0% |

Methods Used and Recommendations for Future Studies

The team performed a review of the secondary literature and asked interviewed New York State NZE building inspectors, architects, design-build firms, builders, property developers, HVAC contractors, solar PV contractors, HERS raters and training, trade, and professional organizations open-ended questions about what challenges or barriers exist in the new construction market in New York State that inhibit the adoption of NZE design and construction practices, and proposed solutions for overcoming these barriers (Table B-17). The team coded responses into categories and calculated the percentage of studies and market actors that reported each category. In future studies, the team recommends two close-ended questions, one for each metric, and using the categories in Table B-16 as answer options for each question (with an “Other” option included).

Table B-17. NZE Market Actor Interview Guide Question Numbers and Secondary Sources Used for Market Indicator Estimates

| | Training, Trade, Professional Organizations | Building Inspectors | Architects, Design-Build, Builders, Developers | HVAC and Solar PV Contractors | HERS Raters |
|---|---|---------------------|--|-------------------------------|-------------|
| Interview or survey question number(s) | Q32 | Q8 | Q29 | Q12 | Q12 |
| Secondary Sources | | | | | |
| Heschong Mahone Group (HMG) (2012), “Road to ZNE.” http://www.energydataweb.com/cpucFiles/pdaDocs/849/PGE_Road_to_ZNE_Workplan_Final_051112.pdf | | | | | |
| Abri Sustainable Design & Consulting (2007), “Approaching Net Zero Energy in Existing Housing.” http://www.affordablecomfort.org/sites/default/files/cmhc_nze_exisitng_henderson_full_2008_s60376_w_.pdf | | | | | |
| TRC, RIA (2014), “Final Residential ZNE Market Characterization.” http://www.calmac.org/publications/TRC_Res_ZNE_MC_Final_Report_CALMAC_PGE0351.01.pdf | | | | | |
| NIST (National Institute of Standards and Technology) (2013), “Strategies to Achieve Net-Zero Energy Homes: A Framework for Future Guidelines.” http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1140.pdf | | | | | |

Appendix C. NZE Post-Construction Phase Market Metrics and Indicators

The team collected and analyzed data from multiple sources for estimates of 11 market metrics, which the team divided into 36 measurable market indicators. Twenty-two are quantitative indicators and 14 are qualitative indicators. Table C-1 lists the metrics and indicators, the indicators types (quantitative or qualitative), and the sources used to collect indicator estimates.

Table C-1. NZE Post-Construction Phase Market Metrics, Indicators, and Data Sources

| Market Metrics (MM) & Indicators (MI) | Type | Secondary Sources | Distributors | Training, Trade, & Professional Orgs | Building Inspectors | Architects, Builders & Developers | HVAC & Solar Contractors | HERS Raters | NZE Homebuyers | Non-NZE Homebuyers |
|--|--------------|-------------------|--------------|--------------------------------------|---------------------|-----------------------------------|--------------------------|-------------|----------------|--------------------|
| <i>MM1: Number, location and geography of NZE homes in New York State</i> | | | | | | | | | | |
| MI1a: Total number of NZE homes built in New York State in 2015 and earlier | Quantitative | X | | | | X | | | | |
| MI1b: Total number of NZE homes built in New York State in 2015 and earlier by location in New York State's economic regions | Quantitative | X | | | | X | | | | |
| MI1c: Total number of NZE homes built in New York State in 2015 and earlier by climate zone in New York State | Quantitative | X | | | | X | | | | |
| MI1d: Total number of NZE homes built in New York State in 2015 and earlier by participation in NYSERDA's LRNC program | Quantitative | X | | | | X | | | | |
| <i>MM2: Number of new NZE homes built and proportion of all new homes built/permitted in New York State</i> | | | | | | | | | | |
| MI2a: Number of new NZE homes built in New York State in 2015 | Quantitative | X | | | | X | | | | |
| MI2b: Number of all homes built/permitted in New York State in 2015 | Quantitative | X | | | | | | | | |
| MI2c: Proportion of all new homes built/permitted in New York State in 2015 that are new NZE homes | Quantitative | X | | | | | | | | |

NYS NZE Residential New Construction Baseline Study NZE Post-Construction Phase Market Metrics and Indicators

| Market Metrics (MM) & Indicators (MI) | Type | Secondary Sources | Distributors | Training, Trade, & Professional Orgs | Building Inspectors | Architects, Builders & Developers | HVAC & Solar Contractors | HERS Raters | NZE Homebuyers | Non-NZE Homebuyers |
|--|--------------|--------------------------|---------------------|---|----------------------------|--|-------------------------------------|--------------------|-----------------------|---------------------------|
| <i>MM3: Sale price, estimated market value, annual sales, and availability of NZE and Non-NZE homes in New York State</i> | | | | | | | | | | |
| MI3a: Estimated market value of NZE and Non-NZE homes in New York State in 2015 | Quantitative | X | | | | | | | | |
| MI3b: Sales price of NZE and Non-NZE homes in New York State in 2015 | Quantitative | X | | | | | | | | |
| MI3c: Average percent difference in building costs of NZE vs. Non-NZE homes in New York State in 2015 reported by interviewed NZE market actors | Quantitative | | | | | X | | | | |
| MI3d: Average percent difference in sales price of NZE vs. Non-NZE homes in New York State in 2015 reported by interviewed NZE market actors | Quantitative | | | | | | | | X | |
| MI3e: Annual number of NZE and Non-NZE homes sold or rented in New York State in 2015 | Quantitative | X | | | | | | | | |
| MI3f: Availability of NZE and Non-NZE homes on the market for sale or rent in New York State in 2015 | Quantitative | X | | | | | | | | |
| <i>MM4: Percentage of NZE and Non-NZE homebuyers who purchased their home before, during, and after it was built, and reasons for doing so</i> | | | | | | | | | | |
| MI4a: Percentage of New York State homebuyers who purchased a NZE and Non-NZE home in 2015 purchased the home before, during, and after it was built | Quantitative | | | | | | | | X | X |
| MI4b: Types of reasons for purchasing a NZE and Non-NZE home before, during, or after it was built | Qualitative | | | | | | | | X | X |
| <i>MM5: New York State homebuyers' awareness, willingness to pay for, and motivations to buy NZE and Non-NZE homes</i> | | | | | | | | | | |

| Market Metrics (MM) & Indicators (MI) | Type | Secondary Sources | Distributors | Training, Trade, & Professional Orgs | Building Inspectors | Architects, Builders & Developers | HVAC & Solar Contractors | HERS Raters | NZE Homebuyers | Non-NZE Homebuyers |
|--|--------------|-------------------|--------------|--------------------------------------|---------------------|-----------------------------------|--------------------------|-------------|----------------|--------------------|
| MI5a: Percentage of New York State NZE and Non-NZE homebuyers who are aware of NZE homes | Quantitative | | | | | | | | X | X |
| MI5b: Sources of New York State NZE and Non-NZE homebuyers' awareness of NZE homes | Qualitative | | | | | | | | X | X |
| MI5c: Level of priority New York State NZE and Non-NZE homebuyers place on making their next home a NZE home | Quantitative | | | | | | | | X | X |
| MI5d: Average percentage more in price New York State NZE and Non-NZE homebuyers are willing to pay for their next home to be a NZE home compared to a code-built home | Quantitative | | | | | | | | X | X |
| MI5e: Types of motivations New York State NZE and Non-NZE homebuyers reported for buying a NZE and Non-NZE home | Qualitative | | | | | | | | X | X |
| <i>MM6: New York State homebuyers' level of satisfaction with NZE and Non-NZE homes and reasons for their level of satisfaction</i> | | | | | | | | | | |
| MI6a: New York State NZE and Non-NZE homebuyers' level of overall satisfaction with their home | Quantitative | | | | | | | | X | X |
| MI6b: Types of reasons New York State NZE and Non-NZE homebuyers reported for their level of overall satisfaction with their home | Qualitative | | | | | | | | X | X |
| <i>MM7: Major downstream market barriers for selling and buying NZE homes and solutions for overcoming selling barriers</i> | | | | | | | | | | |
| MI7a: Major downstream market barriers for selling NZE homes | Qualitative | X | | | | X | | | | |
| MI7b: Solutions for overcoming major downstream market barriers for selling NZE homes | Qualitative | | | | | X | | | | |
| MI7c: Major downstream market barriers for buying NZE homes | Qualitative | X | | | | | | | X | ? |

| Market Metrics (MM) & Indicators (MI) | Type | Secondary Sources | Distributors | Training, Trade, & Professional Orgs | Building Inspectors | Architects, Builders & Developers | HVAC & Solar Contractors | HERS Raters | NZE Homebuyers | Non-NZE Homebuyers |
|---|--------------|-------------------|--------------|--------------------------------------|---------------------|-----------------------------------|--------------------------|-------------|----------------|--------------------|
| <i>MM8/MI8: New York State NZE and Non-NZE homebuyer demographic characteristics</i> | Quantitative | | | | | | | | X | X |
| <i>MM9/MI9: New York State NZE and Non-NZE home features and characteristics</i> | Quantitative | X | | | | | | | X | X |
| <i>MM10: Value associated with New York State NZE and Non-NZE home features and characteristics</i> | | | | | | | | | | |
| MI10a: Level of importance New York State NZE and Non-NZE homebuyers assign to energy-related features when they purchased their home | Qualitative | | | | | | | | X | X |
| MI10b: New York State NZE and Non-NZE homebuyers' most important home features included in their home at the time of purchase | Qualitative | | | | | | | | X | X |
| MI10c: New York State NZE and Non-NZE homebuyers' willingness to pay more for the important home features included their home | Qualitative | | | | | | | | X | X |
| MI10d: New York State NZE and Non-NZE homebuyers' most important home features not included in their home at the time of purchase | Qualitative | | | | | | | | X | X |
| MI10e: New York State NZE and Non-NZE homebuyers' willingness to pay more for the important home features not included their home | Qualitative | | | | | | | | X | X |
| MI10f: Features of Non-NZE homes New York State NZE market actors reported are requested by NZE homebuyers but are difficult to include in a NZE home | Qualitative | | | | X | X | X | X | | |
| <i>MM11: New York State market actors' understanding of NYSERDA's definition of NZE homes</i> | | | | | | | | | | |
| MI11a: Percentage of market actors who understand NYSERDA's NZE home definition | Quantitative | | | | X | X | X | X | X | X |

| Market Metrics (MM) & Indicators (MI) | Type | Secondary Sources | Distributors | Training, Trade, & Professional Orgs | Building Inspectors | Architects, Builders & Developers | HVAC & Solar Contractors | HERS Raters | NZE Homebuyers | Non-NZE Homebuyers |
|---|--------------|-------------------|--------------|--------------------------------------|---------------------|-----------------------------------|--------------------------|-------------|----------------|--------------------|
| MI11b: Percentage of market actors who suggest changes to NYSERDA's NZE home definition | Quantitative | | | | X | X | X | X | X | X |
| MI11c: Types of changes market actors suggest to NYSERDA's NZE home definition | Qualitative | | | | X | X | X | X | X | X |

C.1. Number, Location and Geography of NZE Homes in New York State

The team divided this market metric into four measurable market indicators.

1. Total number of NZE homes built in New York State in 2015 and earlier
2. Total number of NZE homes built in New York State in 2015 and earlier by location in New York State's economic regions
3. Total number of NZE homes built in New York State in 2015 and earlier by climate zone in New York State
4. Total number of NZE homes built in New York State in 2015 and earlier that participated in NYSERDA's LRNC program.

C.1.1. Number, Location, Geography, and NYSERDA LRNC Participation of NZE Homes in New York State

Quantitative Market Indicator Description and Estimates

These four quantitative indicators are the total count of confirmed and unconfirmed NZE homes built in New York State by year built and home type, the count of NZE homes by New York State economic region, the count of NZE homes by climate zone, and the count of homes by participation in NYSERDA's LRNC program (Table C-2). Overall, the team identified and confirmed 47 single-family NZE homes and 159 multifamily NZE units built in New York State in 2015, and 29 single-family NZE homes and 6 multifamily NZE units built before 2015. The team also identified but could not confirm 25 single-family NZE homes and 18 multifamily NZE units built in New York State in or before 2015.

Methods Used and Recommendations for Future Studies

The team used multiple sources to find an accurate count of NZE homes built in New York State in 2015 and earlier (Table C-3). First, the team used NYSERDA's CRIS database, which includes the HERS rating, builder, physical address, and year built for each home. Second, the team searched public databases, like the International Passive House Association's and US Passive House Institute's lists of passive houses, the Building Performance Index database, and NESEA's NZE case studies database. Third, the team performed web searches using key words such as "zero energy home [New York State or city]" or "passive house [New York State or city]." Last, the team used counts provided by interviewed NZE builders.

The team verified the NZE homes it identified from sources other than the CRIS data as actual NZE homes by searching the web, public databases, and builders' websites for each home's specifications. Many of the home's specifications were available in the public databases, on builder's websites, or on other websites such as homebuyer blogs, real estate listings, or case study or marketing websites. The team was unable to confirm 25 single-family homes and 18 multifamily units it identified as likely NZE homes due to the lack of any specifications about the home, such as the HERS rating. These homes were listed in databases or on builders' websites as NZE or near-NZE but specifications were unavailable to verify. In addition, the team was unable to find the physical address of some of the NZE homes but identified the county or economic region where all the homes are located through sources such as public databases and builders' websites.

The team computed the count of confirmed and unconfirmed NZE homes by type, year built, economic region, climate zone, and participation in NYSERDA's LRNC program. Home types include single-family and multifamily homes, and climate zones in New York State include zones 4, 5, and 6. The team recommends using the same methodology to update the counts.

Table C-2. Number, Location, Geography, and NYSERDA LRNC Participation of NZE Homes in New York State¹

| | Single Family | | | Multifamily | | | | | |
|-----------------------------------|---------------|----------|-------|-------------|-----------|----------|-----------|-------|-----------|
| | 2015 | Pre-2015 | Total | 2015 | | Pre-2015 | | Total | |
| | | | | Units | Buildings | Units | Buildings | Units | Buildings |
| Confirmed NZE Homes | | | | | | | | | |
| Total | 47 | 29 | 76 | 159 | 14 | 6 | 1 | 165 | 15 |
| Region | | | | | | | | | |
| Long Island | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| New York City | 0 | 0 | 0 | 3 | 1 | 6 | 1 | 9 | 2 |
| Mid-Hudson | 6 | 22 | 28 | 0 | 0 | 0 | 0 | 0 | 0 |
| Capital Region | 5 | 2 | 7 | 156 | 13 | 0 | 0 | 156 | 13 |
| North Country | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mohawk Valley | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Southern Tier | 26 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 0 |
| Central New York | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Finger Lakes | 3 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| Western New York | 6 | 3 | 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| Climate Zone | | | | | | | | | |
| 4 | 1 | 1 | 2 | 3 | 1 | 6 | 1 | 9 | 2 |
| 5 | 15 | 6 | 21 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 31 | 22 | 53 | 156 | 13 | 0 | 0 | 156 | 13 |
| NYSERDA LRNC Participation | | | | | | | | | |
| Yes | 19 | 20 | 49 | 159 | 14 | 0 | 0 | 159 | 14 |
| No | 28 | 9 | 37 | 0 | 0 | 6 | 1 | 6 | 1 |

| | Single Family | | | Multifamily | | | | | |
|--|---------------|----------|-------|-------------|-----------|----------|-----------|-------|-----------|
| | 2015 | Pre-2015 | Total | 2015 | | Pre-2015 | | Total | |
| | | | | Units | Buildings | Units | Buildings | Units | Buildings |
| Unconfirmed NZE Homes² | | | | | | | | | |
| Total | 11 | 14 | 25 | 3 | 1 | 15 | 1 | 18 | 2 |
| Region | | | | | | | | | |
| Long Island | 5 | 9 | 13 | 3 | 1 | 0 | 0 | 3 | 1 |
| New York City | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mid-Hudson | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Capital Region | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| North Country | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mohawk Valley | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Southern Tier | 2 | 3 | 5 | 0 | 0 | 15 | 1 | 15 | 1 |
| Central New York | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Finger Lakes | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Western New York | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Climate Zone | | | | | | | | | |
| 4 | 5 | 9 | 14 | 3 | 1 | 0 | 0 | 3 | 1 |
| 5 | 4 | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 2 | 3 | 5 | 0 | 0 | 15 | 1 | 15 | 1 |

| | Single Family | | | Multifamily | | | | | |
|--|---------------|----------|-------|-------------|-----------|----------|-----------|-------|-----------|
| | 2015 | Pre-2015 | Total | 2015 | | Pre-2015 | | Total | |
| | | | | Units | Buildings | Units | Buildings | Units | Buildings |
| Total Confirmed and Unconfirmed NZE Homes | | | | | | | | | |
| Total | 58 | 43 | 101 | 162 | 15 | 21 | 2 | 183 | 17 |
| Region | | | | | | | | | |
| Long Island | 6 | 10 | 15 | 3 | 1 | 0 | 0 | 3 | 1 |
| New York City | 0 | 0 | 0 | 3 | 1 | 6 | 1 | 9 | 2 |
| Mid-Hudson | 8 | 22 | 30 | 0 | 0 | 0 | 0 | 0 | 0 |
| Capital Region | 7 | 3 | 10 | 156 | 13 | 0 | 0 | 156 | 13 |
| North Country | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mohawk Valley | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Southern Tier | 28 | 3 | 31 | 0 | 0 | 15 | 1 | 15 | 1 |
| Central New York | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Finger Lakes | 3 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| Western New York | 6 | 3 | 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| Climate Zone | | | | | | | | | |
| 4 | 6 | 10 | 16 | 6 | 2 | 6 | 1 | 12 | 3 |
| 5 | 19 | 8 | 27 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 33 | 25 | 58 | 156 | 13 | 15 | 1 | 171 | 14 |
| NYSERDA LRNC Participation² | | | | | | | | | |
| Yes | 19 | 20 | 49 | 159 | 14 | 0 | 0 | 159 | 14 |
| No | 28 | 9 | 37 | 0 | 0 | 6 | 1 | 6 | 1 |

¹ The team found evidence that the “unconfirmed” homes are NZE homes but sufficient specifications were not available verify and confirm.

² None of the unconfirmed NZE homes participated in NYSERDA’s LRNC program.

Table C-3. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | Building Inspectors | Architects, Design-Build, Builders, Developers | HVAC and Solar PV Contractors | HERS Raters |
|---|----------------------------|---|--------------------------------------|--------------------|
| Interview or survey question number(s) | Q5-Q6 | Q4, Q23 | Q5-Q6 | Q5-Q6 |
| Secondary Sources | | | | |
| U.S. Department of Housing and Urban Development (HUD). "State of Cities Data Systems (SOCDS) Building Permits Database, New York, 2015." Accessed June 2016 at http://socds.huduser.gov/permits/ | | | | |
| NYSERDA. "CRIS Database: Low-Rise New Construction Program, 2010-2016." | | | | |
| Passive House Institute US. "Certified Projects Database." Accessed July-August 2016 at http://www.phius.org/phius-certification-for-buildings-and-products/certified-projects-database | | | | |
| International Passive House Association. "Passive House Database." Accessed July-August 2016 at http://www.passivhausprojekte.de/index.php?lang=en | | | | |
| Northeast Sustainable Energy Association (NESEA). "Zero Energy Case Study Database." Accessed July-August 2016 at http://netzeroenergycoalition.com/case-studies/ | | | | |
| US Office of Energy Efficiency and Renewable Energy, Department of Energy. "Building Performance Database." Accessed July-August 2016 at http://energy.gov/eere/buildings/building-performance-database | | | | |
| Zero Energy Project. "Zero Energy Homes for Sale and Zero Energy Developments & Multifamily Building Projects." Accessed July-August at http://zeroenergyproject.org/find/ | | | | |

C.2. Number of New NZE Homes Built and Proportion of All New Homes Built in New York State in 2015

The team divided this market metric into three measurable market indicators.

1. Number of new NZE homes built in New York State in 2015
2. Number of all homes built in New York State in 2015
3. Proportion of all new homes built in New York State in 2015 that are new NZE homes

C.2.1. Number of New NZE Homes Built and New Total Homes Built/Permitted in New York State in 2015, and the Percentage of Total Homes Built/Permitted in 2015 that are NZE Homes

Quantitative Market Indicator Description and Estimates

The three quantitative indicators are the count of new single- and multi-family NZE units built in New York State in 2015, the number of all new single- and multi-family units permitted in 2015, and the percentage of all new homes built/permitted in New York State in 2015 that are NZE homes (Table C-4). The team was unable to find reliable, up-to-date data on new homes built or sold in New York State in 2015 so the team used as a proxy the number of new homes permitted in New York State in 2015 provided by the U.S. Department of Housing and Urban Development (HUD). The team found that NZE homes built in 2015 represent a very small percentage of building permits issued in New York State in 2015.

Table C-4. Number of Building Permits, Confirmed and Unconfirmed NZE Homes, and Proportion of New Building Permits that are NZE Homes in New York State in 2015 (U.S. HUD)

| | 1-Unit Permits | 2-Unit Permits | 3-4 Unit Permits | 5+ Unit Permits | Total Permits | Total Built ¹ |
|---|----------------|----------------|------------------|-----------------|---------------|--------------------------|
| Number of New Building Permits | 7,623 | 1,032 | 1,170 | 61,735 | 71,560 | 15,633 |
| Confirmed NZE Homes Built in 2015 | 47 | 0 | 3 | 156 | 206 | 206 |
| Proportion of New Building Permits that are Confirmed NZE Homes | 0.6% | 0% | 0.3% | 0.3% | 0.3% | 1.3% |
| Confirmed and Unconfirmed NZE Homes Built in 2015 | 58 | 0 | 6 | 156 | 220 | 220 |
| Proportion of New Building Permits that are Confirmed and Unconfirmed NZE Homes | 0.8% | 0% | 0.5% | 0.3% | 0.3% | 1.4% |

¹ Calculated by subtracting the total housing units in NYS reported in the 2014 American Community Survey (ACS; n=8,191,528) from the total housing units in NYS reported in the 2015 ACS (n=8,207,161)

Methods Used and Recommendations for Future Studies

The team performed an extensive search for a reliable and current source for the number of new homes built and/or sold in New York State in 2015 but was unable to find one. The team searched real estate listing websites such as Zillow, Realtor, Trulia, and Redfin; trade associations like the National Association of Builders, the New York State Home Builders Association, and the New York State Association of Realtors; government agencies like the New York State Assembly Committee on Housing, and databases like the U.S. HUD Building Permit Database, and the Census and American Community Survey; and, industry data providers such as Dodge Data and Analytics, the Joint Center for Housing Studies at Harvard University, InfoUSA, and others (Table C-5). These sources did not report residential construction and sales data, reported the data at the national- or regional- instead of the state-level, or reported state-level data in the aggregate instead of by building type.

The team did find the number of new building permits for 1-unit, 2-unit, 3-4 unit, and 5 or more unit buildings in New York state in 2015 through U.S. HUD and used it as a proxy for total homes built. The number of permits is an overestimation of the number of homes built since not all permits resulted in a built home or residential building but is the only data available for each of the different residential building types for New York State. The team also found an estimate for the total homes built by subtracting the total number of units reported in the 2014 ACS from the total number of units reported in the 2015 ACS.

The team used multiple sources to find an accurate count of NZE homes built in New York State in 2015. First, the team used NYSERDA's CRIS database, which includes the HERS rating of each home. Second, the team searched public databases, like the International Passive House Association's and U.S. Passive House Institute's lists of passive houses, the Building Performance Index, and NESEA's NZE case studies. Third, the team performed web searches using key words such as "zero energy home [New York or city]." Last, the team used counts provided by interviewed NZE builders and verified the counts using the aforementioned sources and builders' websites. The team was unable to confirm 11 of the homes it identified as likely NZE homes due to the lack of any specifications about the home, such as the HERS rating. The team divided the count of confirmed NZE homes and the count of all NZE homes (confirmed and unconfirmed) by the total number of building permits issued for 1-unit, 2-unit, 3-4 unit, and 5 or more unit homes in New York State in 2015.

The team recommends using the same methodology to find counts of new NZE homes and all new homes built in New York State. A reliable and current source(s) for all new homes built and/or sold in New York State may become available for 2015 and subsequent years in the future but, until this occurs, the team recommends using the number of new residential building permits as a proxy since data are available for New York State.

Table C-5. NZE Market Actor Interview Guide Question Numbers and Secondary Sources Used for Market Indicator Estimates

| | Building Inspectors | Architects, Design-Build, Builders, Developers | HVAC and Solar PV Contractors | HERS Raters |
|---|----------------------------|---|--------------------------------------|--------------------|
| Interview or survey question number(s) | Q5-Q6 | Q4, Q23 | Q5-Q6 | Q5-Q6 |
| Secondary Sources | | | | |
| U.S. Department of Housing and Urban Development (HUD). "State of Cities Data Systems (SOCDS) Building Permits Database, New York, 2015." Accessed June 2016 at http://socds.huduser.gov/permits/ | | | | |
| NYSERDA. "CRIS Database: Low-Rise New Construction Program, 2010-2016." | | | | |
| Passive House Institute US. "Certified Projects Database." Accessed July-August 2016 at http://www.phius.org/phius-certification-for-buildings-and-products/certified-projects-database | | | | |
| International Passive House Association. "Passive House Database." Accessed July-August 2016 at http://www.passivhausprojekte.de/index.php?lang=en | | | | |
| Northeast Sustainable Energy Association (NESEA). "Zero Energy Case Study Database." Accessed July-August 2016 at http://netzeroenergycoalition.com/case-studies/ | | | | |
| US Office of Energy Efficiency and Renewable Energy, Department of Energy. "Building Performance Database." Accessed July-August 2016 at http://energy.gov/eere/buildings/building-performance-database | | | | |
| Zero Energy Project. "Zero Energy Homes for Sale and Zero Energy Developments & Multifamily Building Projects." Accessed July-August at http://zeroenergyproject.org/find/ | | | | |

C.3. Sale Price, Estimated Market Value, Annual Sales, and Availability of NZE and Non-NZE Homes in New York State

The team divided this market metric into six measurable market indicators.

1. Estimated market value of NZE and Non-NZE homes in New York State in 2015
2. Sales price of NZE and Non-NZE homes in New York State in 2015
3. Average percent difference in building costs of NZE vs. Non-NZE homes in New York State in 2015 reported by interviewed NZE market actors
4. Average percent difference in sales price of NZE vs. Non-NZE homes in New York State in 2015 reported by interviewed NZE market actors
5. Annual number of NZE and Non-NZE homes sold or rented in New York State in 2015
6. Availability of NZE and Non-NZE homes on the market for sale or rent in New York State in 2015

C.3.1. Sale Price and Estimated Market Value of NZE Homes and Non-NZE Homes in New York State in 2015

Quantitative Market Indicator Description and Estimates

These two quantitative indicators are the average sales price and estimated market value of confirmed NZE single-family homes and surveyed Non-NZE single-family homes built in New York State in 2015 (Table C-6). For comparison purposes, the team limited the homes it collected data for to those located in four New York State economic regions – Capital, Finger Lakes, Mid-Hudson, and Western – since these were the only regions to include a new NZE home built in 2015, and presents the average sales prices and estimated market values by number of bedrooms as a proxy for home size. The team found that NZE homes had higher sales prices and estimated market values, on average, compared to Non-NZE homes.

Methods Used and Recommendation for Future Studies

The team was unable to find a database with comprehensive, current, and reliable sales price and market value data for new homes sold in New York State in 2015. The team used county property tax records and four real estate listing websites - Zillow.com, Realtor.com, Trulia.com, and Redfin.com – to individually lookup the sales prices and estimated market values of the NZE and Non-NZE homes built in New York State in 2015 for which the team had location data. For NZE homes, the team looked up all those it confirmed as a NZE home built in 2015 and for which the physical address was available (n=23), not just those interviewed NZE homebuyers purchased. All the single-family NZE homes for which sales price and/or estimated market value was available are in four New York State economic regions: Capital, Finger Lakes, Mid-Hudson, and Western. For Non-NZE homes, the team looked up all those built in 2015, purchased by interviewed Non-NZE homebuyers, and located in the four New York State economic regions.

The team excluded any sales prices and estimated market values that real estate listing websites reported were for the land or lot on which the home was built. Several homebuyers purchased the land on which their home was built and prices for land purchases were much lower than prices for home purchases. In addition, all the real estate websites consistently reported the sales price of the homes in line with the county property tax record but, for some homes, the estimated market value varied across the websites (and is not available on county property tax records). For these homes, the team selected the estimated market value closest to the sales price or, if the sales price was unavailable or only available for the land or lot, the team selected the highest estimated market value.

The team computed the average and range of sales prices and estimated market values for all homes and, for comparison purposes, for homes by number of bedrooms as a proxy for size. There were too few homes for the team to compare NZE and Non-NZE homes within economic regions, cities/towns, or

neighborhoods, which would make for a more accurate comparison of NZE vs. Non-NZE home prices and values since these are greatly influenced by the specific location of the home.

For future studies, the team recommends conducting a search for comprehensive and current databases of new homes built and sold in New York State. Such a database would be needed to make more accurate comparisons of NZE vs. Non-NZE home prices and estimated market values. If a database is not available, the team recommends using the same methodology described above to lookup confirmed NZE homes and then performing a search in the same neighborhoods for new Non-NZE homes, which is like what a home appraiser would do. The “home appraisal” methodology was too costly to perform for this project but would likely yield more accurate comparisons between NZE and Non-NZE home prices and values. If this method is also not feasible, the team recommends using the same methodology described above but attempting to survey a more representative sample of New York State Non-NZE homebuyers in regions, cities, or neighborhoods where new NZE homes are located.

Table C-6. Average Sales Price and Estimated Market Value of New NZE and Non-NZE Homes Sold in New York State in 2015 in the Capital, Finger Lakes, Western New York, and Mid-Hudson Economic Regions of New York State

| | 2015 NZE Single Family Homes | | | 2015 Non-NZE Homes | | | | | | | | |
|-------------------------------|------------------------------|-----------|-----------------------|--------------------------------|-----------|-----------------------|---------------|-----------|-----------------------|-------|-----------|-----------------------|
| | | | | Energy Efficient Single Family | | | Single Family | | | Total | | |
| | N | Mean | Range | N | Mean | Range | N | Mean | Range | N | Mean | Range |
| Sales Price | | | | | | | | | | | | |
| Total | 11 | \$504,294 | \$375,000 - \$629,380 | 37 | \$369,729 | \$219,080 - \$643,507 | 6 | \$312,542 | \$160,000 - \$629,900 | 43 | \$359,925 | \$160,000 - \$643,507 |
| 1-bedroom | 1 | \$446,325 | N/A | 0 | N/A | N/A | 0 | N/A | N/A | 0 | N/A | N/A |
| 2-bedroom | 0 | N/A | N/A | 7 | \$451,067 | \$249,900 - \$643,507 | 0 | N/A | N/A | 7 | \$451,067 | \$249,900 - \$643,507 |
| 3-bedroom | 7 | \$492,059 | \$375,000 - \$623,892 | 14 | \$364,279 | \$252,275 - \$535,900 | 2 | \$201,003 | \$160,000 - \$242,007 | 16 | \$337,067 | \$160,000 - \$535,900 |
| 4-bedroom | 2 | \$513,555 | \$398,000 - \$629,110 | 14 | \$338,704 | \$219,080 - \$580,324 | 4 | \$368,311 | \$256,922 - \$629,900 | 18 | \$345,671 | \$219,080 - \$629,900 |
| 5-bedroom | 1 | \$629,380 | N/A | 2 | \$435,965 | \$392,030 - \$479,900 | 0 | N/A | N/A | 2 | \$435,965 | \$392,030 - \$479,900 |
| Estimated Market Value | | | | | | | | | | | | |
| Total | 18 | \$428,944 | \$144,844 - \$647,406 | 37 | \$361,170 | \$153,835 - \$638,584 | 6 | \$442,173 | \$267,467 - \$657,549 | 43 | \$371,971 | \$153,835 - \$657,549 |
| 1-bedroom | 1 | \$298,573 | N/A | 0 | N/A | N/A | 0 | N/A | N/A | 0 | N/A | N/A |
| 2-bedroom | 2 | \$376,266 | \$349,180 - \$403,352 | 7 | \$419,752 | \$153,835 - \$638,584 | 0 | N/A | N/A | 7 | \$419,752 | \$153,835 - \$638,584 |
| 3-bedroom | 10 | \$437,765 | \$144,844 - \$647,406 | 14 | \$381,613 | \$269,910 - \$563,662 | 1 | \$657,549 | N/A | 15 | \$409,207 | \$269,910 - \$657,549 |
| 4-bedroom | 3 | \$421,879 | \$382,200 - \$493,472 | 14 | \$288,383 | \$234,366 - \$499,675 | 4 | \$370,381 | \$267,467 - \$534,620 | 18 | \$308,883 | \$234,366 - \$534,620 |
| 5-bedroom | 2 | \$513,302 | \$453,705 - \$572,900 | 1 | \$422,191 | N/A | 0 | N/A | N/A | 1 | \$422,191 | N/A |

C.3.2. Average Percent Difference in Building Costs and Sales Prices of NZE vs. Non-NZE Code-Built Homes in New York State in 2015 Reported by Interviewed NZE Market Actors

Quantitative Market Indicator Description and Estimates

These two quantitative indicators are the average percent difference in building costs and in sales prices of new NZE vs. new Non-NZE code-built homes in New York State in 2015 reported by interviewed market actors. Interviewed NZE architects, design-build firms, builders, and property developers reported the percentage more in cost required to build an NZE home compared to a similar Non-NZE code-built home, which ranged from 1.5%-40% (Table C-7).² Interviewed NZE homebuyers reported the percentage more in the sales price they paid for their NZE home compared to what they would have paid for a similar Non-NZE code-built home, which ranged from 5-50% (Table C-8). The team collected these indicators since the sales prices and estimated market values reported in Section C.3.1 for NZE and Non-NZE homes do not permit accurate comparisons of similar homes located in close vicinity of one another.

