



NYSERDA

**NYSERDA Residential
Statewide Baseline Study
Volume 3: HVAC Market Assessment
Final Report**

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NYSERDA Residential Statewide Baseline Study

Volume 3: HVAC Market Assessment

Final Report

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Notice

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Abstract for Volume 3

This volume presents the findings from the heating, ventilating, and air conditioning (HVAC) Market Assessment. The HVAC Market Assessment is a key component of the statewide residential baseline study. The purpose of the HVAC Market Assessment is to identify the baseline conditions for residential non-electric heating and water heating equipment, central air conditioning, and heat pumps in New York State. The study focused on units installed in single-family homes with one to four dwelling units, multifamily buildings, or in townhouse-style configurations where individual units have their own heating systems. The market characterization describes where the market is now (based on equipment sold/installed in 2012 and after) and what percent of the equipment currently being sold is high efficiency. This information will be used to establish more accurate baselines for calculating program energy savings, to estimate the influence of NYSEERDA's and other New York State program administrators' activities on the market, and to support program planning in New York State. The market assessment uses data from a variety of primary and secondary sources that are specific to the New York State residential space heating and cooling, and water heating markets. A primary source of data is 47 telephone surveys of HVAC contractors to collect data on 2013 sales of HVAC equipment by efficiency levels. The data was confirmed, whenever possible, by comparisons to D&R International (D&R) which reported New York State-specific Heating, Air-conditioning and Refrigeration Distributors International (HARDI) sales data for 2013. In addition, Tetra Tech made comparisons to data on HVAC equipment installed in the past two years from on-site inspections of 179 new construction homes. Data were also included from the on-site inspections of the existing homes that had installed new HVAC equipment in the past two years that included 57 heating systems, 62 cooling systems, and 78 water heaters. Other sources of estimated annual sales data included U.S. Census data for New York State and over 3,000 telephone or Web surveys completed for the residential baseline study with statewide data on type of systems and primary fuels. The results of the residential baseline study are presented in five volumes of reports. HVAC Market Assessment is the third volume of the five.

Keywords

Energy efficiency, single-family homes, market characterization, market assessment, heating and cooling equipment

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1 Introduction

1.1 Background and Study Objectives

In 2011 through 2014, NYSERDA, in collaboration with the E2 Working Group¹ Statewide Study Subcommittee led by the New York State Department of Public Service (DPS), conducted a residential statewide baseline study. The NYSERDA evaluation group, in coordination with the lead contractor of this study, Tetra Tech MA, Inc. (Tetra Tech), and its subcontractors, Performance Systems Development (PSD), and GDS Associates, Inc. (GDS), developed and implemented a detailed work plan to complete this study.

The study included single-family and multifamily residential housing segments and a broad range of energy uses and efficiency measures. The overall objective of the study was to understand the residential building stock and associated energy use, including the saturations of energy-consuming equipment (electric, natural gas, and other fuels) and the penetrations of energy efficient equipment, building characteristics, and energy management practices. The study also collected customer household and demographic information that can be correlated with energy usage features.

The heating, ventilating, and air conditioning (HVAC) Market Assessment is a key component of the statewide residential baseline study. The purpose of the HVAC Market Assessment is to identify the baseline conditions for residential non-electric heating and water heating equipment, central air conditioning, and heat pumps in New York State. The market assessment describes where the market is now (based on equipment sold or installed in 2012 and after) and what percent of the equipment currently being sold is high efficiency. This information will be used to establish more accurate baselines for calculating program energy savings, to estimate the influence of NYSERDA's and other New York State program administrators' activities on the market, and to support program planning in New York State.

Data to support the market assessment were collected in single-family home surveys and on-site inspections, contractor interviews, and distributor sales reports. The compilation of sources was used to determine the baseline