Table C-7. Average Percent Difference in Building Costs of NZE vs. Non-NZE Code-Built Homes in New York State in 2015 Reported by Interviewed NZE Market Actors

| | Architects | Design-Build | Builders | Developer |
|---|------------|--------------|----------|-----------|
| N | 3 | 4 | 4 | 1 |
| Average % Increase in Cost for NZE home vs. code-built Non-NZE home | 12% | 10% | 17% | 25% |
| Range | 10%-15% | 2.5%-30% | 1.5%-40% | 25% |

Table C-8. Average Percent Difference in Sales Prices of NZE vs. Non-NZE Code-Built Homes in New York State Reported by Interviewed NZE Homebuyers

| | Built in 2015 | Built in 2015 or earlier |
|----------------------------------|---------------|--------------------------|
| N | 7 | 18 |
| Average % More Paid for NZE home | 18% | 19% |
| Range | 5%-40% | 5%-50% |

Methods Used and Recommendations for Future Studies

The team asked interviewed NZE design and construction market actors about the percentage increase in the cost of building a NZE home compared to building a similar Non-NZE code-built home (Table C-9). The team also asked surveyed NZE homebuyers the percentage more in sales price they paid for their NZE home compared to the price they would have paid for a similar Non-NZE code-built home (Table C-9). The

² The majority of market actors reported some experience with code-built homes and thus were able to answer questions comparing NZE homes to code-built homes.

team computed the average percentages reported by interviewed NZE market actors and surveyed NZE homebuyers. The team recommends using the same methodology in future studies. In addition, the team recommends continuing to use code-built homes as the baseline comparison since, in the future, market actors with experience primarily with code-built homes may begin building NZE homes and would be unable to compare their NZE experience with anything but code-built homes.

Table C-9. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | Architects, Design-Build, Builders, and Developers | NZE Homebuyers |
|--|--|----------------|
| Interview or survey question number(s) | Q37 | Q40 |

C.3.3. Annual Sales and Availability of NZE and Non-NZE Homes in New York State in 2015

Quantitative Market Indicator Description and Estimates

These two quantitative indicators are the annual number of new NZE and Non-NZE homes sold or rented in New York State in 2015, and the availability of new 2015 NZE and Non-NZE homes for sale or rent in 2016 (Table C-10). The team found data for these indicators for NZE homes but not Non-NZE homes, and all homes for which data are available were sold or rented by 2016.

Table C-10. Annual Sales and Availability of NZE and Non-NZE Homes in New York State in 2015

| | Number of units | Sold/Rented | Available for Sale/Rent in 2016 |
|---|-----------------|-------------|---------------------------------|
| Confirmed Single Family NZE Homes Built in 2015 | 23 ¹ | 100% | 0% |
| Confirmed Multifamily NZE Units Built in 2015 | 159 | 100% | 0% |

¹ Data for 24 of the 47 confirmed NZE homes built in 2015 were not available on the real estate listing websites. The team was unable to determine the status of these homes (e.g. if they sold or were for sale).

Methods Used and Recommendations for Future Studies

The team could not find a reliable, comprehensive, and current database or listing of new Non-NZE homes in New York State to use for looking up annual sales, rentals, and availability. The team looked-up each of the 23 confirmed new NZE homes built in New York State in 2015 for which the team had the physical address on real estate listing websites; sales prices and estimated home values were not available for 24 of the 47 confirmed NZE homes built in 2015. The websites reported whether the home was for sale or had been sold (Table C-11). The team also asked interviewed NZE architects, design-build firms, builders, and

property developers if any of their homes or multifamily units were vacant (or not sold or rented yet). The team calculated the percentage of new NZE homes that were sold or rented in 2015, and subtracted this from 100% to calculate the percentage of homes still available on the market in 2016.

The team recommends using the same methodology for calculating the percentage of new NZE home sales and availability. The team also recommends searching for comprehensive and current data for new Non-NZE homes in New York State that can be used to determine the number of homes built, annual sales, and availability. Without such data, estimating these indicators for Non-NZE homes is not possible.

Table C-11. NZE Market Actor Interview Guide Question Numbers and Secondary Sources Used for Market Indicator Estimates

| | Architects, Design-Build, Builders, and Developers |
|---|---|
| Interview or survey question number(s) | Q8, Q12, Q17, Q22 |
| Secondary Sources | |
| Zillow.com, http://www.zillow.com/ | |
| Realtor.com, http://www.realtor.com/ | |
| Trulia.com, https://www.trulia.com/ | |
| Redfin.com, https://www.redfin.com/ | |
| Homes.com, http://www.homes.com/ | |
| Zero Energy Project. "Zero Energy Homes for Sale and Zero Energy Developments & Multifamily Building Projects." http://zeroenergyproject.org/find/ | |

C.4. Percentage of NZE and Non-NZE Homebuyers Who Purchased their Home Before, During, and After It was Built, and Reasons for Doing So

The team divided this market metric into two measurable market indicators.

1. Percentage of New York State homebuyers who purchased a NZE and Non-NZE home in 2015 purchased the home before, during, and after it was built
2. Types of reasons for purchasing a NZE and Non-NZE home before, during, or after it was built

C.4.1. Percentage of New York State NZE and Non-NZE Homebuyers Who Purchased their Home Before, During, or After It was Built and the Types of Reasons for Purchasing Their Home Before, During, or After It was Built

Quantitative and Qualitative Market Indicator Description and Estimates

The quantitative market indicator is the percentage of surveyed New York State NZE and Non-NZE homebuyers who purchased their home before, during, or after it was built (Table C-12). The qualitative

indicator is the types of reasons homebuyers reported for purchasing their home before, during, or after it was built, which was collected from an open-ended survey question, and the percentage of surveyed homebuyers who mentioned each type of reason (Table C-12). Most surveyed homebuyers reported buying their home before it was built, except single- and multi-family Non-NZE homebuyers.

Table C-12. Percentage of New York State NZE and Non-NZE Homebuyers Who Purchased Their Home Before, During, or After It Was Built, and Their Reasons for Doing So

| | NZE Homebuyers | | Non-NZE Homebuyers | | | |
|---|----------------|--------------------------|--------------------------------|---------------|--------------|-------|
| | Built in 2015 | Built in 2015 or Earlier | Energy Efficient Single Family | Single Family | Multi-family | Total |
| N | 7 | 17 | 57 | 11 | 3 | 71 |
| Percent who bought home <u>before</u> construction | 57% | 65% | 85% | 46% | 0% | 75% |
| Reasons why (multiple response allowed): (N) | 4 | 11 | 43 | 5 | 0 | 48 |
| Wanted to Design Own Home/Be Involved in Process | 75% | 55% | 19% | 0% | 0% | 17% |
| Ability to Customize or Personalize Home Design | 25% | 45% | 51% | 40% | 0% | 50% |
| Wanted to Include Energy Efficiency and Sustainability Features | 25% | 36% | 5% | 20% | 0% | 6% |
| Wanted New Construction | 0% | 0% | 23% | 40% | 0% | 25% |
| Liked Location, Community, Neighborhood | 0% | 0% | 12% | 40% | 0% | 15% |
| Building Plans Met Needs | 0% | 0% | 14% | 0% | 0% | 13% |
| No Preferred Existing Homes in Area | 0% | 0% | 7% | 20% | 0% | 8% |
| Liked the Value/Cost | 0% | 0% | 5% | 20% | 0% | 6% |
| Liked the Property/Lot | 0% | 9% | 0% | 0% | 0% | 0% |
| Percent who bought home <u>during</u> construction | 14% | 6% | 11% | 18% | 0% | 11% |
| Reasons why (multiple response allowed): (N) | 1 | 1 | 6 | 2 | 0 | 8 |
| Liked Location, Community, Neighborhood | 100% | 100% | 17% | 0% | 0% | 13% |
| Building Plans Met Needs | 0% | 0% | 33% | 100% | 0% | 50% |
| Ability to Customize or Personalize Home | 0% | 0% | 33% | 0% | 0% | 25% |
| Liked the Value/Cost | 0% | 0% | 17% | 50% | 0% | 25% |
| Wanted to Design and Build Own Home | 0% | 0% | 17% | 0% | 0% | 13% |
| Wanted New Construction | 0% | 0% | 17% | 0% | 0% | 13% |

| | NZE Homebuyers | | Non-NZE Homebuyers | | | |
|---|----------------|--------------------------|--------------------------------|---------------|--------------|-------|
| | Built in 2015 | Built in 2015 or Earlier | Energy Efficient Single Family | Single Family | Multi-family | Total |
| Liked Location, Community, Neighborhood | 0% | 0% | 13% | 0% | 0% | 8% |
| Wanted Energy Efficient Features | 0% | 0% | 0% | 50% | 0% | 13% |
| Good Builder Reputation | 100% | 100% | 0% | 0% | 0% | 0% |
| Liked the Floorplan | 100% | 100% | 0% | 0% | 0% | 0% |
| Percent who bought home after construction | 29% | 29% | 5% | 36% | 100% | 14% |
| Reasons why (multiple response allowed): (N) | 2 | 5 | 3 | 4 | 3 | 10 |
| Wanted to See Home Before Purchasing | 50% | 40% | 100% | 0% | 0% | 30% |
| Liked Location, Community, Neighborhood | 0% | 0% | 0% | 25% | 67% | 30% |
| Building Plans Met Needs | 0% | 0% | 0% | 25% | 33% | 20% |
| Wanted to Know Final Cost Before Purchasing | 0% | 0% | 0% | 25% | 0% | 20% |
| Ready to Move In | 50% | 20% | 0% | 25% | 0% | 9% |
| Did Not Want to Wait for Home to be Built | 0% | 20% | 0% | 25% | 0% | 10% |
| Renovating Historic Home | 0% | 20% | 0% | 0% | 0% | 0% |

Methods Used and Recommendations for Future Studies

The team asked surveyed New York State NZE and Non-NZE homebuyers if they purchased their new home before, during, or after it was built, and calculated the percentage that mentioned each option (Table C-13). The team also asked surveyed homebuyers about the primary reasons they purchased their home before, during, or after it was built; the team coded the responses into categories of reasons and computed the percentage of each homebuyer group that mentioned each category.

The team reported percentages by type of surveyed homebuyer. Types of NZE homebuyers are those who purchased a NZE home built in 2015, for comparison with Non-NZE homebuyers, and the total NZE homebuyers interviewed (those who purchased a NZE home built in 2015 or before). Non-NZE homebuyer types are energy efficient single-family, single-family (unknown energy efficiency), multifamily (unknown energy efficiency), and total homebuyers.

The team recommends using the same methodology in future studies and changing the open-ended question about reasons for purchasing a home before, during, or after it was built to a close-ended question using the categories in Table C-12 to create answer choices.

Table C-13. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | NZE Homebuyers | Non-NZE Homebuyers |
|--|-----------------------|---------------------------|
| Interview or survey question number(s) | Q10-Q11, Q15, Q19 | Q5-Q6, Q9, Q12 |

C.5. New York State Homebuyers’ Awareness, Willingness to Pay For, and Motivations to Buy NZE and Non-NZE Homes

The team divided this market metric into five measurable market indicators.

1. Percentage of New York State NZE and Non-NZE homebuyers who are aware of NZE homes
2. Sources of New York State NZE and Non-NZE homebuyers’ awareness of NZE homes
3. Level of priority New York State NZE and Non-NZE homebuyers place on making their next home a NZE home
4. Average percentage more in price New York State NZE and Non-NZE homebuyers are willing to pay for their next home to be a NZE home compared to a code-built home
5. Types of motivations New York State NZE and Non-NZE homebuyers reported for buying a NZE and Non-NZE home

C.5.1. Percentage of New York State NZE and Non-NZE Homebuyers Who are Aware of NZE homes and Sources of Homebuyers’ Awareness

Quantitative and Qualitative Market Indicator Description and Estimates

The quantitative indicator is the percentage of surveyed NZE and Non-NZE homebuyers who reported awareness of NZE homes (Table C-14). The qualitative indicator is the sources of awareness reported by these aware homebuyers, which were collected from an open-ended survey question, and the percentage who reported each source (Table C-14). The team found that a minority of Non-NZE homebuyers reported awareness of NZE homes, and that NZE and Non-NZE homebuyers reported different sources of awareness.

Table C-14. Percentage of New York State NZE and Non-NZE Homebuyers Who are Aware of NZE homes and Sources of Homebuyers’ Awareness

| | NZE Homebuyers | | Non-NZE Homebuyers | | | |
|---|----------------|--------------------------|--------------------------------|---------------|--------------|-------|
| | Built in 2015 | Built in 2015 or earlier | Energy Efficient Single Family | Single Family | Multi-family | Total |
| N | 7 | 18 | 48 | 9 | 3 | 60 |
| Percent Aware | 100% | 100% | 23% | 33% | 0% | 24% |
| Sources of Awareness (multiple responses allowed): (N) | 7 | 18 | 7 | 3 | 0 | 10 |
| Builder or Designer | 57% | 50% | 14% | 0% | 0% | 10% |
| Real Estate Agent | 29% | 22% | 0% | 0% | 0% | 0% |
| Work in Industry or Interested in Renewable Energy & Sustainability | 29% | 22% | 14% | 0% | 0% | 10% |
| Self-Directed Research | 0% | 0% | 14% | 67% | 0% | 30% |
| Word of Mouth (Family/Friends/Neighbors) | 43% | 33% | 0% | 0% | 0% | 0% |
| News Media, Magazines | 0% | 0% | 43% | 33% | 0% | 40% |
| Internet | 0% | 0% | 29% | 0% | 0% | 20% |
| Television | 0% | 0% | 14% | 0% | 0% | 10% |

Methods Used and Recommendations for Future Studies

Before asking surveyed NZE and Non-NZE homebuyers about NYSERDA’s NZE home definition, the team asked whether they are aware of NZE homes (Table C-15). The team calculated the percentage of homebuyers who awareness of NZE homes. The team also asked interviewed homebuyers who reported awareness of NZE homes an open-ended question about their sources of awareness. The team coded homebuyers’ reported sources of awareness into categories and computed the percentage of homebuyers who mentioned each category.

The team reported percentages by type of surveyed homebuyer. Types of NZE homebuyers are those who purchased a NZE home built in 2015, for comparison with Non-NZE homebuyers, and the total NZE homebuyers interviewed (those who purchased a NZE home built in 2015 or before). Non-NZE homebuyer types are energy efficient single-family, single-family (unknown energy efficiency), multifamily (unknown energy efficiency), and total homebuyers. The team recommends using the same methodology but changing the survey question about sources of awareness of NZE homes to a close-ended question and using the categories in Table C-14 as answer choices.

Table C-15. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | NZE Homebuyers | Non-NZE Homebuyers |
|--|----------------|--------------------|
| Interview or survey question number(s) | Q3 | Q29, Q31 |

C.5.2. Level of Priority New York State Homebuyers Place on Making Their Next Home a NZE Home and Average Percentage More in Price Homebuyers Are Willing to Pay for Their Next Home to Be an NZE Home Compared to a Code-Built Home

Quantitative Market Indicator Description and Estimates

The first quantitative indicator is the percentage of surveyed homebuyers that reported making their next home a NZE home would be of high, medium, low, or no priority (Table C-16). The second quantitative indicator is the average percentage more in price surveyed homebuyers reported willing to pay for their next home to be a NZE compared to a code-built home (Table C-16). The team found that most surveyed homebuyers reported a high or medium priority on making their next home a NZE home and that they would pay 0%-100% more for it.

Table C-16. Level of Priority New York State Homebuyers Place on Making Their Next Home a NZE Home and Average Percentage More in Price Homebuyers Are Willing to Pay for Their Next Home to Be an NZE Home Compared to a Code-Built Home

| | NZE Homebuyers | | Non-NZE Homebuyers | | | |
|---|----------------|--------------------------|--------------------------------|---------------|--------------|---------|
| | Built in 2015 | Built in 2015 or earlier | Energy Efficient Single Family | Single Family | Multi-family | Total |
| N | 5 | 15 | 36 | 8 | 2 | 46 |
| Priority on buying NZE home in the future | | | | | | |
| High Priority | 80% | 87% | 22% | 0% | 50% | 20% |
| Medium Priority | 20% | 13% | 50% | 50% | 0% | 48% |
| Low Priority | 0% | 0% | 22% | 25% | 50% | 23% |
| No Priority | 0% | 0% | 6% | 25% | 0% | 8% |
| N | 1 | 4 | 58 | 11 | 11 | 72 |
| Average percent more that respondents reported they are willing to pay for NZE home vs. code-built home | 10% | 15% | 9% | 27% | 7% | 13% |
| Range | 10% | 10%-20% | 0%-50% | 0%-100% | 5%-10% | 0%-100% |

Methods Used and Recommendations for Future Studies

The team asked surveyed NZE and Non-NZE homebuyers to rank the level of priority they would place on making their next home a NZE home on a four-point scale of high, medium, low, and no priority (Table C-17). The team calculated the percentage of homebuyers that selected each level. The team also asked homebuyers about what percentage more in price they would pay to make their next home a NZE home compared to a similar home built to code. The team computed the average percentage reported by homebuyers.

The team reported percentages by type of surveyed homebuyer. Types of NZE homebuyers are those who purchased a NZE home built in 2015, for comparison with Non-NZE homebuyers, and the total NZE homebuyers interviewed (those who purchased a NZE home built in 2015 or before). Non-NZE homebuyer types are energy efficient single-family, single-family (unknown energy efficiency), multifamily (unknown energy efficiency), and total homebuyers. The team recommends using the same methodology in future studies.

Table C-17. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | NZE Homebuyers | Non-NZE Homebuyers |
|--|-----------------------|---------------------------|
| Interview or survey question number(s) | Q43, Q45 | Q39, Q41 |

C.5.3. Types of Motivations New York State Homebuyers Reported for Buying a NZE and Non-NZE Home

Qualitative Market Indicator Description and Estimates

This qualitative indicator is the types of motivations surveyed NZE and Non-NZE homebuyers reported for buying their home, which was collected from an open-ended survey question, and the percentage who mentioned each type (Table C-18). Surveyed homebuyers reported 10 categories of motivations.

Table C-18. Types of Motivations New York State Homebuyers Reported for Buying a NZE and Non-NZE Home (Multiple Responses Allowed)

| Motivations | NZE Homebuyers | | Non-NZE Homebuyers | | | |
|---|----------------|--------------------------|--------------------------------|---------------|-------------|-------|
| | Built in 2015 | Built in 2015 or earlier | Energy Efficient Single Family | Single Family | Multifamily | Total |
| N | 6 | 16 | 51 | 11 | 3 | 65 |
| Reduce Carbon Footprint | 33% | 56% | 0% | 0% | 0% | 0% |
| Low Energy Bills/Energy Efficiency/Incentives Offered | 33% | 38% | 6% | 0% | 0% | 5% |
| Location, Neighborhood & Community | 33% | 31% | 33% | 55% | 40% | 37% |
| Quality of Construction and/or Reputation of Builder | 33% | 19% | 21% | 0% | 0% | 17% |
| Design, Features & Layout of Home | 0% | 19% | 38% | 36% | 20% | 38% |
| Value & Cost | 0% | 13% | 27% | 36% | 0% | 28% |
| Independence from Fossil Fuels | 0% | 6% | 0% | 0% | 0% | 0% |
| New Construction & Low Maintenance | 0% | 0% | 25% | 9% | 20% | 23% |
| Personalization & Customization | 0% | 0% | 8% | 27% | 0% | 11% |
| Other | 0% | 0% | 8% | 0% | 0% | 6% |

Methods Used and Recommendations for Future Studies

The team asked surveyed NZE and Non-NZE homebuyers an open-ended question about what primarily motivated them to buy their home (Table C-19). The team coded homebuyers’ responses into categories of motivations and calculated the percentage who mentioned each category.

The team reported percentages by type of surveyed homebuyer. Types of NZE homebuyers are those who purchased a NZE home built in 2015, for comparison with Non-NZE homebuyers, and the total NZE homebuyers interviewed (those who purchased a NZE home built in 2015 or before). Non-NZE homebuyer types are energy efficient single-family, single-family (unknown energy efficiency), multifamily (unknown energy efficiency), and total homebuyers.

The team recommends changing the survey question to a close-ended question and using the categories of motivations in Table C-18 to create answer choices (with an “Other” option).

Table C-19. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | NZE Homebuyers | Non-NZE Homebuyers |
|--|----------------|--------------------|
| Interview or survey question number(s) | Q22 | Q14 |

C.6. New York State Homebuyers’ Level of Satisfaction with NZE and Non-NZE Homes and Reasons for Their Level of Satisfaction

The team divided this market metric into two measurable market indicators.

1. New York State NZE and Non-NZE homebuyers’ level of overall satisfaction with their home
2. Types of reasons New York State NZE and Non-NZE homebuyers reported for their level of overall satisfaction with their home

C.6.1. New York State NZE and Non-NZE Homebuyers’ Average Level of Satisfaction with their Home and Types of Reasons for their Level of Satisfaction

Quantitative and Qualitative Market Indicator Description and Estimates

The quantitative market indicator is the average level of overall satisfaction surveyed New York State NZE and Non-NZE homebuyers reported with their home, as measured on 0 to 10 scale where 0 means not at all satisfied and 10 means extremely satisfied (Table C-20). The qualitative indicator is the types of positive and negative reasons surveyed homebuyers reported for their overall level of satisfaction, which were collected from an open-ended survey question, and the percentage of homebuyers who reported each type of reason (Table C-20). The team found that surveyed homebuyers were overall highly satisfied with their home, and that they reported 10 positive reasons and 10 negative reasons for their satisfaction rating.

Table C-20. New York State NZE and Non-NZE Homebuyers' Average Level of Overall Satisfaction with Their Home, and Positive and Negative Reasons for Their Level of Satisfaction

| Satisfaction (0 = Not at all satisfied, 10 = Extremely satisfied) | NZE Homebuyers | | Non-NZE Homebuyers | | | |
|--|----------------|--------------------------|--------------------------------|---------------|--------------|--------|
| | Built in 2015 | Built in 2015 or earlier | Energy Efficient Single Family | Single Family | Multi-family | Total |
| N | 6 | 16 | 58 | 11 | 3 | 72 |
| Average Satisfaction Rating | 9 | 9.5 | 8.5 | 8.5 | 9 | 9 |
| Range | 8 – 10 | 8 – 10 | 6 – 10 | 3 – 10 | 9 – 10 | 3 – 10 |
| Reasons for rating (multiple response allowed): (N) | 4 | 10 | 41 | 6 | 3 | 50 |
| Positive Responses | | | | | | |
| Met or Exceeded Expectations | 25% | 36% | 2% | 33% | 0% | 6% |
| Home is Comfortable | 25% | 29% | 12% | 17% | 33% | 14% |
| Energy Costs Lower than Expected | 0% | 29% | 7% | 33% | 0% | 10% |
| Like the Design & Layout | 25% | 14% | 34% | 17% | 67% | 34% |
| High Quality of Construction | 25% | 14% | 20% | 17% | 0% | 18% |
| Good Experience with Contractor or Builder | 0% | 0% | 17% | 17% | 0% | 16% |
| Like the Property Location | 0% | 0% | 7% | 17% | 67% | 12% |
| Good Neighborhood & Community | 0% | 0% | 7% | 17% | 33% | 10% |
| High Value for Price Paid | 0% | 0% | 5% | 17% | 0% | 6% |
| No Problems | 0% | 0% | 15% | 17% | 33% | 16% |
| Negative Responses | | | | | | |
| Humidity & Air Exchange Issues | 0% | 14% | 0% | 0% | 0% | 0% |
| Heating or Cooling Problems | 25% | 14% | 0% | 0% | 0% | 0% |
| Issues with Home Comfort | 25% | 7% | 2% | 0% | 0% | 2% |
| Design & Layout is Not Preferred | 25% | 7% | 7% | 33% | 0% | 10% |
| Issues with Plumbing | 0% | 7% | 0% | 0% | 0% | 0% |
| Low Quality of Construction | 0% | 0% | 17% | 17% | 0% | 16% |
| Bad Experience with Contractor or Builder | 0% | 0% | 10% | 0% | 0% | 8% |
| Did not Meet Expectations | 0% | 0% | 5% | 0% | 0% | 4% |
| Low Value for Price Paid | 0% | 0% | 5% | 0% | 0% | 4% |
| Do Not like Property Location | 0% | 0% | 2% | 0% | 0% | 2% |

Methods Used and Recommendations for Future Studies

The team asked surveyed New York State NZE and Non-NZE homebuyers to rate their overall level of satisfaction with their new home on a scale of 0 to 10, where 0 means not at all satisfied and 10 means extremely satisfied (Table C-21). The team computed the average rating for each homebuyer group. The team also asked homebuyers about the primary reasons for the level of satisfaction they reported; the team coded the responses into types of reasons and calculated the percentage of surveyed homebuyers who reported each category.

The team reported percentages by type of surveyed homebuyer. Types of NZE homebuyers are those who purchased a NZE home built in 2015, for comparison with Non-NZE homebuyers, and the total NZE homebuyers interviewed (those who purchased a NZE home built in 2015 or before). Non-NZE homebuyer types are energy efficient single-family, single-family (unknown energy efficiency), multifamily (unknown energy efficiency), and total homebuyers.

The team recommends using the same methodology in future studies and changing the open-ended question about reasons for homebuyers’ level of satisfaction to a close-ended question using the categories in Table C-20 to create answer choices.

Table C-21. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | NZE Homebuyers | Non-NZE Homebuyers |
|--|----------------|--------------------|
| Interview or survey question number(s) | Q28 | Q28 |

C.7. Major Downstream Market Barriers for Selling and Buying NZE Homes and Solutions for Overcoming Selling Barriers

The team divided this market metric into three measurable indicators.

1. Major downstream market barriers for selling NZE homes
2. Solutions for overcoming major downstream market barriers for selling NZE homes
3. Major downstream market barriers for buying NZE homes

C.7.1. Major Downstream Market Barriers for Selling NZE Homes and Solutions for Overcoming Barriers

Qualitative Market Indicator Description and Estimates

These two qualitative market indicators are the types of barriers or challenges for selling NZE homes and proposed solutions for overcoming these barriers reported interviewed by New York State NZE market

actors who have experience selling NZE homes to homebuyers (Table C-22). Interviewed market actors reported five types of downstream selling barriers. These metrics are qualitative because the team asked open-ended interview questions since the team did not know what answer choices to use in advance.

Table C-22. Types of Major Downstream Market Barriers for Selling NZE Homes and Solutions for Overcoming Barriers (Multiple Responses Allowed)

| Selling Barriers | Solutions | Architects | Design-Build | Builders | Developer |
|--|--|------------|--------------|----------|-----------|
| N | | 3 | 4 | 4 | 1 |
| Higher cost, unwillingness to pay | Lower cost of NZE construction through higher incentives and tax credits | 33% | 50% | 75% | 0% |
| Limited availability of NZE homes | Update building and product codes to promote NZE construction | 33% | 75% | 50% | 100% |
| Low awareness of NZE homes, value, and payback | Generate more awareness through marketing and NZE spec homes | 33% | 50% | 50% | 100% |
| NZE customers want more features or options than can included due to affordability or technicality | Temper customers' desires and expectations | 100% | 75% | 50% | 0% |
| Low trust and high skepticism due to some professionals building "green" homes that don't perform | Don't know | 33% | 0% | 25% | 0% |

Methods Used and Recommendations for Future Studies

The team asked interviewed New York State NZE market actors with experience selling (or renting) NZE homes – architects, design-build firms, builders, and property developers – open-ended questions about what challenges they experienced selling their NZE homes and what they did to overcome these challenges (Table C-23). The team coded the challenges and solutions into categories and computer the percentage of market actors that mentioned each category. The team recommends using the categories in Table C-22 to create answer choices for close-ended questions in future studies.

Table C-23. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | Architects, Design-Build, Builders, Developers |
|--|--|
| Interview or survey question number(s) | Q41, Q42 |

C.7.2. Major Downstream Market Barriers for Buying NZE Homes

Qualitative Market Indicator Description and Estimates

This mixed indicator is the types of barriers and challenges surveyed New York State NZE and Non-NZE homebuyers reported when considering purchasing a NZE home (Table C-24 and Table C-25). The team asked NZE homebuyers about eight barriers, and Non-NZE homebuyers reported four types of barriers and seven changes needed to overcome the barriers. The indicator for NZE homebuyers is quantitative since they were asked about the same concerns and the indicator for Non-NZE homebuyers is qualitative since they were asked open-ended questions.

Methods Used and Recommendations for Future Studies

The team asked surveyed NZE homebuyers to rate the level of concern they had with aspects of an NZE before they purchased one on a four-point scale: not at all concerned, slightly concerned, somewhat concerned, and extremely concerned (Table C-26). The team calculated the percentage of NZE homebuyers who selected each level of concern for the NZE aspects.

The team asked Non-NZE homebuyers if they were aware of NZE homes at the time they purchased their Non-NZE home, and asked those who reported awareness of NZE homes why they didn't purchase a NZE home (Table C-26). The team calculated the percentages of NZE homebuyers who reported each reason. The team also asked Non-NZE homebuyers if they would place a high, medium, low, or no priority on making their next home a NZE home, and asked those who did not select "high priority" what would need to change for them to place a high priority on making their next home a NZE home. The team coded the reported needed changes into categories and calculated the percentage who mentioned each category.

For NZE homebuyers, the team recommends using the same methods for future studies. For Non-NZE homebuyers, the team recommends changing the open-ended questions in to close-ended questions using the categories in Table C-25 for creating answer choices.

Table C-24. Types of and Levels of Concerns About Purchasing a NZE Home Reported by New York State NZE Homebuyers

| Concerns before purchase | NZE Homebuyers | | | | | | | | | |
|--|---------------------|----------|----------|------------|-----------|---------------------------------|----------|----------|------------|-----------|
| | Built in 2015 (n=6) | | | | | Built in 2015 or Earlier (n=14) | | | | |
| | Not at all | Slightly | Somewhat | Moderately | Extremely | Not at all | Slightly | Somewhat | Moderately | Extremely |
| Resale value | 50% | 17% | 17% | 0% | 17% | 43% | 14% | 7% | 21% | 14% |
| Initial Cost | 33% | 0% | 0% | 17% | 50% | 21% | 7% | 7% | 36% | 29% |
| Managing or using any of the high-tech features of your home | 33% | 17% | 0% | 0% | 50% | 36% | 29% | 0% | 7% | 29% |
| Providing sufficient ventilation and air quality | 33% | 17% | 17% | 0% | 33% | 29% | 14% | 7% | 7% | 43% |
| Providing comfort and safety | 33% | 0% | 0% | 17% | 50% | 36% | 0% | 7% | 7% | 50% |
| Providing sufficient renewable energy to meet demand | 33% | 0% | 0% | 17% | 50% | 29% | 7% | 7% | 14% | 43% |
| Finding home built by or finding credible, experienced designer, builder, and subcontractors | 33% | 0% | 17% | 17% | 33% | 21% | 14% | 29% | 14% | 21% |
| Cost of maintenance | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% | 0% |

Table C-25. Non-NZE Homebuyers’ Reported Reasons for Not Purchasing a NZE Home and Changes Needed to Make NZE a Higher Priority for Their Next Home

| Reasons for Not Buying NZE home | Non-NZE Homebuyers | | | |
|--|--------------------|---------------|-------------|-------|
| | EE Single Family | Single Family | Multifamily | Total |
| N | 48 | 9 | 3 | 60 |
| Unaware of NZE homes at time of purchase | 77% | 67% | 100% | 76% |
| NZE homes unavailable in desired location | 8% | 22% | 0% | 10% |
| Not a high priority | 8% | 11% | 0% | 8% |
| Costs too high | 6% | 0% | 0% | 5% |
| Changes Needed Make NZE a Higher Priority for Next Home | EE Single Family | Single Family | Multifamily | Total |
| N | 19 | 2 | 1 | 22 |
| Lower Cost of NZE Homes | 58% | 50% | 0% | 55% |
| Better Understanding of Overall Benefits | 42% | 0% | 100% | 41% |
| Increased of Awareness of Availability | 16% | 0% | 0% | 14% |
| Disprove Doubts About Benefits of Solar in North East | 11% | 0% | 0% | 9% |
| NZE Homes More Aesthetically Pleasing | 11% | 0% | 0% | 9% |
| Experience Increasing Energy Prices | 11% | 0% | 0% | 9% |
| Energy Costs Minor Compared to Mortgage Costs & Property Tax | 0% | 50% | 0% | 5% |

Table C-26. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | NZE Homebuyers | Non-NZE Homebuyers |
|--|----------------|--------------------|
| Interview or survey question number(s) | Q29 | Q29, Q38, Q40 |

C.8. New York State NZE and Non-NZE Homebuyer Demographic Characteristics

Quantitative Market Indicator Description and Estimates

This quantitative market indicator is the percentages, averages, ranges of surveyed New York State NZE and Non-NZE homebuyers’ demographic characteristics. See below and Table C-27 for the list of six demographic characteristics the team collected.

Methods Used and Recommendations for Future Studies

The team asked surveyed New York State NZE and Non-NZE homebuyers about six demographic characteristics (Table C-28). The team designed the demographic survey questions based on those from the U.S. Census and American Community Survey.

- *Age:* The team asked surveyed homebuyers for their year of birth. The team calculated the average age of homebuyers and the range of ages reported.
- *Gender:* The team asked surveyed homebuyers whether they are male or female and calculated the percentage of females.
- *Number of Adults and Children in Household:* The team asked surveyed homebuyers how many adults 18 and older, including themselves, and children under 18 live in their home at least six months of the year. The team computed the average and range of adults and children who live in respondents' homes.
- *Race and ethnicity:* The team asked surveyed homebuyers if they are Hispanic, Latino/a, or Spanish, and if they are American Indian or Alaska Native, Asian, Black, Native Hawaiian or Pacific Islander, White, or some other race. Respondents could choose more than one category. The team calculated the percentage of homebuyers' that selected each ethnic/racial category.
- *Level of Education:* The team asked surveyed homebuyers about their highest level of education. Categories include less than high school, high school graduate or equivalent, some college but no degree, two-year degree or certification, four-year degree, or graduate or professional degree. The team calculated the percentage of homebuyers' who selected each category.
- *Annual Household Income:* The team asked surveyed homebuyers about the amount of their annual household income. Respondents could choose from among 10 categories (Table C-27) and the team calculated the percentage who selected each category.

The team reported percentages, averages, and ranges by type of surveyed homebuyer. Types of NZE homebuyers are those who purchased a NZE home built in 2015, for comparison with Non-NZE homebuyers, and the total NZE homebuyers interviewed (those who purchased a NZE home built in 2015 or before). Non-NZE homebuyer types are energy efficient single-family, single-family (unknown energy efficiency), multifamily (unknown energy efficiency), and total homebuyers. The team recommends using the same methodology in future studies.

Table C-27. New York State NZE and Non-NZE Homebuyer Demographic Characteristics

| Demographics | NZE Homebuyers | | Non-NZE Homebuyers | | | |
|--|----------------|--------------------------|--------------------------------|---------------|-------------|---------|
| | Built in 2015 | Built in 2015 or earlier | Energy Efficient Single Family | Single Family | Multifamily | Total |
| N | 7 | 18 | 58 | 11 | 3 | 72 |
| Average Age | 48 | 50 | 55 | 47 | 46 | 53 |
| Age Range | 36 – 57 | 36 – 68 | 28 – 82 | 32 – 81 | 39 – 57 | 28 – 82 |
| Percent Female | 57% | 41% | 52% | 25% | 33% | 48% |
| Household Size | | | | | | |
| Average Number of Adults in Household | 2 | 2 | 2 | 2 | 2 | 2 |
| Range of Adults in Household | 1 – 4 | 1 – 4 | 1 – 7 | 1 – 2 | 2 – 2 | 1 – 7 |
| Average Number of Children in Household | 0 | 1 | 1 | 1 | 1 | 1 |
| Range of Children in Household | 0 – 2 | 0 – 4 | 0 – 3 | 0 – 2 | 1 – 1 | 0 – 3 |
| Race & Ethnicity (multiple responses allowed) | | | | | | |
| Hispanic, Latino or Spanish | 17% | 13% | 6% | 0% | 33% | 7% |
| American Indian or Alaska Native | 0% | 0% | 0% | 0% | 0% | 0% |
| Asian | 0% | 0% | 4% | 13% | 33% | 7% |
| Black or African American | 0% | 0% | 4% | 0% | 33% | 5% |
| Native Hawaiian or Pacific Islander | 0% | 0% | 0% | 0% | 0% | 0% |
| White or Caucasian | 75% | 92% | 87% | 88% | 33% | 85% |
| Other (Brazilian) | 25% | 8% | 0% | 0% | 0% | 0% |
| Other (American) | 0% | 0% | 4% | 0% | 0% | 3% |

| Demographics | NZE Homebuyers | | Non-NZE Homebuyers | | | |
|---|----------------|--------------------------|--------------------------------|---------------|-------------|-------|
| | Built in 2015 | Built in 2015 or earlier | Energy Efficient Single Family | Single Family | Multifamily | Total |
| Level of Education | | | | | | |
| Less than high school graduate | 0% | 0% | 0% | 0% | 0% | 0% |
| High school graduate or equivalent (such as GED) | 0% | 0% | 0% | 0% | 0% | 0% |
| Some college, no degree | 0% | 0% | 10% | 11% | 0% | 10% |
| 2-year degree (Associate) or certification from trade/technical college | 0% | 0% | 13% | 0% | 33% | 12% |
| 4-year degree (Bachelor's degree) | 29% | 35% | 33% | 56% | 0% | 35% |
| Graduate degree, professional degree | 71% | 65% | 44% | 33% | 67% | 43% |
| Household Income | | | | | | |
| Under \$20,000 | 0% | 7% | 0% | 0% | 0% | 0% |
| \$20,000 to under \$30,000 | 0% | 0% | 0% | 0% | 0% | 0% |
| \$30,000 to under \$40,000 | 0% | 0% | 0% | 0% | 0% | 0% |
| \$40,000 to under \$50,000 | 0% | 0% | 3% | 0% | 0% | 2% |
| \$50,000 to under \$60,000 | 0% | 0% | 3% | 0% | 0% | 2% |
| \$60,000 to under \$75,000 | 20% | 7% | 14% | 14% | 0% | 13% |
| \$75,000 to under \$100,000 | 0% | 14% | 19% | 0% | 0% | 15% |
| \$100,000 to under \$150,000 | 20% | 21% | 39% | 43% | 67% | 41% |
| \$150,000 to under \$200,000 | 20% | 21% | 11% | 14% | 0% | 11% |
| Over \$200,000 | 0% | 14% | 11% | 29% | 33% | 15% |
| Prefer not to say | 40% | 14% | 0% | 0% | 0% | 0% |

Table C-28. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | NZE Homebuyers | Non-NZE Homebuyers |
|--|----------------|--------------------|
| Interview or survey question number(s) | Q47-Q53 | Q43-Q49 |

C.9. New York State NZE and Non-NZE Homebuyers' Home Features and Characteristics

Quantitative Market Indicator Description and Estimates

This quantitative indicator is the percentages and averages of surveyed New York State NZE and Non-NZE homebuyers' eight home features and characteristics. See below and Table C-29 for the list of eight home features and characteristics the team collected.

Quantitative Market Indicator Estimates

Table C-29. New York State NZE and Non-NZE Homebuyers' Home Features and Characteristics

| Home Characteristics | NZE Homebuyers | | Non-NZE Homebuyers | | | |
|--|----------------|--------------------------|--------------------------------|---------------|--------------|-------|
| | Built in 2015 | Built in 2015 or earlier | Energy Efficient Single Family | Single Family | Multi-family | Total |
| N | 7 | 18 | 58 | 11 | 3 | 72 |
| Number of Bedrooms | | | | | | |
| 1 | 0% | 6% | 0% | 0% | 0% | 0% |
| 2 | 17% | 13% | 18% | 9% | 0% | 16% |
| 3 | 83% | 69% | 42% | 36% | 33% | 41% |
| 4 | 0% | 6% | 33% | 46% | 33% | 35% |
| 5 | 0% | 6% | 7% | 9% | 33% | 9% |
| Type of Home | | | | | | |
| Single-family detached | 86% | 94% | 84% | 73% | 33% | 80% |
| Two-, Three-, Four-unit home | 14% | 6% | 4% | 0% | 33% | 4% |
| Townhome | 0% | 0% | 7% | 18% | 0% | 9% |
| Condo | 0% | 0% | 2% | 0% | 33% | 3% |
| Other | 0% | 0% | 4% | 9% | 0% | 4% |
| Average Monthly Summer Electricity Bill | | | | | | |
| Average | \$15 | \$16 | \$155 | \$143 | \$207 | \$126 |
| Median | \$19 | \$17 | \$120 | \$130 | \$230 | \$130 |
| Key Features Included | | | | | | |
| Finished basement | 14% | 28% | 16% | 9% | 0% | 14% |
| Garage | 71% | 66% | 76% | 73% | 33% | 74% |
| High or vaulted ceilings | 57% | 50% | 81% | 91% | 100% | 83% |
| Hardwood or tile flooring | 86% | 83% | 74% | 82% | 100% | 76% |

| Home Characteristics | NZE Homebuyers | | Non-NZE Homebuyers | | | |
|---|----------------|--------------------------|--------------------------------|---------------|--------------|-------|
| | Built in 2015 | Built in 2015 or earlier | Energy Efficient Single Family | Single Family | Multi-family | Total |
| Laundry room or area | 86% | 83% | 88% | 100% | 100% | 90% |
| Outdoor living area | 86% | 83% | 33% | 46% | 100% | 38% |
| Pool, spa, hot tub | 29% | 16% | 3% | 0% | 0% | 3% |
| Energy Efficient Technologies Included | | | | | | |
| Additional or high performance insulation | 57% | 72% | 76% | 46% | 33% | 69% |
| ENERGY STAR appliances | 71% | 61% | 79% | 82% | 67% | 79% |
| Energy efficient lighting (CFL or LED) | 71% | 72% | 81% | 64% | 67% | 78% |
| High-performance windows | 71% | 78% | 74% | 64% | 33% | 71% |
| Programmable or smart thermostat | 86% | 78% | 81% | 82% | 67% | 81% |
| Renewable electric generation | 86% | 83% | 3% | 0% | 0% | 3% |
| High efficiency cooling system | 57% | 72% | 53% | 64% | 33% | 54% |
| High efficiency heating system | 71% | 78% | 71% | 64% | 33% | 66% |
| Type of Cooling System(s) | | | | | | |
| Standard Central air system | 0% | 0% | 16% | 18% | 33% | 17% |
| High efficiency central air system | 29% | 11% | 53% | 64% | 33% | 54% |
| Standard window AC unit(s) | 0% | 0% | 0% | 0% | 67% | 3% |
| High efficiency window unit(s) | 0% | 0% | 21% | 9% | 33% | 19% |
| Portable AC unit(s) | 0% | 0% | 0% | 0% | 0% | 0% |
| Ceiling fan(s) | 0% | 0% | 29% | 27% | 0% | 28% |
| Floor fan(s) | 0% | 0% | 2% | 0% | 0% | 1% |
| Air Source Heat Pump | 14% | 28% | 0% | 0% | 0% | 0% |
| Geothermal / Ground Source Heat Pump | 43% | 50% | 0% | 0% | 0% | 0% |
| Type of Heating System(s) | | | | | | |
| Standard natural gas furnace | 0% | 0% | 14% | 27% | 33% | 17% |
| High efficiency natural gas furnace | 14% | 6% | 64% | 64% | 33% | 63% |
| Geothermal / Ground Source Heat Pump | 43% | 50% | 7% | 0% | 0% | 3% |
| Air Source Heat Pump | 14% | 33% | 0% | 0% | 0% | 0% |
| Oil furnace | 0% | 0% | 0% | 0% | 0% | 0% |
| Propane furnace | 0% | 0% | 2% | 0% | 0% | 1% |
| Electric baseboard or wall heater(s) | 0% | 0% | 3% | 9% | 0% | 4% |
| Portable heater(s) | 0% | 0% | 0% | 0% | 33% | 1% |
| Gas fireplace | 0% | 0% | 45% | 55% | 33% | 46% |
| Wood fireplace | 0% | 0% | 0% | 0% | 0% | 0% |

| Home Characteristics | NZE Homebuyers | | Non-NZE Homebuyers | | | |
|----------------------|----------------|--------------------------|--------------------------------|---------------|--------------|-------|
| | Built in 2015 | Built in 2015 or earlier | Energy Efficient Single Family | Single Family | Multi-family | Total |
| Wood stove | 0% | 0% | 0% | 0% | 0% | 0% |
| Gas Boiler | 14% | 6% | 0% | 0% | 0% | 0% |
| Region | | | | | | |
| Long Island | 0% | 0% | 0% | 9% | 0% | 1% |
| New York City | 14% | 6% | 0% | 18% | 67% | 6% |
| Mid-Hudson | 14% | 44% | 7% | 9% | 33% | 8% |
| Capital Region | 43% | 28% | 24% | 0% | 0% | 19% |
| North Country | 0% | 0% | 0% | 0% | 0% | 0% |
| Mohawk Valley | 0% | 0% | 0% | 0% | 0% | 0% |
| Southern Tier | 0% | 0% | 0% | 9% | 0% | 1% |
| Central New York | 0% | 0% | 12% | 0% | 0% | 10% |
| Finger Lakes | 14% | 11% | 28% | 18% | 0% | 25% |
| Western New York | 14% | 11% | 29% | 36% | 0% | 29% |

Methods Used and Recommendations for Future Studies

The team asked surveyed New York State NZE and Non-NZE homebuyers about eight features and characteristics of their home (Table C-30). The team designed the home characteristic survey questions based on those from national housing surveys like the American Housing Survey and Residential Energy Consumption Survey.

Number of Bedrooms: The team asked surveyed homebuyers how many bedrooms are in their home and calculated the percentage who reported each number of bedrooms.

Type of Home: The team asked surveyed homebuyers about their type of home (single-family detached; 2-, 3-, or 4-unit; townhome; condo; or other) and calculated the percentage who reported each type.

Average Monthly Summer Electricity Bill: The team asked surveyed homebuyers how much on average their electricity bill is in the summer month. The team calculated the average and median amounts reported by homebuyers.

Key Features Included: The team asked surveyed homebuyers if their home included up to seven key features at the time they purchased it. The features include finished basement, garage, high or vaulted

ceilings, hardwood or tile flooring, laundry room, outdoor living area, and pool, spa, or hot tub. The team calculated the percentage of homebuyers who reported each feature.

Energy Efficient Technologies Included: The team also asked surveyed homebuyers if their home included up to eight energy efficient technologies at the time they purchased it. The energy efficient technologies include additional or high-performance insulation, ENERGY STAR appliances, energy efficient lighting, high-performance windows, programmable or smart thermostat, renewable electric generation, and high efficient cooling and heating systems. The team calculated the percentage of homebuyers who selected each technology.

Type of Cooling System: The team asked surveyed Non-NZE homebuyers what type of cooling system or technologies came with their home at the time they purchased it. Types of cooling technologies include standard central air system, high efficiency central air system, standard window unit, high efficiency window unit, portable units, ceiling fans, floor fans, air source heat pumps, and ground source heat pumps. The team used the NYSERDA CRIS database to identify the types cooling systems in NZE homes. The team calculated the percentage of homebuyers whose home came with each type of cooling technology.

Type of Heating System: The team asked surveyed Non-NZE homebuyers what type of heating system or technologies came with their home at the time they purchased it. Types of heating technologies include standard natural gas furnace, high efficiency natural gas furnace, air source heat pump, ground source heat pump, oil furnace, propane furnace, electric baseboard and wall heaters, portable heaters, gas fireplace, wood fireplace, wood stove, and gas boiler. The team used the NYSERDA CRIS database to identify the types heating systems in NZE homes. The team calculated the percentage of homebuyers whose home came with each type of cooling technology.

New York State Economic Region: The team matched the physical address of surveyed New York State NZE and Non-NZE homebuyers' homes to the New York State economic region. Economic regions include Long Island, New York City, Mid-Hudson, Capital, North Country, Mohawk Valley, Southern Tier, Central New York, Finger Lakes, and Western New York. The team calculated the percentage of NZE and Non-NZE homebuyers' homes in each region.

The team reported percentages by type of surveyed homebuyer. Types of NZE homebuyers are those who purchased a NZE home built in 2015, for comparison with Non-NZE homebuyers, and the total NZE homebuyers interviewed (those who purchased a NZE home built in 2015 or before). Non-NZE homebuyer types are energy efficient single-family, single-family (unknown energy efficiency), multifamily (unknown energy efficiency), and total homebuyers. The team recommends using the same methodology in future studies.

Table C-30. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | NZE Homebuyers | Non-NZE Homebuyers |
|--|-----------------------|---------------------------|
| Interview or survey question number(s) | Q6, Q8, Q23-Q24, Q46 | Q1, Q3, Q15-Q18, Q42 |
| Secondary Sources | | |
| NYSERDA. "CRIS Database: 2010-2016" | | |
| New York State. 2016. "Regional Economic Development Council Guidebook." https://www.ny.gov/sites/ny.gov/files/atoms/files/REDCGuidebookFINALV3.pdf | | |

C.10. Value Associated with New York State NZE and Non-NZE Home Features and Characteristics

The team divided this market metric into six measurable market indicators.

1. Level of importance New York State NZE and Non-NZE homebuyers assign to energy-related features when they purchased their home
2. New York State NZE and Non-NZE homebuyers' most important home features included in their home at the time of purchase
3. New York State NZE and Non-NZE homebuyers' willingness to pay more for the important home features included their home
4. New York State NZE and Non-NZE homebuyers' most important home features not included in their home at the time of purchase
5. New York State NZE and Non-NZE homebuyers' willingness to pay more for the important home features not included their home
6. Features of Non-NZE homes New York State NZE market actors reported are requested by NZE homebuyers but are difficult to include in a NZE home

C.10.1. Level of Importance New York State NZE and Non-NZE Homebuyers Assign to Energy-Related Features When They Purchased Their Home

Quantitative Market Indicator Description and Estimates

This quantitative indicator is the average level of importance, measured on a 0 to 10 scale where 0 means not at all important and 10 means extremely important, that surveyed New York State NZE and Non-NZE homebuyers assign to eight energy-related features when they purchased their home (Table C-31).

Table C-31. Level of Importance New York State NZE and Non-NZE Homebuyers Assign to Energy-Related Features When They Purchased Their Home

| Importance of Energy-Related Features (0 = Not at all important, 10 = Extremely important) | NZE Homebuyers | | | | Non-NZE Homebuyers | | | | | | | |
|---|----------------|-------|--------------------------|-------|--------------------|-------|---------------|-------|-------------|-------|---------|-------|
| | Built in 2015 | | Built in 2015 or earlier | | EE Single Family | | Single Family | | Multifamily | | Total | |
| N | 7 | | 18 | | 58 | | 11 | | 3 | | 72 | |
| Features | Average | Range | Average | Range | Average | Range | Average | Range | Average | Range | Average | Range |
| Type of cooling system | 4 | 0-10 | 5 | 0-10 | 7 | 0-10 | 7 | 2-10 | 3 | 0-7 | 7 | 0-10 |
| Type of heating system | 6 | 0-10 | 7 | 0-10 | 8 | 5-10 | 8 | 5-10 | 4 | 0-9 | 8 | 0-10 |
| Type of appliances | 6 | 0-10 | 6 | 0-10 | 8 | 3-10 | 7 | 4-10 | 4 | 0-7 | 8 | 0-10 |
| Type of lighting | 6 | 0-10 | 6 | 0-10 | 8 | 5-10 | 6 | 0-10 | 3 | 0-5 | 7 | 0-10 |
| Type of windows | 7 | 0-10 | 7 | 0-10 | 8 | 1-10 | 7 | 3-10 | 3 | 0-6 | 8 | 0-10 |
| Type of insulation | 7 | 0-10 | 7 | 0-10 | 8 | 1-10 | 7 | 2-10 | 3 | 0-6 | 8 | 0-10 |
| Renewable generation | 8 | 0-10 | 8 | 0-10 | 2 | 0-10 | 3 | 0-10 | 2 | 0-3 | 2 | 0-10 |
| The overall energy costs | 8 | 0-10 | 8 | 0-10 | 9 | 3-10 | 7 | 0-10 | 3 | 0-7 | 8 | 0-10 |

Methods Used and Recommendations for Future Studies

The team asked surveyed New York State NZE and Non-NZE homebuyers to rate the level of importance they assign to the energy-related features of their home when they purchased their home (Table C-32). The energy-related features include the type of cooling and heating systems, appliances, lighting, windows, and renewable generation, as well as the overall energy costs of the home. Homebuyers could choose a rating between 0 and 10, where 0 means not at all important and 10 means extremely important. The team calculated the average and range of ratings homebuyers assigned to each energy-related feature.

The team reported averages and ranges by type of surveyed homebuyer. Types of NZE homebuyers are those who purchased a NZE home built in 2015, for comparison with Non-NZE homebuyers, and the total NZE homebuyers interviewed (those who purchased a NZE home built in 2015 or before). Non-NZE homebuyer types are energy efficient single-family, single-family (unknown energy efficiency), multifamily (unknown energy efficiency), and total homebuyers.

The team recommends using the same methodology in future studies, with one exception. The team analyzed respondents’ ratings by income level, time of purchase (before, during, or after construction), concerns and expectations about purchasing their home, and whether the home was their first owned to explain variation in the ratings. These variables, however, did not explain any variation in respondent’s ratings, indicating that other factors the team did not ask about should be collected in future studies. The team recommends asking respondents why they gave their rating for each home feature to learn more about why some provided high ratings and others provided low ratings.

Table C-32. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | NZE Homebuyers | Non-NZE Homebuyers |
|--|-----------------------|---------------------------|
| Interview or survey question number(s) | Q25 | Q25 |

C.10.2. New York State NZE and Non-NZE Homebuyers’ Most Important Home Features and Willingness to Pay More for Important Home Features Included and Not Included in Their Home

Qualitative Market Indicator Description and Estimates

Two of these four qualitative indicators are the most important home features included in surveyed New York State NZE and Non-NZE homebuyers’ homes, and their willingness to pay more for these features (Table C-33). The other two qualitative indicators are the most important home features not included in surveyed New York State NZE and Non-NZE homebuyers’ homes, and their willingness to pay more for these features (Table C-34). These metrics are qualitative because the team used an open-ended survey question to ask about important features.

Table C-33. New York State NZE and Non-NZE Homebuyers' Most Important Home Features and Willingness to Pay More for Important Home Features Included in Their Home

| | NZE Homebuyers | | | | Non-NZE Homebuyers | | | | | | | |
|-------------------------------------|----------------|---------------------|--------------------------|---------------------|--------------------|---------------------|---------------|---------------------|-------------|---------------------|-----------|---------------------|
| | Built in 2015 | | Built in 2015 or earlier | | EE Single Family | | Single Family | | Multifamily | | Total | |
| N | 7 | | 18 | | 58 | | 11 | | 3 | | 72 | |
| Features (Included in Home) | Important | Willing to pay more | Important | Willing to pay more | Important | Willing to pay more | Important | Willing to pay more | Important | Willing to pay more | Important | Willing to pay more |
| Type or style of appliances | 29% | 0% | 11% | 33% | 43% | 76% | 18% | 100% | 67% | 50% | 40% | 75% |
| Bedrooms and/or bathrooms | 0% | 0% | 11% | 50% | 55% | 75% | 64% | 100% | 100% | 67% | 58% | 76% |
| Type or condition of cooling system | 14% | 0% | 33% | 100% | 36% | 67% | 45% | 100% | 33% | 0% | 38% | 67% |
| Energy storage | 0% | 0% | 0% | 0% | 2% | 18% | 0% | 0% | 33% | 0% | 3% | 17% |
| Energy management system | 0% | 0% | 6% | 0% | 10% | 33% | 0% | 0% | 33% | 0% | 10% | 31% |
| Finished basement | 0% | 0% | 17% | 100% | 9% | 41% | 9% | 0% | 33% | 100% | 10% | 44% |
| Type of flooring | 0% | 0% | 17% | 100% | 47% | 85% | 27% | 100% | 33% | 0% | 43% | 83% |
| Garage | 0% | 0% | 11% | 0% | 55% | 77% | 64% | 100% | 33% | 0% | 56% | 76% |
| Comfort or safety | 0% | 0% | 22% | 100% | 34% | 89% | 55% | 100% | 67% | 100% | 39% | 91% |
| Colors | 0% | 0% | 0% | 0% | 19% | 22% | 18% | 0% | 33% | 100% | 19% | 26% |
| Countertops | 0% | 0% | 6% | 100% | 41% | 76% | 36% | 100% | 33% | 0% | 40% | 74% |
| Gym or workout area | 0% | 0% | 0% | 0% | 3% | 29% | 9% | 0% | 33% | 100% | 6% | 33% |
| High or vaulted ceilings | 43% | 0% | 28% | 0% | 36% | 76% | 27% | 100% | 67% | 0% | 36% | 71% |
| Type or condition of heating system | 14% | 0% | 44% | 100% | 29% | 74% | 36% | 100% | 67% | 50% | 32% | 73% |
| Layout of the home | 29% | 0% | 39% | 100% | 62% | 93% | 64% | 75% | 67% | 50% | 63% | 89% |

| | NZE Homebuyers | | | | Non-NZE Homebuyers | | | | | | | |
|---|----------------|---------------------|--------------------------|---------------------|--------------------|---------------------|---------------|---------------------|-------------|---------------------|-----------|---------------------|
| | Built in 2015 | | Built in 2015 or earlier | | EE Single Family | | Single Family | | Multifamily | | Total | |
| N | 7 | | 18 | | 58 | | 11 | | 3 | | 72 | |
| Features (Included in Home) | Important | Willing to pay more | Important | Willing to pay more | Important | Willing to pay more | Important | Willing to pay more | Important | Willing to pay more | Important | Willing to pay more |
| Home security system | 0% | 0% | 0% | 0% | 12% | 25% | 9% | 100% | 33% | 100% | 13% | 33% |
| Type or quality of insulation | 43% | 0% | 61% | 100% | 33% | 68% | 18% | 100% | 33% | 100% | 31% | 73% |
| Laundry room | 0% | 0% | 22% | 100% | 50% | 69% | 55% | 67% | 100% | 50% | 53% | 68% |
| Type, quality, or placement of lighting | 29% | 0% | 17% | 0% | 29% | 76% | 27% | 100% | 33% | 0% | 29% | 74% |
| Location | 14% | 0% | 28% | 100% | 55% | 79% | 36% | 100% | 100% | 67% | 54% | 78% |
| Kitchen layout or size | 0% | 0% | 28% | 0% | 43% | 89% | 45% | 100% | 33% | 0% | 43% | 86% |
| Outdoor living area/space | 0% | 0% | 22% | 100% | 22% | 64% | 27% | 100% | 67% | 100% | 25% | 71% |
| Pool or Spa | 0% | 0% | 0% | 0% | 0% | 8% | 0% | 0% | 0% | 100% | 0% | 15% |
| Programmable or smart thermostat | 0% | 0% | 6% | 0% | 31% | 60% | 9% | 100% | 0% | 0% | 26% | 61% |
| Size of Home | 0% | 0% | 17% | 67% | 43% | 87% | 45% | 100% | 33% | 50% | 43% | 85% |
| Solar PV or other Renewable Generation | 29% | 0% | 44% | 100% | 5% | 29% | 0% | 0% | 33% | 100% | 6% | 33% |
| Storage Spaces | 0% | 0% | 11% | 0% | 28% | 67% | 27% | 0% | 67% | 0% | 29% | 62% |
| Style of Home | 0% | 0% | 11% | 50% | 48% | 90% | 36% | 100% | 67% | 0% | 47% | 87% |
| Types or size of windows/ skylights | 43% | 0% | 39% | 0% | 26% | 67% | 36% | 100% | 33% | 0% | 28% | 65% |

Table C-34. New York State NZE and Non-NZE Homebuyers' Most Important Home Features and Willingness to Pay More for Important Home Features Not Included in Their Home

| | NZE Homebuyers | | | | Non-NZE Homebuyers | | | | | | | |
|-------------------------------------|----------------|---------------------|--------------------------|---------------------|--------------------|---------------------|---------------|---------------------|-------------|---------------------|-----------|---------------------|
| | Built in 2015 | | Built in 2015 or earlier | | EE Single Family | | Single Family | | Multifamily | | Total | |
| N | 7 | | 18 | | 58 | | 11 | | 3 | | 72 | |
| Features (Not Included in Home) | Important | Willing to pay more | Important | Willing to pay more | Important | Willing to pay more | Important | Willing to pay more | Important | Willing to pay more | Important | Willing to pay more |
| Type or style of appliances | 0% | 0% | 17% | 100% | 7% | 60% | 0% | 0% | 33% | 0% | 7% | 50% |
| Bedrooms and/or bathrooms | 14% | 0% | 6% | 0% | 2% | 100% | 0% | 0% | 33% | 0% | 3% | 50% |
| Type or condition of cooling system | 0% | 0% | 6% | 100% | 9% | 60% | 0% | 0% | 67% | 50% | 10% | 57% |
| Energy storage | 0% | 0% | 6% | 100% | 0% | 0% | 9% | 0% | 33% | 0% | 3% | 0% |
| Energy management system | 0% | 0% | 0% | 0% | 3% | 33% | 9% | 0% | 33% | 0% | 6% | 25% |
| Finished basement | 0% | 0% | 0% | 0% | 16% | 43% | 27% | 0% | 67% | 50% | 19% | 40% |
| Type of flooring | 0% | 0% | 6% | 0% | 3% | 100% | 9% | 0% | 33% | 0% | 6% | 50% |
| Garage | 0% | 0% | 6% | 0% | 3% | 100% | 9% | 100% | 100% | 67% | 8% | 83% |
| Comfort or safety | 0% | 0% | 6% | 0% | 2% | 100% | 0% | 0% | 33% | 0% | 3% | 100% |
| Colors | 0% | 0% | 0% | 0% | 7% | 0% | 0% | 0% | 33% | 0% | 7% | 0% |
| Countertops | 0% | 0% | 6% | 0% | 2% | 100% | 0% | 0% | 33% | 0% | 3% | 50% |
| Gym or workout area | 0% | 0% | 0% | 0% | 3% | 0% | 9% | 0% | 33% | 0% | 6% | 0% |
| High or vaulted ceilings | 0% | 0% | 6% | 0% | 3% | 100% | 0% | 0% | 33% | 0% | 4% | 67% |
| Type or condition of heating system | 0% | 0% | 6% | 100% | 5% | 100% | 0% | 0% | 33% | 0% | 6% | 50% |
| Layout of the home | 0% | 0% | 6% | 100% | 0% | 0% | 0% | 0% | 33% | 0% | 1% | 0% |

| | NZE Homebuyers | | | | Non-NZE Homebuyers | | | | | | | |
|---|----------------|---------------------|--------------------------|---------------------|--------------------|---------------------|---------------|---------------------|-------------|---------------------|-----------|---------------------|
| | Built in 2015 | | Built in 2015 or earlier | | EE Single Family | | Single Family | | Multifamily | | Total | |
| N | 7 | | 18 | | 58 | | 11 | | 3 | | 72 | |
| Features (Not Included in Home) | Important | Willing to pay more | Important | Willing to pay more | Important | Willing to pay more | Important | Willing to pay more | Important | Willing to pay more | Important | Willing to pay more |
| Home security system | 0% | 0% | 0% | 0% | 9% | 50% | 9% | 100% | 33% | 0% | 10% | 50% |
| Type or quality of insulation | 0% | 0% | 11% | 100% | 9% | 100% | 0% | 0% | 67% | 50% | 10% | 80% |
| Laundry room | 0% | 0% | 6% | 0% | 0% | 0% | 0% | 0% | 33% | 0% | 1% | 0% |
| Type, quality, or placement of lighting | 0% | 0% | 6% | 100% | 2% | 100% | 0% | 0% | 33% | 0% | 3% | 50% |
| Location | 0% | 0% | 6% | 100% | 2% | 100% | 0% | 0% | 0% | 0% | 1% | 100% |
| Kitchen layout or size | 0% | 0% | 6% | 100% | 0% | 0% | 0% | 0% | 33% | 0% | 1% | 0% |
| Outdoor living area/space | 14% | 0% | 11% | 100% | 10% | 57% | 0% | 0% | 33% | 0% | 10% | 50% |
| Pool or Spa | 0% | 0% | 0% | 0% | 9% | 33% | 0% | 0% | 33% | 0% | 8% | 29% |
| Programmable or smart thermostat | 0% | 0% | 6% | 100% | 0% | 0% | 18% | 100% | 33% | 0% | 4% | 50% |
| Size of Home | 0% | 0% | 6% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Solar PV or other Renewable Generation | 0% | 0% | 6% | 100% | 12% | 63% | 0% | 0% | 33% | 100% | 11% | 67% |
| Storage Spaces | 29% | 0% | 22% | 67% | 2% | 100% | 0% | 0% | 0% | 0% | 1% | 100% |
| Style of Home | 0% | 0% | 6% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Types or size of windows/skylights | 0% | 0% | 6% | 0% | 3% | 100% | 0% | 0% | 33% | 0% | 4% | 67% |

Methods Used and Recommendations for Future Studies

The team asked surveyed New York State NZE and Non-NZE homebuyers open-ended questions about what are the most important features included in their home and the most important features not included in their home (and that they want included) (Table C-35). The team asked a “yes or no” follow-up question for each important feature homebuyers mentioned about whether homebuyers would be willing to pay more for the feature. The team coded the important home features into categories and calculated the percentage of homebuyers who mentioned each category. Among the homebuyers who reported an important feature, the team calculated the percentage who reported that they were willing to pay more for the feature.

The team reported averages and ranges by type of surveyed homebuyer. Types of NZE homebuyers are those who purchased a NZE home built in 2015, for comparison with Non-NZE homebuyers, and the total NZE homebuyers interviewed (those who purchased a NZE home built in 2015 or before). Non-NZE homebuyer types are energy efficient single-family, single-family (unknown energy efficiency), multifamily (unknown energy efficiency), and total homebuyers.

The team recommends creating a close-ended question about important home features in future studies, and using the categories in Table C-33 and Table C-34 to create answer choices. The team recommends using the same methodology discussed above for collecting homebuyer’s willingness to pay for important features.

Table C-35. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | NZE Homebuyers | Non-NZE Homebuyers |
|--|----------------|--------------------|
| Interview or survey question number(s) | Q26-Q27 | Q26-Q27 |

C.10.3. Features of Non-NZE Homes that New York State NZE Market Actors Reported are Requested by NZE Homebuyers but are Difficult to Include in a NZE Home

Qualitative Market Indicator Description and Estimates

This qualitative indicator is the features of Non-NZE homes that interviewed New York State NZE market actors reported are requested by NZE homebuyers but are difficult to include or integrate into a NZE home, and the percentage of market actors who reported each feature (Table C-36). Interview market actors reported 15 different features.

Table C-36. Features of Non-NZE Homes that New York State NZE Market Actors Reported are Requested by NZE Homebuyers but are Difficult to Include in a NZE Home (Multiple Responses Allowed)

| | Building Inspectors | Architects | Design-Build | Builders | Developers | HVAC Contractors | Solar PV Contractors | HERS Raters |
|--|---------------------|------------|--------------|----------|------------|------------------|----------------------|-------------|
| N | 4 | 3 | 4 | 5 | 1 | 5 | 7 | 5 |
| None | 100% | 0% | 0% | 40% | 0% | 40% | 86% | 40% |
| Fireplace/wood stove | 0% | 67% | 25% | 40% | 0% | 40% | 0% | 0% |
| Kitchen/bath exhaust | 0% | 33% | 0% | 40% | 0% | 20% | 0% | 20% |
| Mini-split HVAC systems | 0% | 0% | 0% | 0% | 100% | 20% | 0% | 0% |
| Gas appliances | 0% | 33% | 50% | 20% | 100% | 0% | 0% | 0% |
| Dormers | 0% | 0% | 0% | 0% | 0% | 0% | 14% | 0% |
| Steep roofs | 0% | 0% | 0% | 0% | 0% | 0% | 14% | 0% |
| Small roofs | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 40% |
| Lots of windows | 0% | 33% | 0% | 0% | 0% | 0% | 0% | 0% |
| Complex geometry in floor plan | 0% | 33% | 25% | 20% | 0% | 0% | 0% | 0% |
| Radiant heating | 0% | 33% | 0% | 0% | 0% | 0% | 0% | 0% |
| Skylights | 0% | 33% | 0% | 0% | 0% | 0% | 0% | 0% |
| Trees or other objects blocking southern sky | 0% | 33% | 25% | 0% | 0% | 0% | 14% | 20% |
| Basement | 0% | 0% | 0% | 20% | 0% | 0% | 0% | 0% |
| Edison-style light bulbs | 0% | 0% | 0% | 20% | 0% | 0% | 0% | 0% |
| Exhaust vents on roof | 0% | 33% | 25% | 0% | 0% | 0% | 14% | 0% |

Methods Used and Recommendations for Future Studies

The team asked interviewed New York State NZE building inspectors, architects, design-build firms, builders, property developers, HVAC contractors, solar PV contractors, and HERS raters which features of Non-NZE homes are requested by their NZE customers and are difficult to include in a NZE home (Table C-37). The team coded the reported features into categories and calculated the percentage of market actors who reported each home feature category.

For future studies, the team recommends changing the open-ended question about customer-requested home features that are difficult to include in NZE homes to a close-ended question using the categories in Table C-36 to create answer choices.

Table C-37. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | Building Inspectors | Architects, Design-Build, Builders, Developers | HVAC and Solar PV Contractors | HERS Raters |
|--|----------------------------|---|--------------------------------------|--------------------|
| Interview or survey question number(s) | Q13 | Q33 | Q18 | Q18 |

C.11. New York State Market Actors’ Understanding of NYSERDA’s Definition of NZE Homes

The team divided this market metric three measurable market indicators.

1. Percentage of market actors who understand NYSERDA’s NZE home definition
2. Percentage of market actors who suggest changes to NYSERDA’s NZE home definition
3. Types of changes market actors suggest to NYSERDA’s NZE home definition

C.11.1. Percentage of New York State Market Actors Who Understand and Who Suggest Changes to NYSERDA’s Definition of NZE Homes, and the Types of Changes Market Actors Suggest to the Definition

Quantitative and Qualitative Market Indicator Description and Estimates

Two of these indicators are quantitative and one is qualitative. The two quantitative indicators are the percentages of interviewed New York State market actors who reported they understood and reported suggested changes to NYSERDA’s NZE home definition (Table C-38). The qualitative indicator, which was collected from an open-ended interview question, is the types of changes to the definition suggested by interviewed market actors and the percentage who mentioned each type of change (Table C-37). The team found the most market actors reported understanding the definition and a few suggested changes to the definition.

NYSERDA’s definition states a new NZE home is “a grid-connected home that is built to be highly energy efficient and is connected to renewable electric generation, so that the renewable generation offsets all of the home’s average annual energy consumption.”

Methods Used and Recommendations for Future Studies

The team presented NYSERDA’s NZE home definition to interviewed New York State building inspectors, architects, design-build firms, builders, property developers, HVAC contractors, solar PV contractors, HERS raters, NZE homebuyers whose home was built in 2015 or earlier, and Non-NZE homebuyers who purchased their home in 2014 or 2015, and asked if they understood it and if they had any suggested changes to make to it (Table C-38). The team calculated the percentage of market actors who reported understanding the definition and suggested changes. The team also asked in an open-ended question about what changes market actors suggested; the team coded their responses into types of suggested changes and calculated the percentage who mentioned each type.

The team recommends using the same methodology in future studies. The question for the qualitative indicator about types of suggested changes to the definition could be changed to a close-ended question using the types in Table C-37 to create answer choices.

Table C-38. Percentage of New York State Market Actors Who Understand and Who Suggest Changes to NYSERDA’s Definition of NZE Homes, and the Types of Changes Market Actors Suggest to the Definition¹

| | Building Inspectors | Architects | Design-Build | Builders | Developers | HVAC Contractors | Solar PV Contractors | HERS Raters | NZE Home-buyers | Non-NZE Home-buyers |
|---|---------------------|------------|--------------|----------|------------|------------------|----------------------|-------------|-----------------|---------------------|
| N | 4 | 3 | 4 | 6 | 1 | 5 | 7 | 5 | 18 | 58 |
| Understood | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 72% | 90% |
| Suggested changes | 0% | 33% | 50% | 17% | 0% | 40% | 14% | 80% | 28% | 21% |
| Types of suggested changes (multiple responses allowed): (N) | 0 | 1 | 2 | 1 | 0 | 2 | 1 | 1 | 5 | 12 |
| Not necessary to mention “grid-connected,” include off-grid homes | 0% | 100% | 0% | 100% | 0% | 0% | 100% | 100% | 0% | 8% |
| Include other possible onsite renewable generation | 0% | 0% | 50% | 100% | 0% | 0% | 0% | 0% | 60% | 17% |
| Include offsite renewable generation | 0% | 0% | 50% | 0% | 0% | 50% | 0% | 0% | 20% | 8% |

| | Building Inspectors | Architects | Design-Build | Builders | Developers | HVAC Contractors | Solar PV Contractors | HERS Raters | NZE Home-buyers | Non-NZE Home-buyers |
|---|---------------------|------------|--------------|----------|------------|------------------|----------------------|-------------|-----------------|---------------------|
| N | 4 | 3 | 4 | 6 | 1 | 5 | 7 | 5 | 18 | 58 |
| Include more details about energy efficiency, like equipment types needed | 0% | 0% | 0% | 100% | 0% | 50% | 0% | 0% | 0% | 8% |
| Include HERS score instead of “highly efficient” | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% | 0% | 0% |
| Change “renewable electric generation” to “renewable energy generation” | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% | 0% | 0% |
| Specify if site or source energy is being offset by renewable generation | 0% | 0% | 0% | 0% | 0% | 50% | 0% | 0% | 0% | 0% |
| Add information about natural gas and propane | 0% | 0% | 0% | 0% | 0% | 50% | 0% | 0% | 0% | 0% |
| Include examples, like Passive House with solar | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 20% | 0% |
| Include information about breathability, ventilation | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 20% | 0% |
| Simplify definition, too complex to understand | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 67% |
| ¹ NYSERDA’s definition states a new NZE home is “a grid-connected home that is built to be highly energy efficient and is connected to renewable electric generation, so that the renewable generation offsets all of the home’s average annual energy consumption”. | | | | | | | | | | |

Table C-39. NZE Market Actor Interview Guide Question Numbers Used for Market Indicator Estimates

| | Building Inspectors | Architects, Design-Build, Builders, and Developers | HVAC and Solar PV Contractors | HERS Raters | NZE Home-buyers | Non-NZE Home-buyers |
|--|---------------------|--|-------------------------------|-------------|-----------------|---------------------|
| Interview or survey question number(s) | Q3 | Q1 | Q1 | Q1 | Q1 | Q32-Q33 |

Appendix D. Market Actor Interview and Survey Methods, Dispositions, and Instruments

D.1. Distributors of NZE-needed Technologies

The team compiled a list of distributors of four key NZE-needed technologies who distribute to market actors in New York State. The team worked with NYSERDA’s LRNC staff members to identify the four types of NZE-needed technologies on which to focus. These are HVAC technologies, solar PV systems, high performance insulation products, and high performance windows. The team also received recommendations from NYSERDA LRNC staff members and performed a web search for distributors of these technologies who offer their services in New York State.

The team identified four HVAC distributors, four solar PV system distributors, 11 insulation distributors, and six windows distributors who service New York State and distribute NZE-needed equipment (Table D-1). During August 2016, the team contacted distributors up to six times via phone and/or email until completing the goal of four interviews, one interview with a distributor of each of the four types of NZE-needed technologies, to collect market indicator estimates. Interviews averaged about 15 minutes and the team used *Microsoft Excel* compute market indicators from the data collected from interviewed distributors.

Market indicator estimates collected from these distributors are qualitative indicators. This is because the team interviewed one distributor for each technology type instead of attempting a census or conducting a random sample probability survey of all distributors that supply NZE-needed technologies to New York State.

The team also cold-called an additional 14 NZE-needed technology distributors – three or four for each NZE-needed technology type – to collect prices on specific NZE-needed technologies. The team provided each distributor with product specifications and received a price for each product.

Table D-1. Interview Dispositions for Distributors of NZE-Needed Technologies that Service New York State

| Distributor Type | Number in List | Number Attempted | Not Reached | Refused | Completed Interview |
|-------------------------|----------------|------------------|-------------|---------|---------------------|
| HVAC Distributors | 4 | 1 | 0 | 0 | 1 |
| Solar Distributors | 4 | 2 | 1 | 0 | 1 |
| Insulation Distributors | 11 | 11 | 1 | 9 | 1 |
| Windows Distributors | 6 | 6 | 2 | 3 | 1 |

Interview Guide

Introduction

- S1. Hello, my name is _____ and I'm calling on behalf of NYSERDA [the New York State Energy Research and Development Authority]. We are conducting research on the market for energy efficient homes, particularly Net Zero Energy homes, in New York State in order to improve the types of support NYSERDA provides in this market. We're talking briefly with businesses like yours who may supply some of the equipment and products needed for these types of homes. Are you a good person to speak with about your company's products for energy efficient homes?
1. Yes → SKIP TO S3
 2. No
 3. Do not carry products/equipment for high efficiency homes → Why not? → THANK & TERMINATE
- S2. Is there someone available I could talk to about your company's equipment for high efficiency homes?
1. Yes
 2. No → When is a good time to call back and who should I ask for? → THANK & TERMINATE
- S3. Do you have about 10 minutes to answer a few questions about your business and some of the products you carry?
1. Yes
 2. No → When would be a good time to call back?

If needed:

- I work for Research Into Action, a firm selected by NYSERDA to do this research.
- This is not a sales call, we are conducting research on the market for Net Zero Energy homes in New York State to inform NYSERDA of ways it can support and speed the development of this market.
- A high efficiency or energy efficient home is a home that is designed and built to use less energy than a home that is built to building codes.
- A Net Zero Energy home is built to be highly energy efficient and uses renewable energy, like solar panels, to generate as much energy as is consumed in the home. Some might refer to these homes as Zero Net Energy homes instead of Net Zero Energy homes.
- Your responses are confidential and anonymous to the extent permissible by law.

- For verification of this study, you can contact Patricia Gonzales at NYSERDA, at 518-862-1090 ext. 3338 or patricia.gonzales@nyserdera.ny.gov.

High Efficiency Equipment and Products

To begin with, I'd like to ask you a few questions about your company and the equipment or products you supply to customers who work on new energy efficient and Net Zero Energy homes.

S4. First, what is your role in your company?

Q1. What types or categories of equipment and products does your company supply for any type of single- and multi-family homes [not just energy efficient or Net Zero Energy homes]?

[MULTIPLE RESPONSE; DO NOT READ]

1. HVAC equipment
2. Lighting equipment
3. Windows
4. Insulation, forms, and panels
5. Solar PV
6. Electrical equipment
7. Plumbing equipment
8. Roofing products
9. Appliances
10. Other 1:
11. Other 2:
12. Other 3:

[Do not read:]

98. Don't know
99. Refused

[IF NO SOLAR, HVAC, OR SHELL → CONFIRM, THANK & TERMINATE]

Q2. Have you heard of or are you familiar with Net Zero Energy, or NZE, homes or buildings that are built to be highly energy efficient to use less energy and that have renewable electric generation, like solar panels, to generate as much energy as is consumed in the home?

1. Yes
2. No

[Do not read:]

98. Don't know
99. Refused

Q3. How about other types of energy efficient homes? Have you heard of or are you familiar with energy efficient homes that are designed and built to use less energy than a home built to standard building codes? [IF NEEDED: These types of homes include ENERGY STAR Certified homes, Passive House homes, and LEED certified homes.]

1. Yes
2. No

[Do not read:]

98. Don't know
99. Refused

[IF SOLAR ONLY → SKIP TO Q6]

Q4. Do you supply high efficiency [INSERT ITEM] models/products for NZE or energy efficient homes? [ASK ABOUT EACH MENTIONED IN Q1 IF “HIGH EFFICIENCY” APPLIES]

1. HVAC [like ERVs, HRVs, high SEER CACs and furnaces, heat pumps, geothermal systems] → IF NO, Why not?
2. Windows [like triple-pane or double-glazed windows] → IF NO, Why not?
3. Insulation, forms, and panels [like XPS, EPS, insulated concrete forms, structural insulated panels, ZipWalls] → IF NO, Why not?

[Do not read:]

98. Don't know
99. Refused

Q5. [IF NO SOLAR FROM Q1 OR EE HVAC OR SHELL FROM Q4] What products or equipment does your company supply for NZE or energy efficient homes?

1. → IF NOT RELATED TO SOLAR, HVAC, OR SHELL, THANK & TERMINATE
2. None → Why not? → THANK AND TERMINATE

Q6. Last year, did your company’s sales of [INSERT ITEM] increase, remain about the same, or decrease compared to previous years? [ASK ABOUT EACH MENTIONED IN Q4 AND Q5]

- | | | | |
|--|----------|------|------------|
| 1. High efficiency HVAC equipment | Increase | Same | Decrease → |
| [IF INCREASE/DECREASE] Why do you think that is? | | | |
| 2. High efficiency windows | Increase | Same | Decrease → |
| [IF INCREASE/DECREASE] Why do you think that is? | | | |
| 3. High efficiency insulation, forms, or panels | Increase | Same | Decrease → |
| [IF INCREASE/DECREASE] Why do you think that is? | | | |
| 4. Solar PV | Increase | Same | Decrease → |
| [IF INCREASE/DECREASE] Why do you think that is? | | | |

Q10. Does your company offer recommendations to your customers about any high efficiency products and equipment for their NZE or energy efficient jobs?

1. Yes → What types of equipment or products do you recommend?
2. No → Why not?

[Do not read:]

98. Don't know
99. Refused

Q11. Do your customers ever ask you for recommendations about products or equipment that would work well in NZE or energy efficient homes?

1. Yes → What types of equipment or products do you recommend?
2. No → Why do you think that is?

[Do not read:]

98. Don't know
99. Refused

Q12. What do you think needs to be done or needs to change to encourage greater adoption of equipment and products needed for NZE and other energy efficient homes? [PROBE: What has your business done to encourage greater adoption of high performance products? What could distributors, manufacturers, or others do to support the development of the market for high performance products? What about your customers, what could they do to speed adoption of energy efficient technologies?]

- 1.

[Do not read:]

98. Don't know
99. Refused

Firmographics

We are almost done with this interview. The last few questions are about your company.

Q13. How many years has your company been in business?

- 1.

[Do not read:]

98. Don't know
99. Refused

Q14. How many employees are in your office?

1.

[Do not read:]

98. Don't know

99. Refused

Q15. What region or regions does your office serve?

1.

[Do not read:]

98. Don't know

99. Refused

Q16. How many other offices does your company have ...?

1. In New York State

2. Outside New York State

[Do not read:]

98. Don't know

99. Refused

D.2. NZE Training, Trade, and Professional Organizations

Based on interviews with market actors, recommendations from NYSERDA LRNC staff members, and secondary research, the team compiled a list of 14 training, trade, and professional organizations that have members in New York State and provide support for the residential NZE market and market actors (Table D-2). During August and September of 2016, the team contacted these organizations up to six times via phone and/or email, and completed the goal of five interviews. Interviews averaged about 20 minutes, and the team used *Microsoft Excel* compute market indicators from the data collected from NZE-related organizations.

Market indicator estimates collected from these organizations are qualitative indicators. This is because the team used purposive sampling to identify and interview the goal of five organizations instead of attempting a census or conducting a random sample probability survey of all NZE-related organizations that provide services to market actors in New York State.

Table D-2. Interview Dispositions for NZE-Related Training, Trade, and Professional Organizations that Provide Services to NZE Market Actors in New York State

| Organization | Attempted Contact | Not Reached | Completed Interview |
|--|-------------------|-------------|---------------------|
| Northeast Sustainable Energy Associates (NESEA) | X | | X |
| New York Passive House (NYPH) | X | | X |
| North American Board of Certified Energy Practitioners (NABCEP) | X | | X |
| International Ground Source Heat Pump Association (IGSHPA) | X | | X |
| New York State Builders Association (NYSBA) | X | | X |
| Building Performance Institute (BPI) | X | X | |
| New York Solar Energy Industry Association (NYSEIA) | X | X | |
| New York Chapter of American Society of Heating, Refrigerating, and Air-Conditioning Engineers (NY-ASHRAE) | X | X | |
| Association of Energy Engineers (AEE) | X | X | |
| New York Chapter of the U.S. Green Buildings Council (NY-USGBC) | X | X | |
| Northeast Home Energy Rating System Alliance (NE-HERSA) | | | |
| New York Chapter of the National Association of Home Builders (NY-NAHB) | | | |
| Hudson Valley Community College (HVCC; training only) | | | |
| HeatSpring (training only) | | | |

Interview Guide

Introduction

S1. Hello, my name is _____ and I’m calling on behalf of NYSERDA [the New York State Energy Research and Development Authority]. We are conducting research on the market for energy efficient homes, particularly Net Zero Energy homes, in New York State in order to improve the types of support NYSERDA provides in this market. We’re talking briefly with organizations like yours who may provide services or support to professionals and others working in the market for energy efficient and Net Zero Energy homes. Are you a good person to speak with about your organization’s services and support for energy efficient home professionals?

1. Yes → SKIP TO S3
2. No
3. We do not provide services or support to energy efficient home professionals → Why not? → THANK & TERMINATE

S2. Is there someone available I could talk to about your organization's services and support for energy efficient home professionals?

1. Yes
2. No → When is a good time to call back and who should I ask for? → THANK & TERMINATE

S3. Do you have about 15 minutes to answer a few questions about your organization and some of the support and services it provides?

1. Yes
2. No → When would be a good time to call back?

If needed:

- I work for Research Into Action, a firm selected by NYSERDA to do this research.
- This is not a sales call, we are conducting research on the market for Net Zero Energy homes in New York State to inform NYSERDA of ways it can support and speed the development of this market.
- A high efficiency or energy efficient home is a home that is designed and built to use less energy than a home that is built to building codes.
- A Net Zero Energy home is built to be highly energy efficient and uses renewable energy, like solar panels, to generate as much energy as is consumed in the home. Some might refer to these homes as Zero Net Energy homes instead of Net Zero Energy homes.
- Yours are confidential and anonymous to the extent permissible by law.
- For verification of this study, you can contact Patricia Gonzales at NYSERDA, at 518-862-1090 ext. 3338 or patricia.gonzales@nyserdera.ny.gov.

Support and Services to NZE & Energy Efficiency Professionals

To begin with, I'd like to ask you a few questions about your organization.

Q1. First, just to confirm, have you heard of or are you familiar with Net Zero Energy, or NZE, homes or buildings that are built to be highly energy efficient to use less energy and that have renewable electric generation, like solar panels, to generate as much energy as is consumed in the home?

1. Yes
2. No

[Do not read:]

98. Don't know
99. Refused

Q2. And, how about other types of energy efficient homes? Have you heard of or are you familiar with energy efficient homes that are designed and built to use less energy than a home built to standard building codes? [IF NEEDED: These types of homes include ENERGY STAR Certified homes, Passive House homes, and LEED certified homes.]

1. Yes
2. No

[Do not read:]

98. Don't know
99. Refused

Q3. What is your title and role at [INSERT NAME OF ORGANIZATION HERE]?

Q4. What is your organization's mission or goals?

Q5. Does your organization require membership?

1. Yes → How many members do you have?
2. No, but membership is offered → How many members do you have?
3. No, no memberships

Q6. [IF MEMBERSHIPS] During 2015, did your memberships increase, remain about the same, or decrease compared to previous years?

1. Increased
2. Same
3. Decreased

[Do not read:]

98. Don't know
99. Refused

Q7. Who is your organization's target [audience or members] and where are they typically from?

[PROBE: Builders, architects, HVAC contractors, solar contractors, consultants, raters, anyone working in the construction market or in EE market]

1. → About what percent of your organization's [audience or members] works with NZE or energy efficient homes or buildings? [Your best estimate is fine].

Q8. Which of the following services or types of support does your organization provide to professionals or others working in the market for NZE and energy efficient single- and multi-family homes in New York State/Northeastern US?

1. Trainings (courses, seminars, webinars)
2. Certification/credentials

3. Industry/market research, news, or advise
4. Conferences or other events
5. Networking opportunities/Member list
6. Any others?

Q9. In 2015, did the range or types of services and support your organization provides to professionals or others working with NZE or energy efficient homes increase, remain about the same, or decrease compared to previous years?

1. Increase → What was added and why?
2. Same
3. Decrease → What was removed and why?

[Do not read:]

98. Don't know
99. Refused

Q10. Thinking ahead to next year, does your organization plan to expand, reduce, or keep the same types of services and support your organization provides to professionals or others working with NZE or energy efficient homes?

1. Expand → Why?
2. Same
3. Reduce → Why?

[Do not read:]

98. Don't know
99. Refused

Trainings [IF NO TRAININGS OFFERED → SKIP TO Q18]

Q11. What trainings has your organization offered in the past two years that apply to NZE or energy efficient homes, and what are the goals of each?

- 1.

[Do not read:]

98. Don't know
99. Refused

Q12. How are these trainings delivered? [Probes: Online, classroom, other]

- 1.

[Do not read:]

98. Don't know
99. Refused

Q13. Who are the instructors who deliver these trainings? [Probes: organization staff, professionals in the field]

1. → How many instructors do you have?

[Do not read:]

98. Don't know

99. Refused

Q14. Where are these trainings offered? [PROBE: Region and places (community colleges, local schools, event centers, on job sites, etc.)]

1.

[Do not read:]

98. Don't know

99. Refused

Q15. What types of professionals typically take these trainings? [PROBE: Builders, architects, HVAC contractors, solar contractors, consultants, raters, anyone working in the construction market or in EE market]

1. → [IF MEMBERSHIPS] Do they have to be a member of your organization?

[Do not read:]

98. Don't know

99. Refused

Q16. About how many people took these trainings in New York in 2015? [Your best estimate is fine].

1.

[Do not read:]

98. Don't know

99. Refused

Q17. Do any of these trainings result in a certification or credential for attendees?

1. Yes → What certifications and credentials, and what are the goals of each? → SKIP TO Q19

2. No

[Do not read:]

98. Don't know

99. Refused

Certifications [IF NO CERTIFICATIONS OR CREDENTIALS OFFERED → SKIP TO Q20]

Q18. [IF NOT DISCUSSED ABOVE] What certifications do you offer that apply to residential NZE or energy efficiency professionals, and what are the goals of each?

1. → How does someone earn that certification? [Probe: Number of continuing education credits, take a course, pass an exam?]

[Do not read:]

98. Don't know
99. Refused

Q19. In 2015, about how many people in New York received certificates from your organization related to NZE or energy efficient homes?

- 1.

[Do not read:]

98. Don't know
99. Refused

Trainings/Certifications Challenges [IF NO TRAININGS/CERTIFICATIONS OFFERED → SKIP TO Q25]

Q20. Do you collaborate or work with other organizations to provide [training and/or certifications] related to NZE or energy efficient homes?

1. Yes → What organizations, trainings, and certifications?
2. No

[Do not read:]

98. Don't know
99. Refused

Q21. Overall, what are goals of your organization regarding the NZE-related [trainings and/or certifications] it provides?

- 1.

[Do not read:]

98. Don't know
99. Refused

Q22. What challenges has your organization experienced in developing or offering [trainings and/or certifications] to NZE or energy efficient home professionals?

1. → How did you overcome this/these challenge(s)?
2. None

[Do not read:]

- 98. Don't know
- 99. Refused

Q23. What are the major barriers that make it difficult for NZE or energy efficiency professionals to [take trainings and/or earn certifications]?

- 1. → Ways to overcome these barriers?

Q24. What gaps in NZE-related [trainings and/or certifications] exist for those working on NZE homes?

- 1.

[Do not read:]

- 98. Don't know
- 99. Refused

Industry/Market Research, News, & Advice [IF NO INDUSTRY/MARKET RESEARCH, NEWS, ADVICE OFFERED → SKIP TO Q28]

Q25. What types of industry or market research, news, and/or advice does your organization publish or offer?

- 1. → How does your organization make this information available? [PROBE: website, magazine/newsletter, emails, advertising]

[Do not read:]

- 98. Don't know
- 99. Refused

Q26. [IF MEMBERSHIPS] Is it available to members only or to anyone?

- 1. Members only
- 2. Anyone
- 3. Some to members only, some to anyone

[Do not read:]

- 98. Don't know
- 99. Refused

Q27. How much of the research, news, and other information provided by your organization has a focus on NZE or energy efficiency?

- 1. [COLLECT % OR USE None, A little, Some, A lot, All]

[Do not read:]

- 98. Don't know
- 99. Refused

Conferences & Events [IF NO CONFERENCES OR EVENTS OFFERED → SKIP TO Q31]

Q28. How many and what kinds of conferences or other events does your organization host or sponsor in a year?

1.

[Do not read:]

98. Don't know

99. Refused

Q29. Where are these conferences and/or events typically held? [Region]

1.

[Do not read:]

98. Don't know

99. Refused

Q30. To what extent do your conferences and/or other events focus on NZE or energy efficient homes or buildings?

1. [COLLECT % OR USE None, A little, Some, A lot, All]

[Do not read:]

98. Don't know

99. Refused

Networking Opportunities [IF NO NETWORKING OPPORTUNITIES OFFERED TO Q32] SKIP

Q31. What kinds of networking opportunities for NZE and energy efficient professionals does your organization offer?

1. → IF NOT CLEAR: How does your organization facilitate networking among your audience/members?

[Do not read:]

98. Don't know

99. Refused

Challenges and Solutions in NZE Market

Q32. What do you think needs to be done or needs to change to encourage...? [PROBE: What has your organization done? What could trade organizations or NYSERDA or others do? What about your audience/members, what could they do?]

1. More professionals to gain skills or credentials needed for working on NZE or other energy efficient homes
2. Greater adoption of NZE and energy efficient design and building practices
3. Greater adoption of technologies and building materials needed for NZE or other energy efficient homes
4. The building and selling of more NZE and energy efficient homes

Firmographics

We are almost done with this interview. The last few questions are about your company.

Q33. How many people work for your organization?

1. [NUMBER OF EMPLOYEES]

[Do not read:]

98. Don't know
99. Refused

Q34. Where is your organization's headquarters or main office located?

[SINGLE]

- 1.

[Do not read:]

98. Don't know
99. Refused

Q35. Does your organization have a national chapter or any regional or local chapters?

1. Yes → Please explain your organization's structure.
2. No

D.3. NZE Building Inspectors

The team compiled a list of 20 building inspection and permitting offices in cities and towns in New York State the team identified as places where new NZE homes were built. The team used data from the NYSERDA Comprehensive Residential Information Systems (CRIS) database, public databases such as the International Passive House Association's and U.S. Passive House Institute's passive house databases, web searches, and interviews with architects, builders, and developers to locate places where NZE homes were built in 2015 and earlier.

The team began attempting interviews with offices in towns and cities with the most confirmed NZE homes (Table D-3). The team called and/or emailed building inspectors up to five times and fielded the interviews in August and September 2016. The team attempted interviews with nine building inspectors and completed the goal of four interviews with building inspectors. These four inspectors worked on a total of

168 NZE units (156 multifamily units and 10 single family homes) in 2015. Interviews averaged about 15 minutes, and the team used *Microsoft Excel* compute market indicators from the data collected from NZE building inspectors.

Market indicator estimates collected from these building inspectors are qualitative indicators. This is because the team used purposive sampling to identify and interview the goal of four inspectors instead of attempting a census or conducting a random sample probability survey of all building inspector offices in cities and towns in New York State where NZE have been built.

Table D-3. Interview Dispositions for New York State Building Inspectors with Experience with NZE Homes

| City/Town with NZE home(s) | Number of Confirmed NZE Homes/Units | Disposition |
|----------------------------|-------------------------------------|-------------------------------|
| Rotterdam | 156 units | Completed interview |
| East Amherst | 6 homes | Completed interview |
| Schenectady | 2 homes | Completed interview |
| Gardiner | 2 homes | Completed interview |
| New Paltz | 17 homes | Refused |
| Brooklyn | 3 units | Not reached |
| Webster | 2 homes | Not reached |
| Cold Spring | 1 home | Not reached |
| Saratoga Springs | 1 home | Not reached |
| Ballston Spa | 2 homes | Goal reached, did not attempt |
| Getzville | 2 homes | Goal reached, did not attempt |
| Hillsdale | 1 home | Goal reached, did not attempt |
| Greenwich | 1 home | Goal reached, did not attempt |
| Bloomfield | 1 home | Goal reached, did not attempt |
| Lockport | 1 home | Goal reached, did not attempt |
| Cambridge | 1 home | Goal reached, did not attempt |
| Esopus | 1 home | Goal reached, did not attempt |
| Clifton Park | 1 home | Goal reached, did not attempt |
| Lima | 1 home | Goal reached, did not attempt |
| Ithaca | 1 home | Goal reached, did not attempt |

Interview Guide

Introduction & Screening

S1. *Hello, may I speak to [CONTACT NAME]? OR [IF NO CONTACT NAME] Hello, may I speak to someone in your office who has experience inspecting Net Zero Energy homes in [CITY/TOWN NAME]?

[SINGLE RESPONSE; DO NOT READ]

1. Yes
2. No or not available → When would be a good time to reach them? [COLLECT TIME, NAME, AND CONTACT INFO; THANK & TERMINATE]
3. No, our office has not inspected NZE homes → [CONFIRM USING ADDRESS OF NZE HOME; THANK & TERMINATE]
99. Refused → [THANK & TERMINATE]

[IF NEEDED FOR GATEKEEPER]:

- My name is [NAME] and I'm calling on behalf of NYSERDA, the New York State Energy and Research Development Authority. [IF NEEDED] I work for Research Into Action, we have been selected by NYSERDA to do this research.
- We are conducting research on the market for high performance homes New York State to inform NYSERDA of ways it can support and speed the development of this market.
- A Net Zero Energy home is a type of high performance home that is designed and built to be highly energy efficient and uses renewable energy, like solar panels, to generate as much energy as is consumed in the home.
- For verification of this study, you can contact Patricia Gonzales at NYSERDA, at 518-862-1090 ext. 3338 or patricia.gonzales@nyserdera.ny.gov.

[IF RESPONDENT IS AVAILABLE]

S2. *Hello, my name is [NAME] and I'm calling on behalf of NYSERDA, the New York State Energy and Research Development Authority. We are conducting a study for NYSERDA on Net Zero Energy homes in the State, which are highly energy efficient homes that generate as much energy through renewables, like solar, as they consume. The goal of this study is assess the market for Net Zero Energy homes in the State, and to inform NYSERDA of ways it can support and speed the development of this market.

NYSERDA helped support the construction of [NUMBER OF NZE HOMES IN CITY/TOWN] in [CITY/TOWN]. Are you a good person speak with about your offices experience with inspecting Net Zero Energy homes?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → SKIP TO S4
2. No → **[ASK TO SPEAK WITH BEST PERSON AND REPEAT S2; IF NOT AVAILABLE, COLLECT NAME, CONTACT INFO, AND TIME TO REACH BEST PERSON, THANK & TERMINATE]**
3. No, our office did not/has not inspected NZE homes → **[VERIFY]**

S3. *Which office would have inspected and permitted these homes?

1. → **[THANK & TERMINATE]**

S4. *Great, I have a few questions about your office's planning for and experience with Net Zero Energy homes, it should take about 10-15 minutes to get through the questions, depending on how much you have to say. Would this be a convenient time for us to talk?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Thank you. Would it be OK if I recorded our conversation to aid in my note taking?
→ **SKIP TO Q1**
2. No → **[COLLECT CONTACT INFO AND BEST TIME TO CONTACT] → SKIP TO S5**
99. Refused → **[THANK AND TERMINATE]**

[IF NEEDED FOR RESPONDENT]

- I work for Research Into Action, a firm selected by NYSERDA to do this research.
- This is not a sales call, we are conducting research on the market for Net Zero Energy homes in New York State to inform NYSERDA of ways it can support and speed the development of this market.
- This should take about 10-15 minutes, depending on how much you have to say.
- A Net Zero Energy home is built to be highly energy efficient and uses renewable energy, like solar panels, to generate as much energy as is consumed in the home. Some might refer to these homes as Zero Net Energy homes instead of Net Zero Energy homes.
- Your responses are confidential and anonymous to the extent permissible by law.
- For verification of this study, you can contact Patricia Gonzales at NYSERDA, at 518-862-1090 ext. 3338 or patricia.gonzales@nyserda.ny.gov.
- **[AS NEEDED TO GAIN PARTICIPATION]** We would be happy to send you the study once published early next year.

S5. *Before you go, is there anyone else in your office who I could speak with about Net Zero Energy in [CITY/TOWN]?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → **[IF AVAILABLE, ASK TO SPEAK WITH THEM, RESTART AT S2; IF UNAVAILABLE, COLLECT NAME AND CONTACT INFO, THANK & TERMINATE]**
2. No → **[THANK & TERMINATE]**

Title & Role

Q1. To begin, what is your title and main responsibilities for your agency?

1. Title:
2. Responsibilities:

Q2. *In addition to planning for, inspecting, and permitting buildings in [CITY/TOWN], what other services does your office provide?

[SINGLE RESPONSE; DO NOT READ]

1. Any other services (please specify):
2. None

NZE Definition

Q3. Next, I'd like to ask you to comment on NYSERDA's proposed definition for new Net Zero Energy, or NZE homes. The definition states a new NZE home is "a grid-connected home that is built to be highly energy efficient and is connected to renewable electric generation, so that the renewable generation offsets all of the home's average annual energy consumption". From a building planning and inspection perspective, what changes, if any, do you recommend making to improve this definition?

[SINGLE RESPONSE; DO NOT READ]

1. Changes:
2. No changes
98. Don't know
99. Refused

Experience and Challenges with NZE Homes

Now, I have a few questions about you're the types of new homes inspected by your office and your experience with NZE homes in [CITY/TOWN].

Q4. *I'd like to get an approximate breakdown of the types of homes your office has experience inspecting or permitting. Of all the homes your office inspected in 2015, what percentage was... [IF NEEDED: Your best estimate is fine.] [EACH PAIR SHOULD TOTAL 100%]

1. a. Newly constructed homes: ____% vs. b. Existing homes [that had been retrofitted]: ____%

2. a. Single-family: % vs. b. Multifamily (2 or more units): ____%
3. a. Custom-built: % vs. b. Production- or Spec-built: ____%
4. a. High performance or built-above-code (not just NZE): ____% vs. b. Built-to or built-near code: ____%

[IF NEEDED: By high performance home, we mean a home that is designed to use much less energy than a typical home built to or near code.]

[IF Q3.1a = 0 OR IF Q3.4a=0 → VERIFY, THANK AND TERMINATE]

- Q5. *Approximately how many of the following types of homes did your office inspect and permit in 2015? [IF NEEDED: A highly efficient home that uses renewable generation to offset consumption on an annual basis; only new construction, excluding any existing home retrofits.]
1. New single-family NZE homes:
 2. New single family non-NZE homes:
 3. New multifamily NZE buildings: and units
 4. New multifamily non-NZE buildings: and units

- Q6. Overall, how many [INSERT ITEM] has your office ever inspected or permitted? [IF NEEDED: Only new construction, excluding any existing home retrofits; not just in 2015]

[SINGLE RESPONSE]

1. New single-family NZE homes:
 2. New multifamily NZE buildings:
- Q7. *Next, for each of the following, please describe the major challenges your office or agency has experienced with NZE homes in [CITY/TOWN] and how you overcame those challenges.

| | Challenges? | Why? | Solutions? |
|--|-------------|------|------------|
|--|-------------|------|------------|

1. Planning for NZE homes in [CITY/TOWN]
2. Inspecting and permitting new NZE homes
3. Other challenges with NZE homes

[PLANNING/INSPECTING/PERMITTING PROBES: zoning laws, building codes, lack of support in county]

[INSPECTING/PERMITTING PROBES: lack of skilled builders/designers or knowledge of permitting process, lack of options for resolving a problem in NZE homes to meet code, lack of understanding of NZE design/construction details]

Q8. *Thinking more broadly about the residential market in [CITY/TOWN] and in New York State, what do you consider the main challenges or barriers to increasing the adoption of each of the following in the residential new construction market?

Challenges/Barriers? Solutions?

1. Planning for NZE homes
2. NZE inspecting and permitting practices
3. NZE design and construction practices
4. NZE construction-needed materials
5. NZE-needed technologies and equipment
6. Any others

[DESIGN PRACTICES PROBES: accommodating solar panels, thicker walls, high efficiency insulation throughout, ventilation, heating and cooling, features of the home]

[CONSTRUCTION PRACTICES PROBES: translating the building design into plan of action, building to achieve an NZE home energy rating, building the foundation, building different parts of the structure, installing materials and equipment, using specialized tools, and the like]

[MATERIALS PROBE: insulation for foundation, floor, walls, attics; concrete slabs or forms; vapor barriers; pipes; wiring; wood forms and trusses; furrings]

[TECHNOLOGY/EQUIPMENT PROBE: HVAC equipment, water heating equipment, lighting, energy management system]

Q9. *On a scale of 0 to 10, where '0' means "very poor" and '10' means "excellent", how would you rate your overall experience working with new NZE homes in [CITY/TOWN]?

1. [0-10] Why do say that?
98. Don't know
99. Refused

Q10. *Does your agency have plans to continue preparing for new NZE homes built in [CITY/TOWN] in the future?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What do the plans include? [PROBE: training, coordinating w/other agencies, building support, streamlining permitting/inspections]
2. No → Why not?
98. Don't know
99. Refused

NZE vs. Non-NZE Homes

The next questions ask about what makes NZE homes different from non-NZE homes.

- Q11. *From a residential building planning and permitting perspective, what are the main features and characteristics, if any, that are unique to NZE homes compared to non-NZE, code-built homes?
[IF NO EXPERIENCE WITH NON-NZE CODE BUILT, ASK ABOUT COMPARISON TO OTHER TYPE OF NON-NZE HOME, COLLECT INFO ON TYPE OF NON-NZE HOME USED FOR COMPARISON, I.E. ENERGY STAR, ZER, ETC.]

[PROBE: By features and characteristics, we mean things like the home size, location, home orientation or roof lines, floor plan layout, number of bed and bathrooms, ceiling height, type of flooring, number of windows and doors, HVAC and solar PV equipment, etc.]

[SINGLE RESPONSE; DO NOT READ]

1. [OPEN-ENDED RESPONSE]
2. None
98. Don't know
99. Refused

- Q12. *[IF Q11=1] Have you noticed any challenges or difficulties for builders, designers, or contractors with including any of these features or characteristics in their NZE home job(s)?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What challenges, and why? [OPEN-ENDED RESPONSE]
2. No
98. Don't know
99. Refused

- Q13. *Are there any technologies, equipment, or design features and characteristics of non-NZE, code-built homes that are difficult to include in NZE homes, from a planning and permitting perspective? IF NEEDED: [Because they negatively affect the HERS rating.]

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What technologies, equipment, or design features and why?
2. No
98. Don't know
99. Refused

- Q14. *Using a scale of 0 to 10, where '0' means "no more difficult" and '10' means "much more difficult", how would you score the process of inspecting and permitting an NZE home compared to a similar [INSERT ITEM]?

1. Non-NZE code-built home [IF >0] Why?
2. Non-NZE energy efficient home [IF >0] Why?

[PROBE: ENERGY STAR CERTIFIED, ZERO ENERGY READY]

Trainings, Certifications, Organizations, and Labels

The next questions are about NZE-related organizations, trainings, certifications, and home labels.

Q15. *What trade or professional organizations do you know of, if any, that have some focus on NZE or energy efficient homes?

[SINGLE RESPONSE; DO NOT READ]

- 1.
2. None
98. Don't know
99. Refused

Q16. *[IF Q15≠2] Are you or other staff at your office a member of any trade or professional organizations that have some focus on NZE or energy efficient homes?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Which organizations?
2. No
98. Don't know
99. Refused

Q17. *What, if any, training or professional development courses related NZE or energy efficient homes have you or other staff at your office taken during the past two years? [IF NEEDED: Planning for or inspecting NZE or HP homes.]

[SINGLE RESPONSE; DO NOT READ]

1. [ASK WHICH ORGANIZATION PROVIDED EACH COURSE]
2. None
98. Don't know
99. Refused

Q18. *Are you aware of any [IF 17=1 → INSERT "other"] professional development or training courses related to planning for or inspecting NZE or energy efficient homes?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Which courses? [ASK WHICH ORGANIZATION PROVIDES EACH COURSE]

- 2. No
- 98. Don't know
- 99. Refused

Q19. *During the past two years, have you or others in your office earned any certifications related to NZE or energy efficient home inspections or planning?

[SINGLE RESPONSE; DO NOT READ]

- 1. [ASK WHICH ORGANIZATION PROVIDED EACH CERTIFICATION]
- 2. None
- 98. Don't know
- 99. Refused

Q20. *Are you aware of any [IF Q19=1 → INSERT “other”] certifications related to planning for or inspecting NZE or energy efficient homes?

[SINGLE RESPONSE; DO NOT READ]

- 1. Yes → Which certifications? [ASK WHICH ORGANIZATION PROVIDES EACH CERTIFICATION]
- 2. No
- 98. Don't know
- 99. Refused

Q21. *Next, I will read you a list some labels that are often used to designate energy efficient homes. For each please tell me if you are familiar with the label and, if so, if you or your colleagues have experience with inspecting or permitting homes that have earned the label. The first label is...
[ASK: Are you familiar with this? IF YES: Do you have experience with inspecting homes that have earned this label?]

[MATRIX QUESTION]

| Label | Familiar with.. | | Experience with.. | | |
|--|-----------------|----|-------------------|----|------------|
| | Yes | No | Yes | No | Don't know |
| Earth Advantage Home label by Earth Advantage | | | | | |
| ENERGY STAR Home label by the EPA | | | | | |
| Indoor airPLUS Qualified Home label by the EPA | | | | | |
| Green Communities Home label by Enterprise | | | | | |
| Green Globes Home label by the Green Building Initiative | | | | | |
| Greenpoint Rated Home label by Build It Green | | | | | |
| Greenstar Home label by the GreenHome Institute | | | | | |

| Label | Familiar with.. | | Experience with.. | | |
|---|-----------------|----|-------------------|----|------------|
| | Yes | No | Yes | No | Don't know |
| Healthy House Home label by the American Lung Association | | | | | |
| Home Energy Rating Certificate by RESNET | | | | | |
| Home Energy Score by the DOE and BPI | | | | | |
| LEED Building Certification by the US Green Buildings Council | | | | | |
| Living Building Challenge Net Zero Energy Building label by the Living Future Institute | | | | | |
| National Green Building Standard Home label by the National Association of Home Builders | | | | | |
| New York City Green Property Certification by the NYC Office of Environmental Remediation | | | | | |
| Passive House Certification by the Passive House Academy or Passive House Institute) | | | | | |
| Zero Energy Ready Home label by the DOE (ENERGY STAR + Indoor airPLUS + EPA Watersense + Solar-ready) | | | | | |

Q22. *Are you aware of any other energy efficient home labels or certifications?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Which ones?
2. No
98. Don't know
99. Refused

Q23. *Which labels or certifications do you think is most helpful in communicating the value and features of NZE homes?

- 1.

[Do not read:]

98. Don't know
99. Refused

Firmographics

We're nearly done with the interview, just a couple of more questions about your office.

Q24. *How many employees work in your office?

[SINGLE RESPONSE; DO NOT READ]

1. Number of employees:

98. Don't know

99. Refused

Q25. *And, how many of these employees are qualified to work on NZE homes?

[SINGLE RESPONSE; DO NOT READ]

1. Number of employees:

98. Don't know

99. Refused

Q26. *That's all the questions I have, I really appreciate your taking the time to talk with me. When we complete the report in early 2017, would you like us to email you a copy?

1. Yes (email address):

2. No

Thanks again, and have a great day.

D.4. NZE Architects, Builders, and Developers

The team compiled a list of 36 architects, builders, and property developers who were thought have worked on a new NZE home in 2015. To compile the list, the team used the NYSERDA CRIS database, NYSERDA's list of approved builders, recommendations from NYSERDA LRNC staff members and interviewed market actors, web searches and public databases, and a list of 21 certified Passive House builders from the Passive House Institute US (PHIUS). The team sent the PHIUS professionals a short Request for Information (RFI) survey via two emails asking if they worked on a new NZE home in 2015. Six builders responded to the RFI survey and were added to the list.

The team attempted a census of the 43 NZE architects, builders, and developers by contacting each up to six times via phone and/or email. The team completed interviews with fourteen qualified architects, builders, and developers to collect market indicator estimates (Table D-4). Interviews lasted about one hour, and the team used *Microsoft Excel* compute market indicator estimates from the data collected from NZE architects, builders, and developers.

During the interviews, the team found that the design and construction market actors fit into four different firm types: designer-builder firms that provide architecture and construction services, architecture/designer firms that provide architecture and consulting services, home builder firms that provide construction services, and property developer firms that build and manage larger developments like neighborhoods and multifamily buildings. The team completed three interviews with architect firms that designed a combined 22 NZE homes, four interviews with design-build firms that designed and built a combined 17 NZE units, six interviews with builder firms that built a combined 55 NZE units, and one interview with a property

development firm that built 156 NZE units in 2015 (Table D-4). Firms within these groups reported servicing different parts of New York State and a wide range of firmographic characteristics and experience.

Five of the market actors in the list designed and built their own home. These “designer-builder-homeowners” reported that their profession does not involve designing or building NZE homes but they had the opportunity and skills to design and build their own NZE home; they preferred to be interviewed as a NZE homebuyer instead. In addition, the 11 market actors the team reached but who reported not working on a new NZE home mentioned that they had the training but not yet an opportunity to design or build an NZE home.

Table D-4. Interview Dispositions of New York State NZE Architects, Design-Build Firms, Builders, and Property Developers

| Disposition | Architect/Designer | Design-Build | Builder | Developer | Total |
|--|--------------------|--------------|---------|-----------|-------|
| Total in list | 15 | 10 | 15 | 3 | 43 |
| Source: | | | | | |
| CRIS database or NYSEDA staff | 3 | 9 | 4 | 2 | 18 |
| Web searches and public databases | 4 | 1 | 6 | 0 | 11 |
| Referrals | 5 | 0 | 2 | 1 | 8 |
| PHIUS | 3 | 0 | 2 | 0 | 5 |
| Not reached | 4 | 0 | 2 | 1 | 7 |
| Refusal | 3 | 1 | 2 | 1 | 5 |
| Did not work on new NZE homes | 5 | 0 | 6 | 0 | 11 |
| Designed/built own home, not a professional NZE home builder | 0 | 5 | 0 | 0 | 0 |
| Partial complete ^a | 0 | 0 | 1 | 0 | 0 |
| Completed interview | 3 | 4 | 5 | 1 | 14 |
| Response rate | 38% | 80% | 67% | 33% | 56% |

^a Completed 50% of interview.

Interview Guide

Introduction & Screening

S1. Hello, may I speak to [CONTACT NAME]? OR [IF NO CONTACT NAME] Hello, may I speak to someone in your company who is knowledgeable about high performance homes?

[SINGLE RESPONSE; DO NOT READ]

1. Yes

2. No or not available → When would be a good time to reach them? [**COLLECT TIME, NAME, AND CONTACT INFO; THANK & TERMINATE**]
3. No, we do not work with high performance homes → [**CONFIRM; THANK & TERMINATE**]
99. Refused → [**THANK & TERMINATE**]

[IF NEEDED FOR GATEKEEPER]:

- My name is [NAME] and I'm calling on behalf of NYSERDA, the New York State Energy and Research Development Authority. [IF NEEDED] I work for Research Into Action, we have been selected by NYSERDA to do this research.
- A high performance home is one that is designed to use much less energy than a typical production or spec home built to code; an example is a Net Zero Energy home (a home is built to be highly energy efficient and uses renewable energy, like solar panels, to generate as much energy as is consumed in the home).
- This is not a sales call, we are conducting research on the market for high performance homes New York State to inform NYSERDA of ways it can support and speed the development of this market.
- For verification of this study, you can contact Patricia Gonzales at NYSERDA, at 518-862-1090 ext. 3338 or patricia.gonzales@nyserda.ny.gov.

[IF RESPONDENT IS AVAILABLE]

- S2. Hello, my name is [NAME] and I'm calling on behalf of NYSERDA, the New York State Energy and Research Development Authority. We are conducting a study for NYSERDA on the market for high performance homes in the State or, more specifically, Net Zero Energy homes, which are highly energy efficient homes that generate as much energy through renewables, like solar, as they consume. The goal of this study is assess the market for Net Zero Energy homes in the State, and to inform NYSERDA of ways it can support and speed the development of this market.

Are you a good person speak with about your company's Net Zero Energy homes business?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → SKIP TO S4
 2. No → [**ASK TO SPEAK WITH BEST PERSON AND REPEAT S2; IF NOT AVAILABLE, COLLECT NAME, CONTACT INFO, AND TIME TO REACH BEST PERSON, THANK & TERMINATE**]
 3. No, we do not work with Net Zero Energy homes → [**VERIFY**]
- S3. Why haven't you worked with Net Zero Energy homes?

[PROBE: no demand/customer requests; too busy; don't have the knowledge/skills]

1. ____ → [THANK & TERMINATE]

- S4. Great, I have a few questions about your company's work with Net Zero Energy homes, it should take about 30 to 45 minutes to get through the questions, depending on how much you have to say. Would this be a convenient time for us to talk?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Thank you. Would it be OK if I recorded our conversation to aid in my note taking?
→ **SKIP TO Q1**
2. No → [COLLECT CONTACT INFO AND BEST TIME TO CONTACT] → **SKIP TO S5**
99. Refused → [THANK AND TERMINATE]

[IF NEEDED FOR RESPONDENT]

- I work for Research Into Action, a firm selected by NYSERDA to do this research.
- This is not a sales call, we are conducting research on the market for Net Zero Energy homes in New York State to inform NYSERDA of ways it can support and speed the development of this market.
- A Net Zero Energy home is built to be highly energy efficient and uses renewable energy, like solar panels, to generate as much energy as is consumed in the home. Some might refer to these homes as Zero Net Energy homes instead of Net Zero Energy homes.
- Your responses are confidential and anonymous to the extent permissible by law.
- For verification of this study, you can contact Patricia Gonzales at NYSERDA, at 518-862-1090 ext. 3338 or patricia.gonzales@nyserda.ny.gov.
- **[AS NEEDED TO GAIN PARTICIPATION]** We would be happy to send you the study once published early next year.

- S5. Before you go, is there anyone else in your company who I could speak with about your Net Zero Energy homes business?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → [IF AVAILABLE, ASK TO SPEAK WITH THEM, RESTART AT S2; IF UNAVAILABLE, COLLECT NAME AND CONTACT INFO, THANK & TERMINATE]
2. No → [THANK & TERMINATE]

NZE Definition

- Q1. To begin, I'd like you to comment on NYSERDA's proposed definition for new Net Zero Energy, or NZE homes. The definition states a new NZE home is "a grid-connected home that is built to be highly energy efficient and is connected to renewable electric generation, so that the renewable generation offsets all of the home's average annual energy consumption." What changes, if any, do you recommend making to improve this definition?

[SINGLE RESPONSE; DO NOT READ]

1. Changes: [NOTE: If their definition of NZE is too loose, ask them to clarify the relationship between home use and home generation, or the timing of home generation]
2. No changes
98. Don't know
99. Refused

Jobs & Services

Next, I have a few questions about the type of work your company does.

- Q2. Of all your company's jobs in New York state in 2015, what percent was for residential buildings, including multifamily and single-family buildings (vs. other building types, like commercial, industrial, institutional, etc.)? [IF NEEDED: Your best estimate is fine.]

[SINGLE RESPONSE; DO NOT READ]

1. ____% of business in residential buildings → [IF NONE, THANK & TERMINATE]
98. Don't know
99. Refused

- Q3. I'd like to get an approximate breakdown of the types of homes your company works with in New York state. Of all of your residential jobs in 2015, what percentage was... [IF NEEDED: Your best estimate is fine.] [EACH PAIR SHOULD TOTAL 100%]

1. a. New construction: ____% vs. b. Existing homes: ____%
2. a. Single-family (detached, 2 units, or townhomes): ____% vs. b. Multifamily (3 or more units): ____%
3. a. Custom: ____% vs. b. Production: ____%
4. a. High performance or built-above-code (not just NZE): ____% vs. b. Built-to or built-near code: ____%

[IF NEEDED: By high performance homes, we mean a home that is designed to use much less energy than a typical production or spec home built to or near code.]

**IF RESPONDENT DOES NOT DO NEW CONSTRUCTION OR HIGH PERFORMANCE
TERMINATE CALL**

From now on, when I use the term NZE, I mean as defined by NYSERDA in the definition I read to you previously.

- Q4. How many of the following types of homes did your company complete in 2015? [IF NEEDED: Only new construction, excluding any existing home retrofits.]
1. [IF Q3.2.a>0%] New single-family NZE homes:
 2. [IF Q3.2.a>0%] New single family non-NZE homes:
 3. [IF Q3.2.b>0%] New multifamily NZE units → In how many buildings?
 4. [IF Q3.2.b>0%] New multifamily non-NZE units → In how many buildings?

ASK Q5 - Q8 ONLY IF ONE SINGLE FAMILY NZE HOME IN 2015

Q5. Did your company [INSERT ITEM] the single family NZE home completed in 2015?

- | | | |
|-------------------------|---|---|
| 1. Design | Y | N |
| 2. Develop property for | Y | N |
| 3. Build | Y | N |

Q6. Was the single family NZE home your company completed in 2015 a...?

1. Custom home built for a specific homebuyer
2. Spec custom or semi-custom home built prior to finding a specific homebuyer
3. Production or tract home

Q7. Did this NZE home include any packaged options?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What did the option(s) include?
2. No
98. Don't know
99. Refused

Q8. Has this NZE home been sold to a homebuyer?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Did it sell directly through your company, or through a realtor or other third party?
2. No → Is it for sale? → [IF YES] Through your company, or realtor or third party?
98. Don't know
99. Refused

ASK Q9 – Q12 ONLY IF MORE THAN ONE SINGLE FAMILY NZE HOME IN 2015

- Q9. How many of the single family NZE homes completed in 2015 did your company [INSERT ITEM]?
1. Design
 2. Develop property for
 3. Build
- Q10. How many of the single family NZE homes your company completed in 2015 were a [INSERT ITEM]?
1. Custom home built for a specific homebuyer
 2. Spec custom or semi-custom home built prior to finding a specific homebuyer
 3. Production or tract home
- Q11. Did any of the [INSERT ITEM] include any packaged options? [ASK FOR EACH MENTIONED IN Q10]
1. Custom NZE homes: No Yes → How many → What did the options include?
 2. Spec NZE homes: No Yes → How many → What did the options include?
 3. Production NZE homes: No Yes → How many → What did the options include?
- Q12. Did the/How many of the [INSERT ITEM] home(s) sell/have been sold to homebuyers? [ASK FOR EACH MENTIONED IN Q10]
1. Custom NZE: → [IF YES] Did this/these sell directly through your company, or through a realtor or other third party? [COLLECT NUMBER SOLD THROUGH EACH SOURCE]
 2. Spec NZE: → [IF YES] Did this/these sell directly through your company, or through a realtor or other third party? [COLLECT NUMBER SOLD THROUGH EACH SOURCE]
 3. Production NZE: → [IF YES] Did this/these sell directly through your company, or through a realtor or other third party? [COLLECT NUMBER SOLD THROUGH EACH SOURCE]

ASK Q13 – Q17 ONLY IF ONE MULTIFAMILY NZE BUILDING IN 2015

- Q13. Did your company [INSERT ITEM] the multi-family NZE building and units completed in 2015?
1. Design Yes No
 2. Develop property for Yes No
 3. Build Yes No

Q14. Are the units in the NZE multifamily building your company completed in 2015...?

1. Apartments
2. Condos or townhomes
3. Duplexes, triplexes, or fourplexes

Q15. Did this NZE multifamily building include any packaged options?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What do the options include?
2. No
98. Don't know
99. Refused

Q16. Did your company, or a realtor or other third party, sell the NZE multifamily building your company completed in 2015?

1. Sold through company
2. Sold through realtor or third party
3. Did not sell

Q17. How about the units in this NZE multifamily building? How many have been rented or sold?

1. Rented: ____ → Did your company or a third party manage this?
2. Sold: ____ → Did your company or a third party manage this?
3. Don't know

ASK Q18 – Q22 ONLY IF MORE THAN ONE MULTIFAMILY NZE BUILDING IN 2015

Q18. How many of the NZE multifamily buildings completed in 2015 did your company [INSERT ITEM]?

1. Design ____ How many units [in each]?
2. Develop property for ____ How many units [in each]?
3. Build ____ How many units [in each]?

Q19. How many of the NZE multifamily buildings and units your company completed in 2015 were [INSERT ITEM]?

1. Apartments ____ buildings, units
2. Condos or townhomes ____ buildings, units
3. Duplexes, triplexes, or fourplexes ____ buildings, units

Q20. Did the/any of the [INSERT ITEM] building(s) include any packaged options? [ASK FOR EACH MENTIONED IN Q19]

1. NZE Apartment: No Yes → How many → What did the options include?
2. NZE Condo/Townhome: No Yes → How many → What did the options include?
3. Du-/Tri-/Fourplex: No Yes → How many → What did the options include?

Q21. Did the/How many of the [INSERT ITEM] building(s) sell/have been sold? [ASK FOR EACH MENTIONED IN Q20; SPECIFY WHOLE BUILDINGS, NOT UNITS]

1. NZE Apartment: → **[IF YES]** Did this/these sell directly through your company, or through a realtor or other third party? Company Realtor/Third Party [COLLECT NUMBER SOLD THROUGH EACH SOURCE]
2. NZE Condo/Townhome: → **[IF YES]** Did this/these sell directly through your company, or through a realtor or other third party? Company Realtor/Third Party [COLLECT NUMBER SOLD THROUGH EACH SOURCE]
3. NZE Du-/Tri-/Fourplex: → **[IF YES]** Did this/these sell directly through your company, or through a realtor or other third party? Company Realtor/Third Party [COLLECT NUMBER SOLD THROUGH EACH SOURCE]

Q22. How about the units in each of the NZE multifamily buildings your company completed in 2015? How many units in the [INSERT ITEM] building(s) have been rented or sold? [ASK FOR EACH MENTIONED IN Q20]

1. NZE Apartment: ____ Rented Sold → Did your company or a third party manage this/these?
2. NZE Condo/Townhome: ____ Rented Sold → Did your company or a third party manage or sell this/these?
3. NZE Du-/Tri-/Fourplex: ____ Rented Sold → Did your company or a third party manage or sell this/these?

ASK ALL

Q23. Overall, how many [INSERT ITEM] has your company ever completed? [IF NEEDED: Only new construction, excluding any existing home retrofits; not just in 2015]

[SINGLE RESPONSE]

1. New single-family NZE homes
2. New multifamily NZE buildings and units

Q24. How long has your firm been ...?

[SINGLE RESPONSE; DO NOT READ]

1. In business: Number of years or year of founding
2. Working with NZE homes? Number of years or year of first NZE home

NZE Collaboration

For the remainder of the interview, we'll focus on your company's new construction residential NZE job(s). These next questions ask about collaborating with others involved in your NZE home job(s).

Q25. In your company's experience, what aspects or tasks in the NZE construction process, from the design to the completion of the home, most benefit from collaboration with others involved in the job?

[IF NEEDED: Others involved could include architects/designers, raters, building code officials, manufacturers/distributors, the homebuyer, and subcontractors like HVAC, electrical, renewable, plumbing.]

- 1.
98. Don't know
99. Refused

Q26. Why is collaboration important for these tasks or aspects of the job? [ASK ABOUT EACH ONE MENTIONED IN Q25]

- 1.
98. Don't know
99. Refused

Q27. In your NZE job(s), what ways has collaboration occurred among those involved?

[PROBE: onsite meetings, offsite meetings, design charrettes, bringing in help from outside the job]

1. ____ → Which do you think is most effective?
98. Don't know

Experience and Challenges with NZE Homes

Q28. Next, for each of the following, please describe the major challenges your company has experienced on your new construction residential NZE job(s) and how you overcame those challenges.

- | | Challenges? | Why? | Solutions? |
|----|---|------|------------|
| 1. | [IF DESIGN NZE] Designing the home(s) | | |
| 2. | [IF DEVELOP NZE] Developing the property(ies) | | |
| 3. | [IF BUILD/DEVELOP NZE] Construction practices needed | | |
| 4. | Inspections and permitting | | |
| 5. | [IF DESIGN/BUILD/DEVELOP] Construction materials needed | | |
| 6. | [IF DESIGN/BUILD/DEVELOP] Technologies and equipment needed | | |
| 7. | Home energy rating | | |
| 8. | [IF SELL NZE] Selling the home(s) | | |
| 9. | Any others | | |

[DESIGN PRACTICES PROBES: accommodating solar panels, thicker walls, high efficiency insulation throughout, ventilation, heating and cooling, features of the home]

[CONSTRUCTION PRACTICES PROBES: translating the building design into plan of action, building to achieve an NZE home energy rating, building the foundation, building different parts of the structure, installing materials and equipment, using specialized tools, and the like]

[DESIGN & CONSTRUCTION PRACTICES CHALLENGES PROBE: cost, time required, lack of demand, lack of skills, too many risks, not enough training opportunities, availability of specialized materials, tools, equipment, underdeveloped technologies]

[MATERIALS PROBE: insulation for foundation, floor, walls, attics; concrete slabs or forms; vapor barriers; pipes; wiring; wood forms and trusses; furrings]

[TECHNOLOGY/EQUIPMENT PROBE: HVAC equipment, water heating equipment, lighting, energy management system]

[MATERIALS & TECHNOLOGY/EQUIPMENT CHALLENGES PROBE: AVAILABILITY; cost; underdevelopment; lack of substitutes; skills needed to install]

Q29. How about in the residential new construction market as a whole in New York? What do you consider the main challenges or barriers to increasing the adoption of each of the following in the residential new construction market? [CAN BE OPEN ENDED, WITH PROBES]

Challenges/Barriers? Solutions?

1. NZE design practices
2. NZE property development
3. NZE construction practices
4. NZE-needed construction materials
5. NZE-needed technologies and equipment
6. Advertising or communicating NZE home features
7. Any others

Q30. On a scale of 0 to 10, where ‘0’ means “very poor” and ‘10’ means “excellent”, how would you rate your overall experience working on new NZE homes in New York State?

1. [0-10] Why do say that? [IF NOT CLEAR, ASK:] And was there anything specific to New York State in your experience?
98. Don't know
99. Refused

NZE vs. Non-NZE Homes

The next questions ask about what makes NZE homes different from non-NZE homes.

Q31. What are the main design features and characteristics, if any, that are unique to NZE homes compared to non-NZE, code-built homes?

[IF CANNOT COMPARE TO CODE-BUILT HOME, ASK WHAT CAN THEY COMPARE TO AND USE IT FOR THE FOLLOWING QUESTIONS.]

[PROBE: By design features and characteristics, we mean things like the home size, location, home orientation or roof lines, kitchen layout, number of bed and bathrooms, ceiling height, type of flooring, storage space, number of windows and doors, outdoor living spaces and landscaping, and the like.]

[SINGLE RESPONSE; DO NOT READ]

- 1.
2. None
98. Don't know
99. Refused

Q32. **[IF Q31=1]** Have you experienced any challenges or difficulties with any of these features or characteristics in your NZE home job(s)?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What challenges, and why? [OPEN-ENDED RESPONSE]
2. No
98. Don't know
99. Refused

Q33. Are there any technologies, equipment, or design features and characteristics of non-NZE, code-built homes that homebuyers need or desire and that are difficult to include in NZE homes?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What technologies/equipment/features/characteristics?
2. No
98. Don't know
99. Refused

Q34. **[IF Q33=YES]** Why is this/are these difficult to include in NZE homes?

- 1.
98. Don't know
99. Refused

Q35. **[IF Q33=YES]** What have you done to overcome these difficulties?

1. [OPEN-ENDED RESPONSE]
98. Don't know
99. Refused

Q36. Using a scale of 0 to 10, where '0' means "no more difficult" and '10' means "much more difficult", how would you score the process of [INSERT ITEM] an NZE home compared to a similar code-built home?

- | | |
|--|------------------------|
| 1. [IF Q4.1=Y] Designing | [IF >0] Why? |
| 2. [IF Q4.3=Y] Developing property for | [IF >0] Why? |
| 3. [IF Q4.2=Y] Building | [IF >0] Why? |
| 4. [IF Q4.4=Y] Selling | [IF >0] Why? |

Q37. On average, what is the percentage increase in the cost for an NZE home compared to a similar code-built home?

[IF NEEDED: A similar code-built home would be an NZE home but without the design, materials, and technologies, like solar panels, thicker walls, and high efficiency insulation and windows, needed to make the home NZE]

1. ____%

98. Don't know → What could you compare the cost of an NZE home to? [COLLECT % INCREASE IN COST FOR NZE COMPARED TO HOME: __%]

99. Refused

Q38. What are the primary factors that contribute to the increased costs?

1. [OPEN-ENDED RESPONSE]

98. Don't know

99. Refused

Perspectives about Customers

Now, I'd like to get your perspectives on your residential customers.

Q39. What percentage of your residential customers in New York State would you say are...?

1. Familiar with NZE homes: ____% DK

2. Willing to pay the higher price for an NZE home: ____% DK

Q40. What do you think would be effective at increasing the percentage of your residential customers' who are...?

1. Familiar with NZE homes: DK

2. Willing to pay the higher price for an NZE home: DK

Q41. What, if anything, do you think makes it challenging for your residential customers in New York State to purchase an NZE home?

1.

98. Don't know

99. Refused

Q42. [IF Q41=1] Do you have any suggestions for how to overcome these challenges?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What suggestions?

2. No

98. Don't know

99. Refused

Q43. And what would you say primarily motivates or would motivate your residential customers in New York State to purchase an NZE home?

1.

98. Don't know

99. Refused

Q44. Compared to previous years, would you say you are getting inquiries for NZE homes...

[SINGLE RESPONSE]

1. Less often,

2. About as often,

3. Or more often

[Do not read:]

98. Don't know

99. Refused

Q45. Does your company have any plans to increase or continue your work on new NZE homes in the future?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What kinds of plans? [PROBE: advertising, training, networking]

2. No → Why not?

98. Don't know → What makes you say that?

99. Refused

Trainings, Certifications, Organizations, and Labels

We're nearly done with the interview, just a few more questions. The next questions are about NZE-related organizations, trainings, certifications, and home labels.

Q46. What trade or professional organizations do you know of, if any, that have some focus on NZE or high performance homes? [IF NEEDED: By high performance homes, we mean a home that is designed to use much less energy than a typical production or spec home built to or near code.]

[SINGLE RESPONSE; DO NOT READ]

1.

2. None

98. Don't know

99. Refused

Q47. [IF Q46≠2] Are you or other staff at your company a member of any trade or professional organizations that have some focus on NZE or high performance homes?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Which organizations?
2. No
98. Don't know
99. Refused

Q48. What, if any, training or professional development courses related to NZE or high performance homes have you or other staff at your company taken during the past two years?

[SINGLE RESPONSE; DO NOT READ]

1. [ASK WHICH ORGANIZATION PROVIDED EACH COURSE]
2. None
98. Don't know
99. Refused

Q49. Are you aware of any [IF Q48=1 → INSERT “other”] professional development or training courses related to NZE or high performance homes?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Which courses? [ASK WHICH ORGANIZATION PROVIDES EACH COURSE]
2. No
98. Don't know
99. Refused

Q50. Have you or others in your company earned any certifications related to NZE or high performance homes during the past two years?

[SINGLE RESPONSE; DO NOT READ]

1. [ASK WHICH ORGANIZATION PROVIDED EACH CERTIFICATION]
2. None
98. Don't know
99. Refused

Q51. Are you aware of any [IF Q50=1 → INSERT “other”] certifications related to NZE or high performance homes that builders can earn?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Which certifications? [ASK WHICH ORGANIZATION PROVIDES EACH CERTIFICATION]
2. No
98. Don't know
99. Refused

Q52. Next, I will read you a list some labels that are often used to designate high-performance homes. For each please tell me if you are familiar with the label and, if so, if your company has used the label on any of its residential jobs. The first label is... [ASK: Are you familiar with this? IF YES: Has your company used it?]

[MATRIX QUESTION]

| Label | Familiar with.. | | Use.. | | |
|---|-----------------|----|-------|----|------------|
| | Yes | No | Yes | No | Don't know |
| 1. Earth Advantage Home label by Earth Advantage | | | | | |
| 2. ENERGY STAR Home label by the EPA | | | | | |
| 3. Indoor airPLUS Qualified Home label by the EPA | | | | | |
| 4. Green Communities Home label by Enterprise | | | | | |
| 5. Green Globes Home label by the Green Building Initiative | | | | | |
| 6. Greenpoint Rated Home label by Build It Green | | | | | |
| 7. Greenstar Home label by the GreenHome Institute | | | | | |
| 8. Healthy House Home label by the American Lung Association | | | | | |
| 9. Home Energy Rating Certificate by RESNET | | | | | |
| 10. Home Energy Score by the DOE and BPI | | | | | |
| 11. LEED Building Certification by the US Green Buildings Council | | | | | |
| 12. Living Building Challenge Net Zero Energy Building label by the Living Future Institute | | | | | |
| 13. National Green Building Standard Home label by the National Association of Home Builders | | | | | |
| 14. New York City Green Property Certification by the NYC Office of Environmental Remediation | | | | | |
| 15. Passive House Certification by the Passive House Academy or Passive House Institute) | | | | | |

| Label | Familiar with.. | | Use.. | | |
|--|-----------------|----|-------|----|------------|
| | Yes | No | Yes | No | Don't know |
| 16. Zero Energy Ready Home label by the DOE (DO NOT READ: ENERGY STAR + Indoor airPLUS + EPA Watersense + Solar-ready) | | | | | |

Q53. Are you aware of any other high performance home labels or certifications?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Which ones?
2. No
98. Don't know
99. Refused

Q54. Which labels or certifications do you think is most helpful in communicating the value and features of NZE homes?

- 1.

[Do not read:]

98. Don't know
99. Refused

Firmographics & Snowball Sampling

These last few questions about your company and about others you might know in New York State who work on NZE new construction homes.

Q55. Which of the following services does your company provide to the New York State residential sector?

[SINGLE RESPONSE]

- | | | | |
|---|---|---|----|
| 1. Architecture or design services | Y | N | DK |
| 2. Home building services | Y | N | DK |
| 3. Property development services | Y | N | DK |
| 4. Heating, ventilation, & air conditioning (HVAC) services | Y | N | DK |
| 5. Renewable energy services | Y | N | DK |
| 6. Home energy audits or ratings | Y | N | DK |
| 7. Other services (please specify): | Y | N | DK |

Q56. How many offices does your company have in New York State?

[SINGLE RESPONSE; DO NOT READ]

1. Number of offices:
98. Don't know
99. Refused

Q57. And, about how many employees work in New York state?

[SINGLE RESPONSE; DO NOT READ]

1. Number of employees:
98. Don't know
99. Refused

Q58. How many of these employees are qualified to work on NZE homes?

[SINGLE RESPONSE; DO NOT READ]

1. Number of employees:
98. Don't know
99. Refused

Q59. In what regions of New York State have you completed residential jobs?

1. Regions:
98. Don't know
99. Refused

Q60. And, in what regions of New York State have you completed your NZE residential job(s)?

1. Regions:
98. Don't know
99. Refused

[IF RESPONDENT CANNOT RECALL ANSWERS TO Q61-Q64, ASK IF WE COULD EMAIL THEM THE QUESTIONS → COLLECT EMAIL ADDRESS:]

Q61. Do you know of any other home builders in New York State who have worked on NZE homes?

1. Yes → Who?
2. No
99. Refused

- Q62. What about architects or designers? Have you worked with or do you know of any who have worked on NZE homes?
1. Yes → Who?
 2. No
 99. Refused
- Q63. What about HVAC contractors? Have you worked with any or do know of any who have worked on NZE homes?
1. Yes → Who?
 2. No
 99. Refused
- Q64. And, last, what about solar PV contractors? Have you worked with any or do know of any who have worked on NZE homes?
1. Yes → Who?
 2. No
 99. Refused
- Q65. That's all the questions I have, I really appreciate your taking the time to talk with me. When we complete the report in early 2017, would you like us to email you a copy?
1. Yes (email address):
 2. No

Thanks again, and have a great day.

D.5. NZE HVAC and Solar Contractors

The team compiled a list of 12 HVAC and 17 solar contractors who were thought to have experience working on new NZE homes in New York State in 2015 based on the NYSERDA CRIS database, NYSERDA's lists of approved contractors, recommendations from NYSERDA LRNC staff members and interviewed market actors, and web searches and public databases.

The team called and/or emailed the full list of HVAC and solar contractors up to six times during August and September 2016. The team completed interviews with five qualified HVAC contractors who completed HVAC installations in 124 NZE units and seven qualified solar contractors who completed solar PV installations on 39 NZE units in 2015; respondents of both groups reported servicing different parts of New York State and a wide range of firmographic characteristics and experience (Table D-5). The interviews averaged approximately 45 minutes and the team used *Microsoft Excel* compute market indicator estimates.

In addition, the four actors who reported not working on a new NZE home mentioned that they had the training but not yet an opportunity to install an HVAC or solar PV system on a new NZE home.

Table D-5. Interview Dispositions of New York State NZE HVAC Contractors and Solar PV Contractors

| Disposition | HVAC Contractors | Solar Contractors |
|--|------------------|-------------------|
| Total in list | 12 | 17 |
| Source: | | |
| NYSERDA staff or approved contractor lists | 4 | 8 |
| Referrals | 5 | 6 |
| Web searches or public databases | 3 | 3 |
| Attempted contact | 12 | 17 |
| Not reached | 3 | 5 |
| Refusal | 2 | 3 |
| Did not work on new NZE homes | 2 | 2 |
| Completed interview | 5 | 7 |
| Response rate | 50% | 47% |

Interview Guide

Introduction & Screening

S1. *Hello, may I speak to [CONTACT NAME]? OR [IF NO CONTACT NAME] Hello, may I speak to someone in your company who is knowledgeable about [IF HVAC: installing HVAC equipment in] [IF SOLAR PV: Installing solar PV on] high performance homes?

[SINGLE RESPONSE; DO NOT READ]

1. Yes
2. No or not available → When would be a good time to reach them? [COLLECT TIME, NAME, AND CONTACT INFO; THANK & TERMINATE]
3. No, we do not work with high performance homes → [CONFIRM; THANK & TERMINATE]
99. Refused → [THANK & TERMINATE]

[IF NEEDED FOR GATEKEEPER]:

- My name is [NAME] and I'm calling on behalf of NYSERDA, the New York State Energy and Research Development Authority. [IF NEEDED] I work for Research Into Action, we have been selected by NYSERDA to do this research.

- This is not a sales call, we are conducting research on the market for high performance homes New York State to inform NYSERDA of ways it can support and speed the development of this market.
- A high performance home is one that is designed to use much less energy than a typical production or spec home built to or near code; an example is a Net Zero Energy home, which is a home is built to be highly energy efficient and uses renewable energy, like solar panels, to generate as much energy as is consumed in the home.
- For verification of this study, you can contact Patricia Gonzales at NYSERDA, at 518-862-1090 ext. 3338 or patricia.gonzales@nyserda.ny.gov.

[IF RESPONDENT IS AVAILABLE]

S2. *Hello, my name is [NAME] and I'm calling on behalf of NYSERDA, the New York State Energy and Research Development Authority. We are conducting a study for NYSERDA on the market for high performance homes in the State or, more specifically, Net Zero Energy homes, with a goal of supporting the development of this market.

Are you a good person speak with about your company's experience with [IF HVAC: installing HVAC equipment in] [IF SOLAR PV: Installing solar PV on] Net Zero Energy homes?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → SKIP TO S4
2. No → [ASK TO SPEAK WITH BEST PERSON AND REPEAT S2; IF NOT AVAILABLE, COLLECT NAME, CONTACT INFO, AND TIME TO REACH BEST PERSON, THANK & TERMINATE]
3. No, we have not worked with Net Zero Energy homes → [VERIFY]

S3. *Why haven't you worked with Net Zero Energy homes?

[PROBE: no demand/customer requests; too busy; don't have the knowledge/skills]

1. ____ → [THANK & TERMINATE]

S4. *Great, I have a few questions about your company's work with Net Zero Energy homes, it should take about 20-25 minutes to get through the questions, depending on how much you have to say. Would this be a convenient time for us to talk?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Thank you. Would it be OK if I recorded our conversation to aid in my note taking? → SKIP TO Q1
2. No → [COLLECT CONTACT INFO AND BEST TIME TO CONTACT] → SKIP TO S5
99. Refused → [THANK AND TERMINATE]

[IF NEEDED FOR RESPONDENT]

- I work for Research Into Action, a firm selected by NYSERDA to do this research.
- This is not a sales call, we are conducting research on the market for Net Zero Energy homes in New York State to inform NYSERDA of ways it can support and speed the development of this market.
- A Net Zero Energy home is built to be highly energy efficient and uses renewable energy, like solar panels, to generate as much energy as is consumed in the home. Some might refer to these homes as Zero Net Energy homes instead of Net Zero Energy homes.
- Your responses are confidential and anonymous to the extent permissible by law.
- For verification of this study, you can contact Patricia Gonzales at NYSERDA, at 518-862-1090 ext. 3338 or patricia.gonzales@nyserda.ny.gov.
- **[AS NEEDED TO GAIN PARTICIPATION]** We would be happy to send you the study once published early next year.

S5. *Before you go, is there anyone else in your company who I could speak with about your Net Zero Energy homes business?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → **[IF AVAILABLE, ASK TO SPEAK WITH THEM, RESTART AT S2; IF UNAVAILABLE, COLLECT NAME AND CONTACT INFO, THANK & TERMINATE]**
2. No → **[THANK & TERMINATE]**

NZE Definition

Q1. *To begin, I'd like to ask you to comment on NYSERDA's proposed definition for new Net Zero Energy, or NZE homes. The definition states a new NZE home is "a grid-connected home that is built to be highly energy efficient and is connected to renewable electric generation, so that the renewable generation offsets all of the home's average annual energy consumption." What changes, if any, do you recommend making to improve this definition?

[SINGLE RESPONSE; DO NOT READ]

1. Changes:
2. No changes
98. Don't know
99. Refused

Jobs & Services

Next, I have a few questions about the type of work your company does.

- Q2. *Of all your company's jobs in New York state in 2015, what percent was for residential buildings, including multifamily and single-family buildings (vs. other building types, like commercial, industrial, institutional, etc.)? [IF NEEDED: Your best estimate is fine.]

[SINGLE RESPONSE; DO NOT READ]

1. ____% of business in residential buildings → **[IF 0%, THANK & TERMINATE]**
98. Don't know
99. Refused

- Q3. *I'd like to get an approximate breakdown of the types of homes your company works with in New York state. Of all of your residential jobs in 2015, what percentage was... [IF NEEDED: Your best estimate is fine.] [EACH PAIR SHOULD TOTAL 100%]

1. a. New construction: ____% vs. b. Existing homes: ____%
2. a. Single-family (detached, 2 units, or townhomes): ____% vs. b. Multifamily (3 or more units): ____%
3. a. Custom: ____% vs. b. Production: ____%
4. a. High performance or built-above-code (not just NZE): ____% vs. b. Built-to or build-near code: ____%

[IF NEEDED: By high performance homes, we mean a home that is designed to use much less energy than a typical production or spec home built to or near code.]

[IF Q3.1.a=0% OR Q3.4.b=0% → VERIFY, AND THANK & TERMINATE]

- Q4. *In addition to [HVAC/Solar PV] services, what other services does your company provide in the residential sector in New York State?

[SINGLE RESPONSE]

1. Other services:
2. None

- Q5. *How many of the following types of [HVAC / Solar PV] jobs did your company complete in 2015? [IF NEEDED: Only new construction, excluding any existing home retrofits.]

1. [IF Q3.2.a>0%] Jobs for new single-family NZE homes:
2. [IF Q3.2.a>0%] Jobs for new single family non-NZE homes:
3. [IF Q3.2.b>0%] Jobs for new multifamily NZE buildings ____ and units ____
4. [IF Q3.2.b>0%] Jobs for new multifamily non-NZE buildings ____ and units ____

- Q6. *In total, how many [INSERT ITEM] has your company completed [HVAC / Solar PV] jobs on?
[IF NEEDED: Only new construction, excluding any existing home retrofits]

[SINGLE RESPONSE]

1. New single-family NZE homes:
2. New multifamily NZE buildings ____ and units ____

- Q7. *How long has your firm been ...?

[SINGLE RESPONSE; DO NOT READ]

1. In business: ____ Number of years
2. Working with NZE homes? ____ Number of years or year of first NZE home

NZE Collaboration

For the remainder of the interview, we'll focus on your company's *new construction residential NZE [HVAC / Solar PV] job(s)*. These next questions ask about collaborating with others involved in your NZE home job(s).

- Q8. *In your company's experience, what aspects or tasks in the NZE construction process, from the design to the completion of the home, most benefit from collaboration with others involved in the job? [**IF NEEDED**: Others involved could include architects/designers, builders, raters, building code officials, manufacturers/distributors, the homebuyer, and other subcontractors like [**IF HVAC**: electrical, renewable, plumbing] [**IF SOLAR PV**: HVAC, electrical, plumbing].

1. [OPEN-ENDED RESPONSE]
98. Don't know
99. Refused

- Q9. *Why is collaboration important for these tasks or aspects of the job? [**ASK ABOUT EACH ONE MENTIONED IN Q8**]

1. OPEN-ENDED RESPONSE]
98. Don't know
99. Refused

- Q10. *In your NZE job(s), what ways has collaboration occurred among those involved?

[PROBE: onsite meetings, offsite meetings, design charrettes, bringing in help from outside the job]

1. ____ → Which do you think is most effective? [OPEN-ENDED RESPONSE]
98. Don't know

Experience and Challenges with NZE Homes

Q11. *Next, for each of the following, please describe the major challenges your company has experienced on your new construction residential NZE job(s) and how you overcame those challenges.

- | | Challenges? | Why? | Solutions? |
|--|-------------|------|------------|
| 1. [IF HVAC] Designing/sizing HVAC system | | | |
| 2. [IF HVAC] Installing HVAC equipment | | | |
| 3. [IF SOLAR PV] Designing/sizing PV system | | | |
| 4. [IF SOLAR PV] Installing solar PV equipment | | | |
| 5. Any other challenges | | | |

[HVAC PROBES: **AVAILABILITY of equipment**; cost of equipment/installation; quality of equipment; sizing the equipment and system; achieving appropriate air exchanges; locating ducts; accounting for passive solar gains; underdevelopment of technologies/lack of substitutes; skills needed to install; inspections and permitting]

[SOLAR PV PROBES: **AVAILABILITY of equipment**; cost of equipment/installation; quality of equipment; sizing the equipment and system; locating where PV should be installed on the home/property; connecting PV to home’s electrical system; underdevelopment of technologies/lack of substitutes; skills needed to install; inspections and permitting]

Q12. *How about the in the residential new construction market as a whole in New York? What do you consider the main challenges or barriers to increasing the adoption of each of the following in the residential new construction market?

- | | Challenges/Barriers? | Solutions? |
|---|----------------------|------------|
| 1. [IF HVAC] NZE HVAC system design & technologies | | |
| 2. [IF SOLAR PV] NZE Solar PV design & technologies | | |
| 3. NZE design and construction practices | | |
| 4. Other NZE-needed technologies and equipment | | |
| 5. Any others | | |

[HVAC DESIGN/INSTALLATION PRACTICES PROBES: **AVAILABILITY of equipment**; cost of equipment/installation; quality of equipment; sizing the equipment and system; achieving appropriate air exchanges; locating ducts; accounting for passive solar gains; underdevelopment of technologies/lack of substitutes; skills needed to install; inspections and permitting]

[SOLAR PV PROBES: **AVAILABILITY of equipment**; cost of equipment/installation; quality of equipment; sizing the equipment and system; locating where PV should be installed on the home/property;

connecting PV to home's electrical system; underdevelopment of technologies/lack of substitutes; skills needed to install; inspections and permitting]

[DESIGN/CONSTRUCTION PRACTICES PROBES: translating the building design into plan of action, building to achieve an NZE home energy rating, installing materials and equipment needed to achieve NZE, using specialized tools, and the like]

[DESIGN & CONSTRUCTION PRACTICES CHALLENGES PROBE: cost; lack of demand, lack of skills, too many risks, not enough training opportunities, availability of specialized material, tools, equipment, underdeveloped technologies]

[TECHNOLOGY/EQUIPMENT PROBE: Solar PV panels and related technologies; geothermal/air source heat pumps; low-capacity gas furnaces; Heat/Energy Recovery Ventilators; solar or heat pump water heaters; energy management systems]

[TECHNOLOGY/EQUIPMENT CHALLENGES PROBE: **AVAILABILITY**; cost; underdevelopment; lack of substitutes; skills needed to install]

Q13. *On a scale of 0 to 10, where '0' means "very poor" and '10' means "excellent", how would you rate your overall experience working on new NZE homes?

1. ____ [0-10] Why do say that?
98. Don't know
99. Refused

Q14. *Compared to previous years, would you say you are getting inquiries for NZE home jobs...

[SINGLE RESPONSE]

1. Less often, → Why do you think this is the case?
2. About as often, → Why do you think this is the case?
3. Or more often → Why do you think this is the case?

[Do not read:]

98. Don't know
99. Refused

Q15. *Does your company have plans to increase or continue your work on new NZE homes in the future?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What kinds of plans? [PROBE: advertising, training, networking]
2. No → Why not?
98. Don't know → What makes you say that?
99. Refused

NZE vs. Non-NZE Homes

The next questions ask about what makes NZE homes different from non-NZE homes.

Q16. *From a [HVAC/Solar PV] perspective, what are the main features and characteristics, if any, that are unique to NZE homes compared to non-NZE, code-built homes?

[PROBE: By features and characteristics, we mean things like the type of equipment, design and installation of equipment, the home's characteristics such size, layout, number of bedrooms, etc.]

[SINGLE RESPONSE; DO NOT READ]

1. [OPEN-ENDED RESPONSE]
2. None
98. Don't know
99. Refused

Q17. *[IF Q14=1] Have you experienced any challenges or difficulties with any of these features in your NZE home job(s)?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What challenges, and why? → How did you overcome them?
2. No
98. Don't know
99. Refused

Q18. *Are there any [HVAC/Solar PV]-related technologies, equipment, or design features of non-NZE, code-built homes that homebuyers need or desire and that are difficult to include in NZE homes?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What technologies/equipment/features/characteristics? [OPEN-ENDED RESPONSE]
2. No
98. Don't know
99. Refused

Q19. *[IF Q16=1] Why is this/are these difficult to include in NZE homes?

1. [OPEN-ENDED RESPONSE]
98. Don't know
99. Refused

Q20. *[IF Q16=1] What have you done to overcome these difficulties?

1. [OPEN-ENDED RESPONSE]

98. Don't know

99. Refused

Q21. *Using a scale of 0 to 10, where '0' means "no more difficult" and '10' means "much more difficult", how would you score the process of [INSERT ITEM] an NZE home compared to a similar code-built home?

1. [IF HVAC] Designing and installing an HVAC system in [IF >0] Why?

2. [IF Solar PV] Designing and installing a solar PV system on [IF >0] Why?

Trainings, Certifications, Organizations, and Labels

We're nearly done with the interview, just a few more questions. The next questions are about NZE-related organizations, trainings, certifications, and home labels.

Q22. *What trade or professional organizations do you know of, if any, that have **some** focus on NZE or high performance homes? [IF NEEDED: By high performance homes, we mean a home that is designed to use much less energy than a typical production or spec home built to or near code.]

[SINGLE RESPONSE; DO NOT READ]

1.

2. None

98. Don't know

99. Refused

Q23. *[IF Q24≠2] Are you or other staff at your company a member of any trade or professional organizations that have some focus on NZE or high performance homes?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Which organizations?

2. No

98. Don't know

99. Refused

Q24. *What, if any, training or professional development courses related to NZE or high performance homes have you or other staff at your company taken during the past two years?

[SINGLE RESPONSE; DO NOT READ]

1. [ASK WHICH ORGANIZATION PROVIDED EACH COURSE]

2. None

98. Don't know

99. Refused

Q25. *Are you aware of any [IF Q26=1 → INSERT "other"] professional development or training courses related to NZE or high performance homes?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Which courses? [ASK WHICH ORGANIZATION PROVIDES EACH COURSE]

2. No

98. Don't know

99. Refused

Q26. *Have you or others in your company earned any certifications related to NZE or high performance homes have during the past two years?

[SINGLE RESPONSE; DO NOT READ]

1. [ASK WHICH ORGANIZATION PROVIDED EACH CERTIFICATION]

2. None

98. Don't know

99. Refused

Q27. *Are you aware of any [IF Q28=1 → INSERT "other"] certifications related to NZE or high performance homes that [solar PV/HVAC] contractors can earn?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Which certifications? [ASK WHICH ORGANIZATION PROVIDES EACH CERTIFICATION]

2. No

98. Don't know

99. Refused

Q28. *Next, I will read you a list some labels that are often used to designate high-performance homes. For each please tell me if you are familiar with the label and, if so, if you have experience with installing [HVAC / SOLAR PV] equipment in/on homes that have earned the label. The first label is... [ASK: Are you familiar with this? IF YES: Have you installed equipment in/on homes that have earned this label?]

[MATRIX QUESTION]

| Label | Familiar with.. | | Experience with.. | | |
|---|-----------------|----|-------------------|----|------------|
| | Yes | No | Yes | No | Don't know |
| Earth Advantage Home label by Earth Advantage | | | | | |
| ENERGY STAR Home label by the EPA | | | | | |
| Indoor airPLUS Qualified Home label by the EPA | | | | | |
| Green Communities Home label by Enterprise | | | | | |
| Green Globes Home label by the Green Building Initiative | | | | | |
| Greenpoint Rated Home label by Build It Green | | | | | |
| Greenstar Home label by the GreenHome Institute | | | | | |
| Healthy House Home label by the American Lung Association | | | | | |
| Home Energy Rating Certificate by RESNET | | | | | |
| Home Energy Score by the DOE and BPI | | | | | |
| LEED Building Certification by the US Green Buildings Council | | | | | |
| Living Building Challenge Net Zero Energy Building label by the Living Future Institute | | | | | |
| National Green Building Standard Home label by the National Association of Home Builders | | | | | |
| New York City Green Property Certification by the NYC Office of Environmental Remediation | | | | | |
| Passive House Certification by the Passive House Academy or Passive House Institute) | | | | | |
| Zero Energy Ready Home label by the DOE (ENERGY STAR + Indoor airPLUS + EPA Watersense + Solar-ready) | | | | | |

Q29. *Are you aware of any other high performance home labels or certifications?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Which ones?
2. No
98. Don't know
99. Refused

Q30. *Which labels or certifications do you think is most helpful in communicating the value and features of NZE homes?

- 1.

[Do not read:]

98. Don't know
99. Refused

Firmographics & Snowball Sampling

These last few questions about your company and about others you might know in New York State who work on NZE new construction homes.

Q31. *How many offices does your company have in New York State?

[SINGLE RESPONSE; DO NOT READ]

1. Number of offices:
98. Don't know
99. Refused

Q32. *And, about how many employees work in New York state?

[SINGLE RESPONSE; DO NOT READ]

1. Number of employees:
98. Don't know
99. Refused

Q33. *How many of these employees are qualified to work on NZE homes?

[SINGLE RESPONSE; DO NOT READ]

1. Number of employees:
98. Don't know
99. Refused

Q34. *In what regions of New York State have you completed residential jobs?

1. Regions:
98. Don't know
99. Refused

Q35. *And, in what regions of New York State have you completed your NZE residential job(s)?

1. Regions:
98. Don't know
99. Refused

[IF RESPONDENT CANNOT RECALL ANSWERS TO Q36-Q38, ASK IF WE COULD EMAIL THEM THE QUESTIONS → COLLECT EMAIL ADDRESS:]

- Q36. Do you know of any [IF HVAC: “other”] HVAC contractors in New York State who have worked on NZE homes?
1. Yes → Who?
 2. No
 99. Refused
- Q37. What about [IF SOLAR PV: “other”] solar PV contractors? Have you worked with any or do know of any who have worked on NZE homes?
1. Yes → Who?
 2. No
 99. Refused
- Q38. What about home builders? What builders have you worked with on NZE homes?
1. Yes → Who?
 2. No
 99. Refused
- Q39. And architects or designers? Have you worked with any or do you know of any who have designs NZE homes?
1. Yes → Who?
 2. No
 99. Refused
- Q40. That’s all the questions I have, I really appreciate your taking the time to talk with me. When we complete the report in early 2017, would you like us to email you a copy?
1. Yes (email address):
 2. No

Thanks again, and have a great day.

D.6. NZE HERS Raters

The team compiled a list of 13 HERS raters who were thought to have experience rating and/or consulting on new NZE homes in New York State in 2015. To compile the list, the team used the NYSERDA CRIS database, recommendations from NYSERDA LRNC staff members and interviewed market actors, the Residential Energy Services Network (RESNET), and the PHIUS list of 81 certified Passive House consultants, raters, and verifiers. The team twice emailed the PHIUS list a short RFI survey asking if they worked on a new NZE home in 2015. The RFI survey resulted in 16 respondents, two of whom reported rating new NZE homes in New York State in 2015.

The team attempted a census of the HERS raters by contacting each rater up to six times via phone and/or email, and completed interviews with five qualified HERS raters who rated 177 NZE units in 2015 (Table D-6). Interview HERS raters reported servicing different parts of New York State and a wide range of firmographic characteristics and experience (see Section C.4). Interviews averaged about 45 minutes and the team used *Microsoft Excel* compute market metrics from the data collected from NZE HERS Raters.

Table D-6. Interview Dispositions of New York State NZE HERS Raters

| Disposition | HERS Raters |
|--------------------------------|-------------|
| Total in list | 13 |
| Source: | |
| CRIS database or NYSERDA staff | 7 |
| RESNET | 3 |
| PHIUS | 2 |
| Referrals | 1 |
| Attempted contact | 13 |
| Not reached | 4 |
| Refusal | 3 |
| Did not rate NZE home in 2015 | 1 |
| Completed interview | 5 |
| Response rate | 42% |

Interview Guide

Introduction & Screening

S1. *Hello, may I speak to [CONTACT NAME]? OR [IF NO CONTACT NAME] Hello, may I speak to someone in your company who is knowledgeable about rating high performance homes?

[SINGLE RESPONSE; DO NOT READ]

1. Yes
2. No or not available → When would be a good time to reach them? [COLLECT TIME, NAME, AND CONTACT INFO; THANK & TERMINATE]
3. No, we do not work with high performance homes → [CONFIRM; THANK & TERMINATE]
99. Refused → [THANK & TERMINATE]

[IF NEEDED FOR GATEKEEPER]:

- My name is [NAME] and I'm calling on behalf of NYSERDA, the New York State Energy and Research Development Authority. [IF NEEDED] I work for Research Into Action, we have been selected by NYSERDA to do this research.
- This is not a sales call, we are conducting research on the market for high performance homes New York State to inform NYSERDA of ways it can support and speed the development of this market.
- A high performance home is one that is designed to use much less energy than a typical production or spec home built to or near code; an example is a Net Zero Energy home which has a HERS rating of 10 or less (and is a home is built to be highly energy efficient and uses renewable energy, like solar panels, to generate as much energy as is consumed in the home).
- For verification of this study, you can contact Patricia Gonzales at NYSERDA, at 518-862-1090 ext. 3338 or patricia.gonzales@nysesda.ny.gov.

[IF RESPONDENT IS AVAILABLE]

S2. *Hello, my name is [NAME] and I'm calling on behalf of NYSERDA, the New York State Energy and Research Development Authority. We are conducting a study for NYSERDA on the market for high performance homes in the State or, more specifically, Net Zero Energy homes, which are highly energy efficient homes that generate as much energy through renewables, like solar, as they consume, and have a HERS rating of 10 or less The goal of this study is assess the market for Net Zero Energy homes in the State, and to inform NYSERDA of ways it can support and speed the development of this market.

Are you a good person to speak with about your company's experience with rating Net Zero Energy homes?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → SKIP TO S4
2. No → **[ASK TO SPEAK WITH BEST PERSON AND REPEAT S2; IF NOT AVAILABLE, COLLECT NAME, CONTACT INFO, AND TIME TO REACH BEST PERSON, THANK & TERMINATE]**
3. No, we have not worked with Net Zero Energy homes → [VERIFY]

S3. *Why haven't you worked with Net Zero Energy homes?

[PROBE: no demand/customer requests; too busy; don't have the knowledge/skills]

1. → **[THANK & TERMINATE]**

- S4. *Great, I have a few questions about your company's work with Net Zero Energy homes, it should take about 20 minutes to get through the questions, depending on how much you have to say.
Would this be a convenient time for us to talk?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Thank you. Would it be OK if I recorded our conversation to aid in my note taking?
→ **SKIP TO Q1**
2. No → **[COLLECT CONTACT INFO AND BEST TIME TO CONTACT] → SKIP TO S5**
99. Refused → **[THANK AND TERMINATE]**

[IF NEEDED FOR RESPONDENT]

- I work for Research Into Action, a firm selected by NYSERDA to do this research.
- This is not a sales call, we are conducting research on the market for Net Zero Energy homes in New York State to inform NYSERDA of ways it can support and speed the development of this market.
- A Net Zero Energy home is built to be highly energy efficient and uses renewable energy, like solar panels, to generate as much energy as is consumed in the home. It has a HERS rating of 10 or less. Some might refer to these homes as Zero Net Energy homes instead of Net Zero Energy homes.
- Your responses are confidential and anonymous to the extent permissible by law.
- For verification of this study, you can contact Patricia Gonzales at NYSERDA, at 518-862-1090 ext. 3338 or patricia.gonzales@nyserdera.ny.gov.
- **[AS NEEDED TO GAIN PARTICIPATION]** We would be happy to send you the study once published early next year.

- S5. *Before you go, is there anyone else in your company who I could speak with about your Net Zero Energy homes business?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → **[IF AVAILABLE, ASK TO SPEAK WITH THEM, RESTART AT S2; IF UNAVAILABLE, COLLECT NAME AND CONTACT INFO, THANK & TERMINATE]**
2. No → **[THANK & TERMINATE]**

NZE Definition

- Q1. *To begin, I'd like to ask you to comment on NYSERDA's proposed definition for new Net Zero Energy, or NZE homes. The definition states a new NZE home is "a grid-connected home that is built to be highly energy efficient and is connected to renewable electric generation, so that the renewable generation offsets all of the home's average annual energy consumption". What changes, if any, do you recommend making to improve this definition?

[SINGLE RESPONSE; DO NOT READ]

1. Changes:
2. No changes
98. Don't know
99. Refused

Jobs & Services

Next, I have a few questions about your company and the work it does.

- Q2. *Of all your company's jobs in New York state in 2015, what percent was in residential buildings, including multifamily and single-family buildings (vs. other building types, like commercial, industrial, institutional, etc.)? [IF NEEDED: Your best estimate is fine.]

[SINGLE RESPONSE; DO NOT READ]

1. ____% of business in residential buildings → [IF 0%, THANK & TERMINATE]
98. Don't know
99. Refused

- Q3. *I'd like to get an approximate breakdown of the types of homes your company works with in New York state. Of all of your *residential* jobs in 2015, what percentage was... [IF NEEDED: Your best estimate is fine.] [EACH PAIR SHOULD TOTAL 100%]

1. a. Newly constructed homes: ____% vs. b. Existing homes [that had been retrofitted]: ____%
2. a. Single-family (detached, 2 units, or townhomes): ____% vs. b. Multifamily (3 or more units): ____%
3. a. Custom-built: ____% vs. b. Production- or Spec-built: ____%
4. a. High performance or built-above-code (not just NZE): ____% vs. b. Built-to or built-near code: ____%

[IF NEEDED: By high performance homes, we mean a home that is designed to use much less energy than a typical production or spec home built to or near code.]

[IF Q3.1a = 0 OR IF Q3.4a=0 → VERIFY, THANK AND TERMINATE]

- Q4. *In addition to home energy ratings, does your company provide [INSERT ITEM] in the residential sector in New York state?

[SINGLE RESPONSE; DO NOT READ]

1. Energy consulting services
 2. High performance home label certification (Passive house, ENERGY STAR, LEED, etc.)
 3. Any other services (please specify):
- Q5. *Approximately how many of the following types of jobs did your company provide home energy ratings for in 2015? [IF NEEDED: Only new construction, excluding any existing home retrofits.]
1. [IF Q3.2a>0] New single-family NZE homes:
 2. [IF Q3.2a>0] New single family non-NZE homes:
 3. [IF Q3.2b>0] New multifamily NZE buildings: ____ and units ____
 4. [IF Q3.2b>0] New multifamily non-NZE buildings: ____ and units ____
- Q6. Overall, how many [INSERT ITEM] has your company ever rated? [IF NEEDED: Only new construction, excluding any existing home retrofits; not just in 2015]

[SINGLE RESPONSE]

1. New single-family NZE homes:
 2. New multifamily NZE units:
- Q7. How long has your firm been ...?

[SINGLE RESPONSE; DO NOT READ]

1. In business: ____ Number of years or year of founding
2. Rating NZE homes? ____ Number of years or year of first NZE home

NZE Collaboration

For the remainder of the interview, we'll focus on your company's *new construction residential NZE job(s)*. These next questions ask about collaborating with others involved in your NZE home job(s).

- Q8. *In your company's experience, what aspects or tasks in the NZE construction process, from the design to the completion of the home, most benefit from collaboration with others involved in the job? [IF NEEDED: Others involved could include architects/designers, builders and general contractors, building code officials, manufacturers/distributors, the homebuyer, and subcontractors like HVAC, electrical, renewable, plumbing.]

1. [OPEN-ENDED RESPONSE]
98. Don't know
99. Refused

Q9. *Why is collaboration important for these tasks or aspects of the job? [ASK ABOUT EACH ONE MENTIONED IN Q8]

1. [OPEN-ENDED RESPONSE]

98. Don't know

99. Refused

Q10. *In your company's NZE job(s), what ways has collaboration occurred among those involved? [PROBE: onsite meetings, offsite meetings, design charrettes, bringing in help from outside the job]

1. → Which do you think is most effective? [OPEN-ENDED RESPONSE]

98. Don't know

Experience and Challenges with NZE Homes

Q11. *Next, for each of the following, please describe the major challenges your company has experienced on your new construction residential NZE job(s) and how you overcame those challenges.

| Challenges? | Why? | Solutions? |
|-------------|------|------------|
|-------------|------|------------|

1. Rating NZE homes

2. [IF Q4.2=Y] Consulting with others involved in new NZE homes

3. Other challenges with NZE homes

[RATING PROBES: cost, time required, acquiring rating equipment, finding/keeping skilled employees, timing of the rating in the construction process, working with inexperienced designers, builders or contractors, rating high performance technologies]

[CONSULTING PROBES: cost; lack of skilled builders/designers/contractors, lack of options for resolving a problem in NZE homes, lack of authority on the job for making changes or fixing problems]

Q12. *How about in the residential new construction market as a whole in New York? What do you consider the main challenges or barriers to increasing the adoption of each of the following in the residential new construction market?

| Challenges/Barriers? | Solutions? |
|----------------------|------------|
|----------------------|------------|

1. Home energy ratings

2. Energy consulting services

3. NZE design practices

4. NZE construction practices

5. NZE construction-needed materials

6. NZE-needed technologies and equipment

7. Any others

[DESIGN PRACTICES PROBES: accommodating solar panels, thicker walls, air changes per hour of 50 pascals, high efficiency insulation throughout, ventilation, heating and cooling, features of the home]

[CONSTRUCTION PRACTICES PROBES: translating the building design into plan of action, building to achieve an NZE home energy rating, utilizing different building practices for building the foundation, double walls, reducing thermal bridging, installing materials and equipment, using specialized tools, and the like]

[MATERIALS PROBE: insulation for foundation, floor, walls, attics; concrete slabs or forms; vapor barriers; pipes; wiring; wood forms and trusses; furrings]

[TECHNOLOGY/EQUIPMENT PROBE: HVAC equipment, water heating equipment, lighting, triple pane or high EE windows, energy management system]

Q13. *On a scale of 0 to 10, where '0' means "very poor" and '10' means "excellent", how would you rate your overall experience working with new NZE homes in New York State?

1. [0-10] Why do say that?
98. Don't know
99. Refused

Q14. *Compared to previous years, would you say you are getting inquiries for NZE homes jobs...

[SINGLE RESPONSE]

1. Less often, → Why do you think this is the case?
2. About as often, → Why do you think this is the case?
3. Or more often → Why do you think this is the case?

[Do not read:]

98. Don't know
99. Refused

Q15. *Does your company have any plans for increasing or continuing your work on new NZE homes in the future?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What kinds of plans? [PROBE: advertising, training, networking]
2. No → Why not?
98. Don't know → What makes you say that?
99. Refused

NZE vs. Non-NZE Homes

The next questions ask about what makes NZE homes different from non-NZE homes.

- Q16. *From a home energy rating perspective, what are the main design features and characteristics, if any, that are unique to NZE homes compared to non-NZE, code-built homes? [IF NO EXPERIENCE WITH NON-NZE CODE BUILT, ASK ABOUT COMPARISON TO OTHER TYPE OF NON-NZE HOME, COLLECT INFO ON TYPE OF NON-NZE HOME USED FOR COMPARISON, I.E. ENERGY STAR, ZER, ETC.]

[PROBE: By design features and characteristics, we mean things like the home size, location, home orientation or roof lines, floor plan layout, number of bed and bathrooms, ceiling height, type of flooring, number of windows and doors, HVAC and solar PV equipment, etc.]

[SINGLE RESPONSE; DO NOT READ]

1. [OPEN-ENDED RESPONSE]
2. None
98. Don't know
99. Refused

- Q17. *[IF Q16=1] Have you noticed any challenges or difficulties for builders, designers, or contractors with including any of these features or characteristics in their NZE home job(s)?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What challenges, and why? [OPEN-ENDED RESPONSE]
2. No
98. Don't know
99. Refused

- Q18. *In your company's experience, are there any technologies, equipment, or design features and characteristics of non-NZE, code-built homes that are difficult to include in NZE homes from a home energy rating perspective? IF NEEDED: [Because they negatively affect the HERS rating.]

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What technologies, equipment, or design features and why?
2. No
98. Don't know
99. Refused

Q19. *Using a scale of 0 to 10, where ‘0’ means “no more difficult” and ‘10’ means “much more difficult”, how would you score the process of rating an NZE home compared to a similar [INSERT ITEM]?

1. Non-NZE code-built home [IF >0] Why?
2. Non-NZE high performance home [IF >0] Why?

[PROBE: ENERGY STAR CERTIFIED, ZERO ENERGY READY]

Trainings, Certifications, Organizations, and Labels

The next questions are about NZE-related organizations, trainings, certifications, and home labels.

Q20. *What trade or professional organizations do you know of, if any, that have **some** focus on NZE or high performance homes? [IF NEEDED: By high performance homes, we mean a home that is designed to use much less energy than a typical production or spec home built to or near code.]

[SINGLE RESPONSE; DO NOT READ]

- 1.
2. None
98. Don't know
99. Refused

Q21. *[IF Q20≠2] Are you or other staff at your company a member of any trade or professional organizations that have some focus on NZE or high performance homes?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Which organizations?
2. No
98. Don't know
99. Refused

Q22. *What, if any, training or professional development courses related to NZE or high performance homes have you or other staff at your company taken during the past two years?

[SINGLE RESPONSE; DO NOT READ]

1. [ASK WHICH ORGANIZATION PROVIDED EACH COURSE]
2. None
98. Don't know
99. Refused

Q23. *Are you aware of any [IF 0=1 → INSERT “other”] professional development or training courses related to NZE or high performance homes?

[SINGLE RESPONSE; DO NOT READ]

- 1. Yes → Which courses? [ASK WHICH ORGANIZATION PROVIDES EACH COURSE]
- 2. No
- 98. Don't know
- 99. Refused

Q24. *Have you or others in your company earned any certifications related to NZE or high performance homes during the past two years?

[SINGLE RESPONSE; DO NOT READ]

- 1. [ASK WHICH ORGANIZATION PROVIDED EACH CERTIFICATION]
- 2. None
- 98. Don't know
- 99. Refused

Q25. *Are you aware of any [IF 0=1 → INSERT “other”] certifications related to NZE or high performance homes that raters can earn?

[SINGLE RESPONSE; DO NOT READ]

- 1. Yes → Which certifications? [ASK WHICH ORGANIZATION PROVIDES EACH CERTIFICATION]
- 2. No
- 98. Don't know
- 99. Refused

Q26. *Next, I will read you a list of some labels that are often used to designate high-performance homes. For each please tell me if you are familiar with the label and, if so, if you have experience with rating homes that have earned the label. The first label is... [ASK: Are you familiar with this? IF YES: Do you have experience with rating homes that have earned this label?]

[MATRIX QUESTION]

| Label | Familiar with.. | | Experience with.. | | |
|--|-----------------|----|-------------------|----|------------|
| | Yes | No | Yes | No | Don't know |
| Earth Advantage Home label by Earth Advantage | | | | | |
| ENERGY STAR Home label by the EPA | | | | | |
| Indoor airPLUS Qualified Home label by the EPA | | | | | |
| Green Communities Home label by Enterprise | | | | | |

| Label | Familiar with.. | | Experience with.. | | |
|---|-----------------|----|-------------------|----|------------|
| | Yes | No | Yes | No | Don't know |
| Green Globes Home label by the Green Building Initiative | | | | | |
| Greenpoint Rated Home label by Build It Green | | | | | |
| Greenstar Home label by the GreenHome Institute | | | | | |
| Healthy House Home label by the American Lung Association | | | | | |
| Home Energy Rating Certificate by RESNET | | | | | |
| Home Energy Score by the DOE and BPI | | | | | |
| LEED Building Certification by the US Green Buildings Council | | | | | |
| Living Building Challenge Net Zero Energy Building label by the Living Future Institute | | | | | |
| National Green Building Standard Home label by the National Association of Home Builders | | | | | |
| New York City Green Property Certification by the NYC Office of Environmental Remediation | | | | | |
| Passive House Certification by the Passive House Academy or Passive House Institute) | | | | | |
| Zero Energy Ready Home label by the DOE (ENERGY STAR + Indoor airPLUS + EPA Watersense + Solar-ready) | | | | | |

Q27. *Are you aware of any other high performance home labels or certifications?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → Which ones?
2. No
98. Don't know
99. Refused

Q28. *Which labels or certifications do you think is most helpful in communicating the value and features of NZE homes?

- 1.

[Do not read:]

98. Don't know
99. Refused

Firmographics

We're nearly done with the interview, just a few more questions about your company.

Q29. *How many offices does your company have in New York State?

[SINGLE RESPONSE; DO NOT READ]

1. Number of offices:
98. Don't know
99. Refused

Q30. *And, about how many employees work in New York state?

[SINGLE RESPONSE; DO NOT READ]

1. Number of employees:
98. Don't know
99. Refused

Q31. *How many of these employees are qualified to work on NZE homes?

[SINGLE RESPONSE; DO NOT READ]

1. Number of employees:
98. Don't know
99. Refused

Q32. *In what regions of New York State have you completed residential jobs?

1. Regions:
98. Don't know
99. Refused

Q33. *And, in what regions of New York State have you completed your NZE residential job(s)?

1. Regions:
98. Don't know
99. Refused

[IF RESPONDENT CANNOT RECALL ANSWERS TO Q34-Q37, ASK IF WE COULD EMAIL THEM THE QUESTIONS → COLLECT EMAIL ADDRESS:]

Q34. *Can you refer any home builders in New York State who have worked on NZE homes?

1. Yes → Who?
2. No
99. Refused

- Q35. *What about architects or designers? Can you refer any who have worked on NZE homes?
1. Yes → Who?
 2. No
 99. Refused
- Q36. *What about HVAC contractors? Can you refer any who have worked on NZE homes?
1. Yes → Who?
 2. No
 99. Refused
- Q37. *And, last, what about solar PV contractors? Can you refer any who have worked on NZE homes?
1. Yes → Who?
 2. No
 99. Refused
- Q38. *That's all the questions I have, I really appreciate your taking the time to talk with me. When we complete the report in early 2017, would you like us to email you a copy?
1. Yes (email address):
 2. No

Thanks again, and have a great day.

D.7. NZE Homebuyers

Since there were few NZE homebuyers who purchased a home built in New York State in 2015, the team was asked by NYSERDA staff members to also interview NZE homebuyers who purchased a NZE home built before 2015. The market indicators based on data collected from surveyed 2015 NZE homebuyers provides the 2015 market indicator baseline estimates and comparisons with surveyed Non-NZE homebuyers. The market indicators based on data collected from the combined 2015 and pre-2015 NZE homebuyers provides historical market indicator baseline estimates for all NZE homebuyers through 2015, and should not be used for comparison with surveyed Non-NZE homebuyers.

The team referenced the NYSERDA CRIS database and recommendations from market actors, and conducted searches of the web, public databases, and architects' and builders' websites to compile a list of 101 confirmed and unconfirmed single family NZE homes built in New York State in 2015 or earlier (see Section D.1). The team confirmed that 76 of these NZE homes are actually NZE homes through finding the home's specifications, like the HERS rating, in public databases, market actor websites, and other web sources.

Of the 76 confirmed NZE homes built in New York State in 2015 or earlier, the team found the physical address of 44 homes. The team used multiple sources to find the 44 homebuyers' names and contact information (phone number and/or email address). For a few of the NZE homes, the team acquired the homebuyer information through county property tax records and web searches. NYSERDA LRNC staff members also obtained contact information for a few NZE homebuyers through the builders of the homes. For the remainder of the NZE homes, the team worked with Marketing Systems Group (MSG), Inc., a company that specializes in creating survey samples, and Energy and Resource Solutions (ERS), Inc., the firm selected by NYSERDA to measure and evaluate the energy performance of the NZE homes that participated in the LRNC program, to obtain homebuyer contact information.

The team found NZE homebuyer names and contact information for all but nine of the 44 homebuyers of confirmed NZE homes (Table D-7). Of the 35 homebuyers for whom the team found contact information, 14 had an email address and a phone number, 15 had a phone number only, and six had an email address only. The team attempted a census of the NZE homebuyers with contact information.

The team began attempting phone surveys with 30 NZE homebuyers for whom phone numbers were available. During August and September 2016, the team called NZE homebuyers with only a phone number up to six times and called NZE homebuyers with a phone number and email address up to four times to schedule and complete a survey. The team completed phone surveys with seven NZE homebuyers and surveys averaged about 40 minutes (Table D-7).

Next, the team emailed a web survey invitation to the 18 NZE homebuyers with an email address and who did not complete a phone interview. The team sent these homebuyers up to four email invitations during September and October 2016 and achieved nine completed surveys (Table D-7). Two of the NZE homebuyers started the survey but were screened-out: one was a renter and the other lived in a six-story high-rise home instead of a low-rise home with four or less stories. The web survey took an average of 30 minutes to complete, and the team used *Microsoft Excel* and *SPSS* to compute market metrics from the data collected from NZE homebuyers.

The team learned that five of the NZE homes are owned by the designer-builder of the home. The team waited to near the end of the data collection period before contacting these builder-owners to determine whether to interview them as designer-builders or NZE homebuyers. The team decided to interview these builder-owners as NZE homebuyers since they reported that designing and/or building NZE homes was either not a core part of their profession or was a one-time project, and all five preferred to be interviewed as a homebuyer.

Table D-7. Survey Dispositions of New York State NZE Homebuyers

| Disposition | Built in 2015 | Built before 2015 | Total |
|---------------------------------|---------------|-------------------|-------|
| Total in list | 23 | 21 | 44 |
| Email or phone number available | 20 | 15 | 35 |
| Phone and email | 7 | 8 | 15 |
| Phone only | 12 | 3 | 15 |
| Email only | 1 | 4 | 5 |
| Attempted Phone Survey | 19 | 11 | 30 |
| Bad or wrong phone number | 2 | 0 | 2 |
| Not reached | 8 | 9 | 17 |
| Refused | 2 | 1 | 3 |
| Partial complete ^a | 1 | 0 | 1 |
| Completed phone interview | 6 | 1 | 7 |
| Emailed Web Survey | 6 | 12 | 18 |
| Nonrespondents | 4 | 3 | 7 |
| Screen out: Renter | 0 | 1 | 1 |
| Completed web survey | 2 | 9 | 11 |
| Total completes | 8 | 10 | 18 |
| Response rate | 35% | 43% | 39% |

^a Completed 50% of survey.

Survey Instrument

Introduction and Screening

- S1. Hello, may I speak to **[CONTACT NAME]**? [IF CONTACT NAME NOT AVAILABLE: Hello, may I speak a person in your household who was involved in the decision to buy your home?]
1. Yes
 2. Who's calling? → This is **[NAME]**, calling on behalf of NYSERDA [New York State Energy Research and Development Authority]. [IF NEEDED: I'd like to speak to him/her about their purchase of the home at ADDRESS. This is not a sales call, NYSERDA is conducting a short survey of recent homebuyers in New York State to help it improve the kinds of support it provides to the market for new energy efficient homes in the State. It is very important that we hear from all the different types of recent homebuyers in the State. Our records show that your home at ADDRESS was purchased in the past couple of years and was designed to use little energy.]

3. Not available → Is there someone else I could speak to about the recent purchase of your home last year?
 - a. Yes
 - b. No → When would be a more convenient time to call back? [**COLLECT TIME, VERIFY CONTACT INFO**]
 5. No, does not reside here → [**VERIFY RESIDENTS ARE NOT OWNERS → THANK & TERMINATE**]
 6. No, not interested (refusal) → [**THANK & TERMINATE**]
- S2. [**FOR RESPONDENT**] Hello, my name is [**NAME**] and I'm calling on behalf of the New York State Energy Research and Development Authority, or NYSERDA. This is not a sales call, NYSERDA is conducting a short survey of recent homebuyers in New York State to help it improve the kinds of support it provides to the market for new energy efficient homes in the State. It is very important that we hear from all the different types of recent homebuyers in the State.
- First, in what month and year did you purchase your home?
1. Yes
 2. No → When was your home purchased?
- [IF BEFORE 2013 OR AFTER MARCH 2016 → THANK & TERMINATE]
- [IF JAN 2013 – MARCH 2016 → CONTINUE]
- S3. And, your home was designed and built to be a Net Zero Energy, or near Net Zero Energy home, correct? [IF NEEDED: An NZE home is a home that is built to be highly energy efficient and that is equipped with renewable generation, like solar panels, to produce as much electricity, or nearly as much electricity as is consumed from the utility in a year, on average.]
1. Yes, that is correct → SKIP TO S5
 2. No, my home is not an NZE home
 98. Don't know → ASK FOR SOMEONE WHO MIGHT KNOW OR THANK & TERMINATE
- S4. [IF S3=2] Is your home energy efficient and/or does it have renewable electric generation, like solar panels?
1. Yes, both EE and RG → What makes your home not an NZE home?
 2. Yes, EE but not RG → CONDUCT NON-NZE HOMEBUYER SURVEY
 3. Yes, RG but not EE → CONDUCT NON-NZE HOMEBUYER SURVEY
 4. No → CONDUCT NON-NZE HOMEBUYER SURVEY
 98. Don't know → ASK FOR SOMEONE WHO MIGHT KNOW OR THANK & TERMINATE

S5. Great, I'd like to ask you a few questions about your home and your reasons for choosing this home. I'm estimating this interview will take about 25 minutes, depending on how much you have to say. Is now a good time to talk? If not, could we schedule another time at your convenience?

5. Yes, continue

6. No, reschedule: [COLLECT TIME AND VERIFY CONTACT INFO]

S6. [IF NOT VERIFIED IN INTRODUCTION] Just to confirm, you or members of your household own this home at [ADDRESS], correct?

[SINGLE RESPONSE]

1. Yes, we own it

2. No, we rent → [VERIFY, THANK & TERMINATE]

[IF NEEDED:]

- I work for Research Into Action, a firm selected by NYSERDA to do this research.
- Your responses are confidential and anonymous to the extent permissible by law and will be reported only in the aggregate.
- The survey should take about 25 minutes to complete, depending on how much you have to say.
- NYSERDA provides support such as training and incentives to home builders in the State who build energy efficient homes, and it is currently considering how best to support others in the new homes market, like homeowners.
- For verification of this study, you can contact Patricia Gonzales at NYSERDA, at 518-862-1090 ext. 3338 or patricia.gonzales@nyserda.ny.gov.

Awareness of NZE & Energy Efficient Homes

Q1. *To begin, as an NZE homeowner, NYSERDA would like you to comment on its working definition of NZE homes. NYSERDA defines an NZE home as “a grid-connected home that is built to be highly energy efficient and is connected to renewable electric generation, so that the renewable generation offsets all of the home’s average annual energy consumption.” Does this definition make sense to you?

[SINGLE RESPONSE; DO NOT READ]

1. Yes

2. No

98. Don't know

99. Refused

Q2. How would you improve this definition drawing on what you consider to be an NZE home?

- 1.
2. No suggested improvements
98. Don't know
99. Refused

Q3. *How did you first learn about Net Zero Energy homes?

- 1.

[Do not read:]

98. Don't know
99. Refused

Q4. *Did your home come with a certification or label regarding its energy efficiency, renewable electric generation, health and safety, or NZE status?

1. Yes → What certification/label?
2. No
98. Don't know
99. Refused

Q5. [ASK ABOUT LABELS NOT MENTIONED IN Q4] *What about other types of energy efficient homes? An energy efficient home is designed and built to use less energy than other homes but, unlike NZE homes, it does not produce as much electricity as is consumed from the utility in an average year. Energy efficient homes include homes with labels or certifications like the [INSERT ITEM]. Have you heard of this type of home before? What about [INSERT ITEM]?

[MULTIPLE RESPONSE]

1. ENERGY STAR Certified Home label [by the EPA]
2. Home Energy Rating Certificate [by RESNET]
3. Home Energy Score [by the DOE and BPI]
4. LEED Building Certification [by the US Green Buildings Council]
5. National Green Building Standard Home label [by the National Association of Home Builders]
6. Passive House Certification [by the Passive House Academy or Passive House Institute]
7. Zero Energy Ready Home label [by the DOE]
8. Any others (specify):

Home Purchase Decisions

Next, I'd like to ask a few questions about your home and some of the important decisions you might have made when you purchased your home.

Q6. *What type is your home? Is it a...?

[SINGLE RESPONSE]

1. Single-family detached home → SKIP TO Q8
2. Two-, three-, or four-unit home → SKIP TO Q8
3. A townhome
4. A condo
5. Brownstone
6. Something else: [IF MOBILE HOME OR SIMILAR → THANK & TERMINATE: We are looking to speak with owners of single-family homes, condos, or apartments.]

Q7. [IF Q6=Townhome, condo, or other multi-unit building] How many floors are in your building?

1. One
2. Two
3. Three
4. Four
5. Five or more [THANK & TERMINATE: We are looking to speak with owners of homes in smaller buildings. Thanks for your time.]

Q8. *How many bedrooms are in your home?

[SINGLE RESPONSE; DO NOT READ]

1. None/Studio
2. One
3. Two
4. Three
5. Four
6. Five
7. Six or more

Q9. *Is this the first home you purchased?

[SINGLE RESPONSE; DO NOT READ]

1. Yes
2. No
99. Refused

Q10. *Did you purchase your before, during, or after it was built?

[SINGLE RESPONSE; DO NOT READ]

1. Before
2. During → SKIP TO Q15
3. After → SKIP TO Q19
98. Don't know
99. Refused

Q11. *[IF Q10 = BEFORE] Why did you decide to purchase an NZE home before it was built?

- 1.

[Do not read:]

98. Don't know
99. Refused

Q12. *[IF Q10 = BEFORE] How did you find the architect and/or builder of your home?

1. → Any challenges?

[Do not read:]

98. Don't know
99. Refused

Q13. *[IF Q10 = BEFORE] What challenges, if any, did you experience during the design and construction of your home? [PROBE: project delays, issues with finding or installing materials or equipment, issues with builder/contractors, cost more than expected]

1. → How did you overcome this/these challenge/s?

[Do not read:]

98. Don't know
99. Refused

Q14. *[IF Q10=BEFORE] Did you request that your home be NZE or have specific energy efficient features or renewable electric generation, or this included as part of a package by the designer or builder?

[SINGLE RESPONSE; DO NOT READ]

1. Owner requested
2. Designer/Builder included
3. Neither → How did you decide which energy efficient features and renewable generation system your home would have?
98. Don't know
99. Refused

[IF BEFORE → SKIP TO Q22]

Q15. *[IF Q10 = DURING] Why did you decide to purchase an NZE while it was being built?

1.

[Do not read:]

98. Don't know

99. Refused

Q16. *[IF Q10 = DURING] How did you find your home? [IF THROUGH BUILDER/ARCHITECT ASK HOW THEY WERE FOUND]

1. → Any challenges?

[Do not read:]

98. Don't know

99. Refused

Q17. *[IF Q10 = DURING] What challenges, if any, did you experience during the design and construction of your home? [PROBE: project delays, issues with finding or installing materials or equipment, issues with builder/contractors, cost more than expected]

1. → How did you overcome this/these challenge/s?

[Do not read:]

98. Don't know

99. Refused

Q18. *[IF Q10=DURING] Did you request that your home be NZE or have specific energy efficient features or renewable electric generation, or this included as part of a package by the designer or builder?

[SINGLE RESPONSE; DO NOT READ]

1. Owner requested

2. Designer/Builder included

3. Neither → How did you decide which energy efficient features and renewable generation system your home would have?

98. Don't know

99. Refused

[IF DURING → SKIP TO Q22]

Q19. *[IF Q10 = AFTER] Why did you decide to purchase an NZE home that was already built rather than buy a home before it was built? [PROBE: Was buying a home before it was built something you considered?]

1.

[Do not read:]

98. Don't know

99. Refused

Q20. *[IF Q10 = AFTER] How did you find your NZE home?

1. → Any challenges?

[Do not read:]

98. Don't know

99. Refused

Q21. *[IF Q10=AFTER] Was your home advertised as being NZE or as having energy efficient features and/or renewable electric generation?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What was advertised?

2. No

98. Don't know

99. Refused

Q22. *Overall, what was the primary reason or motivation you purchased your NZE home versus other homes?

1.

[Do not read:]

98. Don't know

99. Refused

Q23. Did your home include the following features at the time you purchased it?

1. [IF Q1=1 OR 2; SF OR ATTACHED] Finished basement

2. [IF Q1=1 OR 2; SF OR ATTACHED] Garage

3. High or vaulted ceilings

4. Hardwood or tile flooring

5. Laundry room or area

6. Outdoor living area like deck or patio

7. [IF Q1=1 OR 2; SF OR ATTACHED] Pool, spa, or hot tub

Q24. *Which of the following energy saving features and technologies were included in your home at the time of purchase?

Yes No Don't have DK

1. Additional or high performance insulation in attic, walls, or floors
2. ENERGY STAR appliances like refrigerator, dishwasher, oven or stove, clothes washer and drier
3. Energy efficient lighting like CFLs or LEDs
4. High-performance windows
5. High efficiency cooling system
6. High efficiency heating system
7. Programmable or smart thermostat to control heating or cooling
8. Renewable electric generation like solar panels
96. Other, please specify:

Q25. On a scale of 0 to 10, where 0 means not at all important and 10 means extremely important, how important in your decision to purchase your home was the...?

1. Type of cooling system
2. Type of heating system
3. Type of appliances
4. Type of lighting
5. Type of windows
6. Type of insulation
7. Renewable generation
8. The overall energy usage or costs of the home

Q26. *Overall, what features or characteristics of your home were most important to you in your decision to buy this home? [ASK ABOUT EACH: Would you have been willing to pay more or make a tradeoff to keep?] [USE LIST TO PROBE]

[MULTIPLE RESPONSE; READ ONLY TO PROBE]

1. None
2. Appliances (specify):
3. Bedrooms and/or bathrooms:
4. Cooling system:
5. Color
6. Energy storage
7. Energy management system
8. Finished basement

9. Flooring (specify):
10. Garage
11. Countertops:
12. High or vaulted ceilings
13. Heating system (specify):
14. Home layout (specify):
15. Home security system
16. Insulation:
17. Laundry room
18. Lighting (specify):
19. Location (specify):
20. Kitchen layout (specify):
21. Outdoor living area/space
22. Pool/spa
23. Programmable or smart thermostat
24. Size
25. Solar PV or other renewable generation:
26. Storage spaces
27. Style
28. Windows/skylights (specify):
29. Other 1:
30. Other 2:
31. Other 3:
32. Other 4:
33. Other 5:
98. Don't know
99. Refused

Q27. *Are there any features or characteristics of a home that are important to you but were not included or part of your home? [ASK ABOUT EACH: Would you have been willing to pay more or make a tradeoff?] [USE LIST TO PROBE]

[MULTIPLE RESPONSE; DO NOT READ]

1. None
2. Appliances (specify):
3. Bedrooms and/or bathrooms:
4. Cooling system:
5. Color

6. Energy storage
7. Energy management system
8. Finished basement
9. Flooring (specify):
10. Garage
11. Countertops:
12. High or vaulted ceilings
13. Heating system (specify):
14. Home layout (specify):
15. Home security system
16. Insulation:
17. Laundry room
18. Lighting (specify):
19. Location (specify):
20. Kitchen layout (specify):
21. Outdoor living area/space
22. Pool/spa
23. Programmable or smart thermostat
24. Size
25. Solar PV or other renewable generation:
26. Storage spaces
27. Style
28. Windows/skylights (specify):
29. Other 1:
30. Other 2:
31. Other 3:
32. Other 4:
33. Other 5:
98. Don't know
99. Refused

Home Satisfaction

Q28. *Using a scale of 0 to 10, with one meaning “not at all satisfied” and 10 meaning “extremely satisfied” how would you rate your overall satisfaction with your home?

[SINGLE RESPONSE]

1. → Why do you say that?

[Do not read:]

98. Don't know

99. Refused

Q29. When purchasing your home, please tell me if you were “not at all,” “slightly,” “somewhat,” “moderately,” or “highly concerned” about each of the following, because of the home’s status as a NZE home ... [Read options; do not read 97-99]

| Concerns | 1 - Not at all concerned | 2 - Slightly concerned | 3 - Somewhat concerned | 4 - Moderately concerned | 5 - Extremely concerned | 98 DK | 99 RF |
|--|--------------------------------|------------------------------|------------------------------|--------------------------------|-------------------------------|----------|----------|
| a) Resale value | | | | | | | |
| b) Initial cost | | | | | | | |
| c) Managing or using any of the high tech features of your home such as monitoring or maintaining solar panels, appliances or other controls | | | | | | | |
| d) Providing sufficient ventilation and air quality | | | | | | | |
| e) Providing comfort and safety | | | | | | | |
| f) Providing sufficient renewable energy to meet demand | | | | | | | |
| g) Finding home built by or finding credible, experienced designer, builder, and subcontractors | | | | | | | |
| h) Any others? | | | | | | | |

[ASK IF CONCERNS MENTIONED IN Q29 = SOMEWHAT, MODERATELY, OR EXTREMELY CONCERNED]

Q30. And how, if at all, did you resolve your concerns?

1.

[Do not read:]

98. Don't know

99. Refused

Q31. When you purchased your home, did you expect to break even or nearly break even on your monthly electricity bills?

1. Yes
2. No → Why not?
3. Don't know

Q32. Since moving in have you been able to or on you on track to break even or nearly break even on your monthly electricity bills?

1. Yes
2. No
3. Don't know

Q33. What other expectations did you have for living in a NZE home when you purchased the home?

- 1.

[Do not read:]

98. Don't know
99. Refused

Q34. Have those expectations been met so far?

[SINGLE RESPONSE]

1. Yes
2. No

[Do not read:]

98. Don't know
99. Refused

Q35. [ASK IF Q34=NO] Which expectations not been met, and why?

- 1.

[Do not read:]

98. Don't know
99. Refused

Q36. Since moving into your home, what issues, if any, have you experienced that are related to your home being an NZE home? [PROBE: Managing or using any of the high tech features of your home such as monitoring or maintaining solar panels, appliances or other controls, insufficient ventilation and air quality, comfort and safety concerns]

1. → How have you resolved the issue?

[Do not read:]

- 98. Don't know
- 99. Refused

Home Buying Costs and Barriers

Q37. *When shopping for your current home did you consider designing/purchasing another home that was labeled or advertised as being energy efficient or as having renewable electric generation?

[SINGLE RESPONSE; DO NOT READ]

- 1. Yes → Was it an NZE home or something else?
- 2. No → Why not?
- 98. Don't know
- 99. Refused

Q38. *[IF Q37 = YES] Why did you decide to not purchase the other home(s) that was (were) labeled or advertised as being highly energy efficient?

- 1.

[Do not read:]

- 98. Don't know
- 99. Refused

Q38A. If an NZE home were not available when you purchased your home, what type of home would you have purchased instead? Would you have purchased a...?

- 1. Home built to standard energy codes
- 2. Home built slightly energy efficient (with energy efficient appliances, lighting, and heating/cooling)
- 3. Home built highly energy efficient (with energy efficient appliances, lighting, and heating/cooling, as well as efficient walls, attic, floors, windows and the like)
- 4. Other (please specify):
- 98. Don't know
- 99. Refused

Q39. Do you think you spent more, less, or about the same for your NZE as you would have for a home of the same size and location but that was not NZE?

- 1. More
- 2. About the same
- 3. Less
- 98. Don't know
- 99. Refused

Q40. [IF Q39= MORE OR LESS] In terms of a percentage, how much more/less do you think you would have paid for a similar non-NZE home?

- 1. [Record % value]
- 98. Don't know
- 99. Refused

Q41. If your home were for sale, do you think your home's designation as a NZE home would cause it to sell for "more", "less," or "about the same" as a home in the same location and of the same size, but with the energy performance of an average home?

- 1. More
- 2. Less
- 3. About the Same

[Do not read:]

- 98. Don't know
- 99. Refused

Q42. [IF Q41 = MORE OR LESS] In terms of a percentage, about how much [more / less]?

- 1. [Record % value]
- 98. Don't know
- 99. Refused

Q43. *If you were to buy another home to live in, how much of a priority would you place on buying [INSERT ITEM]? Would you say [INSERT ANSWER CHOICES]?

[SINGLE RESPONSE]

None Low priority Medium priority High priority

- 1. NZE home:
- 2. A home with some energy efficient features but not to the extent of NZE:

Q44. *[IF Q43.1 = NONE, LOW, OR MEDIUM PRIORITY] What do you think it would take to make purchasing an NZE home a higher priority for you?

- 1.

[Do not read:]

- 98. Don't know
- 99. Refused

Q45. *How much more would you be willing to spend on your next home for it to be an NZE home?
[INTERVIEWER NOTE: Percentage would be preferable over a \$ amount. That is, if \$ amount is given, ask respondents to give you their answer in terms of a percentage. Also, record verbatim response e.g., “however much will be paid back by energy bills”]

1. → [IF 0%] Why wouldn't you be willing to pay more?

[Do not read:]

98. Don't know

99. Refused

Demographics

Thanks for sharing all that information. We are almost done with the interview. I just have a few final questions about you and your household.

Q46. *How much, on average, is your monthly electricity bill in the summer?

1.

[Do not read:]

99. Refused

Q47. *Including yourself, how many [INSERT ITEM] currently live in your home at least 6 months of the year?

1. Adults 18 years or older

2. Children under 18 years old

Q48. *In what year were you born?

1.

[Do not read:]

99. Refused

Q49. *What is the highest level of education you have completed so far?

[SINGLE RESPONSE]

1. No schooling

2. Less than high school

3. Some high school

4. High school graduate or equivalent (such as GED)

5. Trade or technical school

6. Some college (including Associate degree)

7. College degree (Bachelor's degree)

8. Some graduate school
9. Graduate degree, professional degree
10. Doctorate

[Do not read:]

99. Refused

Q50. *And are you of Hispanic, Latino, or Spanish origin?

[SINGLE RESPONSE]

1. Yes
2. No

[Do not read:]

99. Refused

Q51. *Please tell me which one or more of the following you would use to describe yourself. Would you describe yourself as...?

[MULTIPLE RESPONSE]

1. American Indian or Alaska Native
2. Asian
3. Black or African American
4. Native Hawaiian or Other Pacific Islander
5. White or Caucasian
6. And/Or, something else (please specify):

[Do not read:]

99. Refused

Q52. *Finally, I'm going to read a list of options. Please stop me when I reach the range that includes your total annual household income in 2015, before taxes.

[SINGLE RESPONSE]

1. Under \$20,000
2. 20 to under \$30,000
3. 30 to under \$40,000
4. 40 to under \$50,000
5. 50 to under \$60,000
6. 60 to under \$75,000
7. 75 to under \$100,000
8. 100 to under \$150,000
9. 150 to under \$200,000

10. Over \$200,000
11. Prefer not to say

[Do not read:]

98. Don't know
99. Prefer not to say

Q53. RECORD RESPONDENT'S GENDER

[SINGLE RESPONSE – DO NOT READ]

1. Female
2. Male
98. Don't know

Thank you for time and participation, and have a great day.

D.8. Non-NZE Homebuyers

Initially, the team proposed to conduct surveys with New York State residents who purchased a newly constructed home between July 2014 and March 2016 and whose home did not receive incentives from NYSERDA's LRNC program. The team planned to complete 68 phone surveys to achieve 90/10 confidence/precision; about 75%, or 50 surveys, would be from Non-NZE single-family homebuyers and, about 25%, or 18 surveys, would be from Non-NZE multifamily homebuyers. In addition, the team proposed to interview three non-NZE energy efficient (EE) homebuyers from the CRIS database for a qualitative comparison with NZE and Non-NZE homebuyers.

The team searched the web and consulted with survey sampling and fielding firms to find a rigorous and cost effective method to identify and survey the Non-NZE homebuyers. The team found a list provided by Experian that included 2,654 homebuyers in New York State who took out a mortgage during 2015. Even though the list contained far fewer homebuyers than the number of permits issued in 2015 for new single-family and two- to four-unit homes in New York State (n=9,834; U.S. Department of Housing and Urban Development [HUD], 2016), and appeared to underrepresent homebuyers in upstate New York, it was the most feasible and cost effective list the team could find.³

Two-thirds of members in the Experian list were buyers of single-family homes and one-third were buyers of multi-family homes. This was close to the breakdown of single-family (78%) and two- to four-unit (22%) new home permits issued in New York State in 2015 (HUD, 2016). The list included names and

³ Experian was, in fact, the only source the team discovered for records of homebuyers of newly constructed homes in New York State. All other sources required calling a list of tens of thousands of New York State homeowners and screening out those who did not purchase a new home in 2015, which would have been a very expensive and time-consuming approach that NYSERDA did not approve.

addresses, as well as the mortgage date, indicators for mortgage type, and other similar characteristics. The team removed from the Experian list the NZE and EE homebuyers who were also listed in NYSERDA’s CRIS database since the team planned to interview these homebuyers separately.

To obtain phone numbers of the Non-NZE homebuyers in the Experian list, the team used MSG, Inc., a firm specializing in survey samples, to match names and addresses to phone numbers. The phone number match was successful for 2,190 homebuyers in the list (83% of original list). After completing this step, the proportions of single- and multi-family homebuyers was unchanged.

In early August 2016, the team started calling from the Experian list and discovered an issue. Two of the homebuyers in the list reported that their home was built in the 1990s and that they took out an equity or second mortgage in 2015. The team contacted Experian and further analyzed the Experian list, and discovered that more than half of the homebuyers in the list (53%) took out second mortgages in 2015, rather than taking out a first mortgage on a new home (Table D-8). Removing these second mortgage homeowners from the list resulted in a total of 1,024 Non-NZE Homebuyers (39% of original list) and changed the split between single- and multi-family homeowners to nearly 50/50. In the team’s communications with an Experian representative before purchasing the list, the team was informed that the list contained new home mortgages but was not informed that the list also contained homeowners who took out a second or equity mortgage on their existing home.

Table D-8. Number of Mortgage Borrowers in New York State in 2015, from Experian List

| | Single-Family | Multi-Family | Total |
|----------------------|---------------|--------------|--------------|
| Experian List | 1,760 (66%) | 894 (34%) | 2,654 (100%) |
| Matched phone number | 1,464 (67%) | 726 (33%) | 2,190 (100%) |
| First mortgage | 536 (52%) | 488 (48%) | 1,024 (100%) |

In addition, of the 81 Non-NZE homebuyer calls the team made in August, 26% were bad or incorrect phone numbers. Applying this rate of bad or incorrect numbers to the full list lead the team to anticipate that the contact information for an additional 266 Non-NZE homebuyers will lead to dead ends, resulting in a likely sample of homeowners with accurate contact information of 758 (29% of the original Experian list of 2,654). Based on experience with similar populations, the team anticipated about a 5% response rate to the Non-NZE homebuyer survey. To achieve 68 completes with this response rate, the team needed at least 1,360 sample points, about double the estimated number of contacts with accurate information.

The team proposed to NYSERDA an alternative approach that included combining 739 homebuyers who purchased a LRNC-participating Tier 1 or 2 Non-NZE EE home in the NYSERDA CRIS database with the 1,024 Non-NZE homebuyers in the cleaned Experian list, and calling the full list until the team achieved 68 completes, without any stratification based on the type of home. The team used MSG, Inc. to match names

and numbers with addresses of Non-NZE EE homebuyers in the CRIS database, which resulted in a list of 454 Non-NZE homebuyers (61% of original) with contact information.

The team began calling from the combined Experian and CRIS list of 1,478 Non-NZE homebuyers in mid-August 2016 and discovered another issue. After calling 152 phone numbers in the list, the team achieved only one completed survey, a response rate of less than 1%. In addition, about 20% of the phone numbers were bad or incorrect, 7% refused the survey, and 3% had a language barrier as a non-English speaker. Based on these dispositions, the team projected completing between 10 and 20 surveys after calling the full list up to five times, which was far short of the goal of 68.

The team proposed a second alternative approach to NYSERDA, in which the team would program the survey for the web and mail the combined CRIS and Experian list up to three web survey invitation letters. The team added back into the combined list the 313 Non-NZE homebuyers from the Experian list and the 285 Non-NZE EE homebuyers from CRIS for whom MSG, Inc. could not match a phone number. The final combined list the team used for mailing letters included 2,076 homebuyers, excluding the one homebuyer who responded to the phone survey.

The team worked with Minuteman Press Team to print and mail three web survey letters. The first letter was mailed September 16, the second letter was mailed September 23, and the third letter was mailed October 9, 2016. The team closed data collection October 14, 2016.

The team achieved 72 completed surveys from Non-NZE homebuyers for a response rate of four percent (Table D-9). Most of the completed surveys (81%) were from EE homebuyers, from which the team achieved a response rate of eight percent. Very few Non-NZE single family and multifamily homebuyers responded. Web surveys took about an average of 25 minutes to complete, and the team used *Microsoft Excel* and SPSS to compute market metrics from the data collected from Non-NZE homebuyers.

Given the limitations of the Experian list and the low response rates for single family and multifamily Non-NZE homebuyers, the surveyed Non-NZE homebuyers are not representative of the population of Non-NZE homebuyers in New York State. Thus, the market indicator estimates based on data collected from these homebuyers are qualitative estimates. However, the team obtained enough completed surveys of Non-NZE EE homebuyers to achieve 85/10 confidence/precision for this group, and market indicator estimates based on data collected from these homebuyers are quantitative estimates that can be generalized to all 2015 Non-NZE EE homebuyers (but not all Non-NZE homebuyers).

Table D-9. Survey Dispositions of New York State Non-NZE Homebuyers

| | Total | Non-NZE EE Homebuyers^a | Non-NZE Single-Family Homebuyers^b | Non-NZE Multifamily Homebuyers^b |
|---|--------------|--|---|---|
| Total in list | 2,076 | 739 | 703 | 634 |
| Nonrespondents | 1,993 | 674 | 669 | 611 |
| Screened out: Renter | 6 | 3 | 1 | 2 |
| Screened out: Purchased home before July 2014 or after March 2016 | 31 | 4 | 22 | 5 |
| Screened out: Live in high-rise, 5+ story building | 13 | 0 | 0 | 13 |
| Completed survey | 72 | 58 | 11 | 3 |
| Percent of completes | 100% | 81% | 15% | 4% |
| Response rate | 4% | 9% | 2% | 0.5% |

^a From NYSERDA's CRIS database.

^b From Experian list of 2015 New York State homebuyers.

Survey Invitation Letter

| | | |
|---|---|--|
|  |  | |
| ANDREW M. CUOMO Governor | RICHARD L. KAUFFMAN Chair | JOHN B. RHODES President and CEO |

[DATE]

Dear [FIRST_NAME] [LAST_NAME],

New York State is becoming a leader in the U.S. in building the next generation of new homes that are designed to be more resilient and sustainable. This has become a high priority for the State, especially after the 2008 housing market crash, Hurricane Sandy, and other events that have exposed weaknesses in our infrastructure and communities and caused harm to many New Yorkers.

The New York State Energy Research and Development Authority, or NYSERDA, is planning to provide support for the development of these new types of homes in the State. For this planning to be effective, NYSERDA needs to learn more from residents about the important decisions they make when choosing a home to live in.

Your input to our short survey will help NYSERDA offer the types of support that could be most helpful to residents like you. Your address is one of only a small number from each of the counties in New York State that has been selected to help in this study, so your input is very valuable and important to us.

Completing the survey is short and easy. Just enter this webpage address into your web browser, and then type in the access code to begin the survey. Please have a person in your household who makes decisions about your home complete our survey. It should take only about 10 minutes to complete.

<http://nyserdahomesurvey.com> Passcode: [PASSCODE]

(NOTE: Please enter the web address in the address space in your browser, not the space for Google, Yahoo, or other web searches, and do not type "www." before the address.)

If you are unable to complete the survey on the web, please call 503-943-2372 and speak to one of our interviewers on the phone. If our interviewers are busy, please leave a message mentioning "NYSERDA Home Survey" and leave your name, telephone number, and best time to call you back.

Your responses are voluntary, will be kept confidential, and will be used for research purposes only. NYSERDA has selected Research Into Action to help conduct this study. If you have any questions about this survey, please contact Benn Messer by email at benjamin.messer@researchintoaction.com or by phone at 503-943-2372, or Patricia Gonzales by email at patricia.gonzales@nyserda.ny.gov or by phone at 518-862-1090, ext. 3338.

Thanks in advance for your participation and we look forward to receiving your responses.

Regards,
Patricia Gonzales, Ph.D.
Patricia Gonzales, Sr. Project Manager

| | | | |
|---|---|---|---|
| New York State Energy Research and Development Authority | | | |
| Albany 17 Columbia Circle, Albany, NY 12203-6399 (P) 1-866-NYSERDA (F) 518-862-1091 nyserda.ny.gov info@nyserda.ny.gov | Buffalo 726 Exchange Street Suite 821 Buffalo, NY 14210-1484 (P) 716-842-1522 (F) 716-842-0156 | New York City 1359 Broadway 19th Floor New York, NY 10018-7842 (P) 212-971-5342 (F) 518-862-1091 | West Valley Site Management Program 9030-B Route 219 West Valley, NY 14171-9500 (P) 716-942-9960 (F) 716-942-9961 |

Survey Reminder and Thank You Letter



NEW YORK
STATE OF
OPPORTUNITY.

NYSERDA

ANDREW M. CUOMO
Governor

RICHARD L. KAUFFMAN
Chair

JOHN B. RHODES
President and CEO

[DATE]

Dear **[FIRST_NAME] [LAST_NAME]**,

Last week we mailed you a letter inviting you to complete a short web survey about the types of decisions New York residents like you make when looking for a new home. If you completed our survey, please accept our sincere thanks. If not, we still very much need to hear from you. Even if you haven't looked for a new home recently or plan to in the future, your thoughts about what home features are important to you will be very helpful.

As New York State is becoming a leader in building the next generation of new homes designed to be more resilient and sustainable, the New York State Energy Research and Development Authority, or NYSERDA, will be providing support to speed the development and spread of these new homes across the state. This has become a high priority for New York, especially after Hurricane Sandy and other events that have harmed New Yorker residents and their homes.

Your responses to our survey are important to inform NYSERDA about what types of information and support New York residents like you would find helpful when choosing a new home to live in. Your address is one of only a small number from each of the counties in New York State that has been selected to help in this study, so your input is very valuable and important to us.

Completing the survey is short and easy. Enter this webpage address into your web browser, and then type in the access code to begin the survey. Please have an adult in your household who makes decisions about your home complete the survey. It should take only about 10 minutes to complete.

<http://nyserdahomesurvey.com> Passcode: **[PASSCODE]**

(NOTE: Please enter the web address in the address space in your browser, not the space for Google, Yahoo, or other web searches, and do not type "www." before the address.)

If you are unable to complete the survey on the web, please call 503-943-2372 to speak to one of our interviewers on the phone. If our interviewers are busy, please leave a message mentioning "NYSERDA Home Survey" and leave your name, telephone number, and best time to call you back.

Your responses are voluntary, will be kept confidential, and will be used for research purposes only. NYSERDA has selected Research Into Action to help conduct this study. If you have any questions about this survey, please contact Benn Messer by email at benjamin.messer@researchintoaction.com or by phone at 503-943-2372, or Patricia Gonzales by email at patricia.gonzales@nyserda.ny.gov or by phone at 518-862-1090, ext. 3338.

Thank you and we look forward to receiving your responses,
Patricia Gonzales, Ph.D.
Patricia Gonzales, Sr. Project Manager

New York State Energy Research and Development Authority
Albany
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(P) 1-866-NYSERDA | (F) 518-862-1091
nyserda.ny.gov | info@nyserda.ny.gov

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726 Exchange Street
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(P) 716-842-1522
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New York City
1359 Broadway
19th Floor
New York, NY
10018-7842
(P) 212-971-5342
(F) 518-862-1091

**West Valley Site
Management Program**
9030-B Route 219
West Valley, NY
14171-9500
(P) 716-942-9960
(F) 716-942-9961

Survey Final Reminder Letter



NYSERDA

ANDREW M. CUOMO
Governor

RICHARD L. KAUFFMAN
Chair

JOHN B. RHODES
President and CEO

[DATE]

Dear [FIRST_NAME] [LAST_NAME],

About three weeks ago we sent you a request to complete a short web survey that asks about the features and characteristics of a home that New York residents like you think are most important. To the best of our knowledge, your web survey has not been completed. If you have completed the survey, please accept our sincere thanks, and, if you haven't, we request that you do so before we close the survey in the next few days.

Since everyone's situation differs, it is only by hearing from all kinds of households across New York State that we can ensure the results will be useful. We especially need your help as we attempt to understand the features that residents in each of New York's counties think about when deciding on a home to live in. Even if you haven't looked for a new home recently or plan to in the future, your thoughts about what home features are important to you will be very helpful.]

Your responses to the survey will help NYSERDA better plan the types of support it will be providing to speed the development and spread of new, more resilient and sustainable types homes across the state. This has become a high priority for New York, especially after Hurricane Sandy and other events that have harmed New York residents and their homes.

We are hoping you complete the survey on the Internet because it helps us save both money and time for the state. To do this, enter the webpage address into your web browser, and then type in the access code to begin the survey. Please have an adult in your household who makes decisions about your home complete the survey. It should take only about 15 minutes to complete.

<http://nyserdahomesurvey.com>

Passcode: [PASSCODE]

(NOTE: Please enter the web address in the address space in your browser, not the space for Google, Yahoo, or other web searches, and do not type "www." before the address.)

If you are unable to complete the survey on the web, please call 503-943-2372 to speak to one of our interviewers on the phone. If our interviewers are busy, please leave a message mentioning "NYSERDA Home Survey" and leave your name, telephone number, and best time to call you back.

Your responses are voluntary, will be kept confidential, and will be used for research purposes only. NYSERDA has selected Research Into Action to help conduct this study. If you have any questions about this survey, please contact Benn Messer by email at benjamin.messer@researchintoaction.com or by phone at 503-943-2372, or Patricia Gonzales by email at patricia.gonzales@nyserda.ny.gov or by phone at 518-862-1090, ext. 3338.

Thank you and we look forward to receiving your responses,

Patricia Gonzales, Ph.D.

Patricia Gonzales, Sr. Project Manager

New York State Energy Research and Development Authority

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(F) 518-862-1091

**West Valley Site
Management Program**
9030-B Route 219
West Valley, NY
14171-9500
(P) 716-942-9960
(F) 716-942-9961

Survey Instrument

Introduction & Screening

- S1. Hello, may I speak to **[CONTACT NAME]**? [IF CONTACT NAME NOT AVAILABLE: Hello, may I speak a person in your household who was involved in the decision to buy your home?]
1. Yes
 2. Who's calling? → This is Bob, calling on behalf of NYSERDA [New York State Energy Research and Development Authority], a state agency that focuses on improving energy efficiency in New York State. We are talking with recent homebuyers about the decisions they made when buying a new home. This will help NYSERDA improve the kinds of support it provides to new homebuyers in the state. Do you have 10-15 minutes to talk about your recent home purchase?
 3. Not available → Is there someone else I could speak to about the recent purchase of your home?
 - a. Yes
 - b. No → When would be a more convenient time to call back? **[COLLECT TIME, VERIFY CONTACT INFO]**
 - c. No, we did not buy or own the home
 4. No, owners do not reside here → **[VERIFY RESIDENTS ARE NOT OWNERS □ THANK & TERMINATE]**
 5. No, not interested (refusal) → **[THANK & TERMINATE]**
- S2. **[FOR RESPONDENT]** Hello, my name is Bob, and I'm calling on behalf of NYSERDA [New York State Energy Research and Development Authority], a state agency that focuses on improving energy efficiency in New York State. We are talking with recent homebuyers about the decisions they made when buying a new home. This will help NYSERDA improve the kinds of support it provides to new homebuyers in the state. Do you have 10-15 minutes to talk about your recent home purchase?
- Our records show that your home at **[ADDRESS]** was purchased in 2015, is that correct?
1. Yes → What month?
 2. No → When was your home purchased? **[MONTH/YEAR]**
[IF BEFORE 2015 OR AFTER MARCH 2016 → THANK & TERMINATE]
[IF JAN 2015 – MARCH 2016 → CONTINUE]
 3. No → Not owner → **[VERIFY RESIDENTS ARE NOT OWNERS → THANK & TERMINATE]**

S3. Great, I'd like to ask you a few questions about your home and your reasons for choosing this home. I'm estimating this interview will take about 10 to 15 minutes. Is now a good time to talk? If not, could we schedule another time at your convenience?

1. Yes, continue
2. No, reschedule: [COLLECT TIME AND VERIFY CONTACT INFO]

S4. [IF NOT VERIFIED IN INTRODUCTION] Just to confirm, you or members of your household own this home at [ADDRESS], correct?

[SINGLE RESPONSE]

1. Yes, we own it
2. No, we rent → [VERIFY, THANK & TERMINATE]

[IF NEEDED:]

- I work for Research Into Action, a firm selected by NYSERDA to do this research.
- NYSERDA is the New York State Energy Research and Development Authority and it provides support to builders, contractors, businesses, and homeowners in the state for making buildings more energy efficient and installing renewable energy technologies. Some of the support it provides includes incentives and rebates, trainings, and information about saving energy.
- As a recent homebuyer, your responses will help NYSERDA improve the types of support it provides to those involved in the market for new homes in New York State.
- Your responses are confidential and anonymous to the extent permissible by law and will be reported only in the aggregate.
- The survey should take about 10-15 minutes to complete.
- For verification of this study, you can contact Patricia Gonzales at NYSERDA, at 518-862-1090 ext. 3338 or patricia.gonzales@nyserdera.ny.gov.

Home Purchase Decisions

To begin, I'd like to ask a few questions about your home and some of the important decisions you might have made when you purchased your home.

Q1. *What type is your home? Is it a...?

[SINGLE RESPONSE]

1. Single-family detached home → SKIP TO Q3
2. Two-, three-, or four-unit home → SKIP TO Q3
3. A townhome
4. A condo
5. Brownstone

6. Something else: [IF MOBILE HOME OR SIMILAR → THANK & TERMINATE: We are looking to speak with owners of single-family homes, condos, or apartments.]

Q2. [IF Q1=Townhome, condo, or other multi-unit building] How many floors are in your building?

1. One
2. Two
3. Three
4. Four
5. Five or more [THANK & TERMINATE: We are looking to speak with owners of homes in smaller buildings. Thanks for your time.]

Q3. *How many bedrooms are in your home?

[SINGLE RESPONSE; DO NOT READ]

1. None/Studio
2. One
3. Two
4. Three
5. Four
6. Five
7. Six or more

Q4. *Is this the first home you purchased?

[SINGLE RESPONSE; DO NOT READ]

1. Yes
2. No
99. Refused

Q5. *Did you purchase your before, during, or after it was built?

[SINGLE RESPONSE; DO NOT READ]

1. Before
2. During → SKIP TO Q9
3. After → SKIP TO Q12
98. Don't know
99. Refused

Q6. *[IF Q5 = BEFORE] Why did you decide to purchase a home before it was built?

1.

[Do not read:]

98. Don't know

99. Refused

Q7. *[IF Q5 = BEFORE] How did you find the developer, builder, or architect of your home?

1. → Any challenges?

[Do not read:]

98. Don't know

99. Refused

Q8. *[IF Q5 = BEFORE] What challenges, if any, did you experience during the design and construction of your home? [PROBE: project delays, issues with finding or installing materials or equipment, issues with builder/contractors, cost more than expected]

1. → How did you overcome this/these challenge/s?

[Do not read:]

98. Don't know

99. Refused

Q9. *[IF Q5 = DURING] Why did you decide to purchase a home as it was being built?

1.

[Do not read:]

98. Don't know

99. Refused

Q10. *[IF Q5 = DURING] How did you find your home? [IF THROUGH
DEVELOPER/BUILDER/ARCHITECT

ASK HOW THEY WERE FOUND]

1. → Any challenges?

[Do not read:]

98. Don't know

99. Refused

Q11. *[IF Q5 = DURING] What challenges, if any, did you experience during the design and construction of your home? [PROBE: project delays, issues with finding or installing materials or equipment, issues with builder/contractors, cost more than expected]

1. → How did you overcome this/these challenge/s?

[Do not read:]

98. Don't know

99. Refused

Q12. *[IF Q5 = AFTER] Why did you decide to purchase a home that was already built?

1.

[Do not read:]

98. Don't know

99. Refused

Q13. *[IF Q5 = AFTER] How did you find your home?

1. → Any challenges?

[Do not read:]

98. Don't know

99. Refused

Q14. *Overall, what was the primary reason or motivation you purchased your home versus other homes?

1.

[Do not read:]

98. Don't know

99. Refused

Q15. *Did your home include the following features at the time you purchased it?

1. [IF Q1=1 OR 2] Finished basement
2. [IF Q1=1 OR 2] Garage
3. High or vaulted ceilings
4. Hardwood or tile flooring
5. Laundry room or area
6. Outdoor living area like deck or patio
7. [IF Q1=1 OR 2] Pool, spa, or hot tub

Q16. At the time of purchasing your home, what did it have for cooling?

Yes No DK

1. None
2. Central Air → High efficiency?
3. Window Unit → High efficiency?
4. Portable Unit
5. Ceiling Fan
6. Floor fan
7. Other:
98. Don't know
99. Refused

Q17. What about for heating? At the time of purchasing your home, what type or types of heating did it include?

Yes No DK

1. None
2. Gas Furnace → High efficiency?
3. Oil Furnace
4. Propane Furnace
5. Other Furnace:
6. Baseboard or wall heating → High efficiency?
7. Portable heating
8. Gas Fireplace
9. Wood Fireplace
10. Wood stove
11. Other:
98. Don't know
99. Refused

Q18. *Which of the following energy saving features and technologies were included in your home at the time of purchase?

Yes No DK

1. Additional or high performance insulation in attic, walls, or floors
2. ENERGY STAR appliances like refrigerator, dishwasher, oven or stove, clothes washer and dryer
3. Energy efficient lighting like CFLs or LEDs
4. High-efficiency or solar water heater
5. High-performance windows

6. Programmable or smart thermostat to control heating or cooling
7. Renewable electric generation like solar panels
96. Other, please specify:

Q19. *[IF ANY EE OR RG AND Q5=BEFORE OR DURING] Did you request that your home have this/these energy saving technology, were they included part of a package by the developer or builder, or were they what came “as is” in the home?

[SINGLE RESPONSE; DO NOT READ]

1. Owner requested
2. Developer/Builder included as package
3. Came “as is”
98. Don't know
99. Refused

Q20. *[IF ANY EE OR RG AND Q5=AFTER] Was your home advertised as having this/these energy saving technologies?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What was advertised?
2. No
98. Don't know
99. Refused

Q21. *[IF ANY EE OR RG] Did your home come with a certification or label regarding energy efficiency, renewable electric generation, or health and safety?

1. Yes → What certification/label?
2. No
98. Don't know
99. Refused

Q22. *[IF ANY EE OR RG] Did the energy saving features and technologies in your home cost more to include?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → How much more? (% or \$ more)
2. No
98. Don't know
99. Refused

- Q23. *[IF ANY EE OR RG] When you purchased your home, what concerns, if any, did you have about the energy saving features in it?

[SINGLE RESPONSE; DO NOT READ]

1. → How did you resolve concern(s):
2. None
98. Don't know
99. Refused

- Q24. *[IF ANY EE OR RG] Since moving in, what issues, if any, have you experienced related to the energy savings features or technologies in your home?

[SINGLE RESPONSE; DO NOT READ]

1. → How did you resolve issue(s)?
2. None
98. Don't know
99. Refused

- Q25. *On a scale of 0 to 10, where 0 means not at all important and 10 means extremely important, how important in your decision to purchase your home was the...?

1. Type of cooling system
2. Type of heating system
3. Type of appliances
4. Type of lighting
5. Type of water heating system
6. Type of windows
7. Type of insulation
8. Renewable generation
9. The overall energy usage or costs of the home

- Q26. *Overall, what features or characteristics of your home were most important to you in your decision to buy this home? [ASK ABOUT EACH: Would you have been willing to pay more or make a tradeoff to keep?]

[MULTIPLE RESPONSE; READ ONLY TO PROBE]

1. None
2. Appliances (specify):
3. Bedrooms and/or bathrooms:
4. Cooling system:
5. Energy storage

6. Energy management system
7. Finished basement
8. Flooring (specify):
9. Garage
10. Countertops:
11. High or vaulted ceilings
12. Heating system (specify):
13. Home layout (specify):
14. Home security system
15. Insulation:
16. Laundry room
17. Lighting (specify):
18. Location (specify):
19. Kitchen layout (specify):
20. Outdoor living area/space
21. Pool/spa
22. Programmable or smart thermostat
23. Size
24. Solar PV or other renewable generation:
25. Storage spaces
26. Windows/skylights (specify):
27. Other 1:
28. Other 2:
29. Other 3:
30. Other 4:
31. Other 5:
98. Don't know
99. Refused

Q27. *Are there any features or characteristics of a home that are important to you but were not included or part of your home? [ASK ABOUT EACH: Would you have been willing to pay more or make a tradeoff to have?]

[MULTIPLE RESPONSE; DO NOT READ]

1. None
2. Appliances (specify):
3. Bedrooms and/or bathrooms:
4. Cooling system:

5. Energy storage
6. Energy management system
7. Finished basement
8. Flooring (specify):
9. Garage
10. Countertops:
11. High or vaulted ceilings
12. Heating system (specify):
13. Home layout (specify):
14. Home security system
15. Insulation:
16. Laundry room
17. Lighting (specify):
18. Location (specify):
19. Kitchen layout (specify):
20. Outdoor living area/space
21. Pool/spa
22. Programmable or smart thermostat
23. Size
24. Solar PV or other renewable generation:
25. Storage spaces
26. Windows/skylights (specify):
27. Other 1:
28. Other 2:
29. Other 3:
30. Other 4:
31. Other 5:
98. Don't know
99. Refused

Home Satisfaction

- Q28. *Using a scale of 0 to 10, with '0' meaning "not at all satisfied" and '10' meaning "extremely satisfied" how would you rate your overall satisfaction with your home?

[SINGLE RESPONSE; DO NOT READ]

1. → What makes you say that?
98. Don't know
99. Refused

Awareness of NZE & Energy Efficient Homes

These next questions ask about energy efficient homes.

Q29. Have you heard of Net Zero Energy, or NZE, homes and are you familiar with what they are?

[SINGLE RESPONSE; DO NOT READ]

1. Yes, heard of and familiar
2. Yes, heard of but not familiar
3. No, not heard of or familiar
98. Don't know
99. Refused

Q30. [IF Q29=1, FAMILIAR] What do you consider a NZE home to be?

- 1.
98. Don't know
99. Refused

Q31. *[IF Q29 = 1 OR 2] How did you first hear/learn about Net Zero Energy homes?

- 1.

[Do not read:]

98. Don't know
99. Refuse

Q32. *NYSERDA would like for you to comment on its working definition for NZE homes.

NYSERDA considers an NZE home to be “a grid-connected home that is built to be highly energy efficient and is connected to renewable electric generation, so that the renewable generation offsets all of the home’s average annual energy consumption.” Does this definition make sense to you and would you make any changes to improve it?

1. Yes, makes sense and no changes → SKIP TO Q34
2. Yes, makes sense but I suggest changes: → SKIP TO Q34
3. No, it does not make sense

Q33. [IF Q27=3, NO] Let me you help a bit. A Net Zero Energy home is connected to the electrical grid, like your home, but is also connected to solar panels on the roof and is built to be very energy efficient. [IF NEEDED: It has thicker walls and windows, high quality insulation, efficient appliances, and lighting, as well as heating and cooling equipment that require and use much less

energy than more common homes.] These features allow the home to produce as much energy in a year as it consumes from the electric utility, on average. Does this make sense?

1. Yes → Any improvements or changes?
2. No → SKIP TO Q35

Q34. According to this definition, have you heard of and are you familiar with these types of homes?

[SINGLE RESPONSE; DO NOT READ]

1. Yes, heard of and familiar
2. Yes, heard of but not familiar
3. No, never heard of
98. Don't know
99. Refused

Q35. [ASK IF Q21≠YES] *What about other types of energy efficient homes? An energy efficient home is designed and built to be use less energy than other homes but, unlike NZE homes, it does not produce as much electricity as is consumed from the utility in an average year. Have you heard of energy efficient homes before today?

1. Yes
2. No
3. Don't know

Q36. [ASK IF Q21=YES OR Q35=YES] Energy efficient homes include homes with labels or certifications like the [INSERT ITEM]. Have your heard of this type of home before? What about [INSERT ITEM]?

[MULTIPLE RESPONSE]

1. ENERGY STAR Certified Home label [by the EPA]
2. Home Energy Rating Certificate [by RESNET]
3. Home Energy Score [by the DOE and BPI]
4. LEED Building Certification [by the US Green Buildings Council]
5. National Green Building Standard Home label [by the National Association of Home Builders]
6. Passive House Certification [by the Passive House Academy or Passive House Institute]
7. Zero Energy Ready Home label [by the DOE]
8. Any others?

NZE/HP Home Buying Cost and Barriers

Q37. *When shopping for your current home did you consider purchasing another home that was labeled or advertised as being energy efficient or as having renewable electric generation?

[SINGLE RESPONSE; DO NOT READ]

1. Yes → What type?
2. No → Why not?
98. Don't know
99. Refused

Q38. *[IF Q36 = YES] Why did you decide to not purchase another home that was labeled or advertised as being highly energy efficient?

- 1.

[Do not read:]

98. Don't know
99. Refused

Q39. *If you were to buy another home, how much of a priority would you place on buying [INSERT ITEM]? Would you say [INSERT ANSWER CHOICES]?

[SINGLE RESPONSE]

None Low priority Medium priority High priority

1. NZE home:
2. A home with some energy saving features but not to the extent of NZE:

Q40. *[IF Q37.1 = NONE, LOW, OR MEDIUM PRIORITY] What do you think it would take to make purchasing an NZE home a higher priority for you?

- 1.

[Do not read:]

98. Don't know
99. Refused

Q41. *How much more would you have been willing to spend on your home if it were an NZE home? [IF 0% → ASK WHY NOT?]

[INTERVIEWER NOTE: Percentage would be preferable over a \$ amount. That is, if \$ amount is given, ask respondents to give you their answer in terms of a percentage. Also, record verbatim response e.g., "however much will be paid back by energy bills"]

1. What about your next home, if you were to buy one?

[Do not read:]

98. Don't know

99. Refused

Demographics

Thanks for sharing all that information. We are almost done with the interview. I just have a few final questions to make sure we've heard from all the different types of homebuyers in New York State.

Q42. *How much, on average, is your monthly electricity bill in the summer?

1.

[Do not read:]

99. Refused

Q43. *Including yourself, how many [INSERT ITEM] currently live in your home at least 6 months of the year?

1. Adults 18 years or older

2. Children under 18 years old

Q44. *In what year were you born?

1.

[Do not read:]

99. Refused

Q45. *What is the highest level of education you have completed so far?

[SINGLE RESPONSE; DO NOT READ]

1. Less than high school graduate

2. High school graduate or equivalent (such as GED)

3. Some college, no degree

4. 2-year degree (Associate) or certification from trade/technical college

5. 4-year degree (Bachelor's degree)

6. Graduate degree, professional degree

99. Refused

Q46. *Are you of Hispanic, Latino, or Spanish origin?

[SINGLE RESPONSE; DO NOT READ]

1. Yes

2. No

99. Refused

Q47. *Please tell me which one or more of the following you would use to describe yourself. Would you describe yourself as...?

[MULTIPLE RESPONSE]

1. American Indian or Alaska Native
2. Asian
3. Black or African American
4. Native Hawaiian or Other Pacific Islander
5. White or Caucasian
6. And/Or, something else (please specify):

[Do not read:]

99. Refused

Q48. *Finally, I'm going to read a list of options. Please stop me when I reach the range that includes your total annual household income in 2015, before taxes.

[SINGLE RESPONSE]

1. Under \$20,000
2. 20 to under \$30,000
3. 30 to under \$40,000
4. 40 to under \$50,000
5. 50 to under \$60,000
6. 60 to under \$75,000
7. 75 to under \$100,000
8. 100 to under \$150,000
9. 150 to under \$200,000
10. Over \$200,000

[Do not read:]

98. Don't know
99. Prefer not to say

Q49. RECORD RESPONDENT'S GENDER

[SINGLE RESPONSE; DO NOT READ]

1. Female
2. Male
98. Don't know

Thank you for your time and participation, and have a great day.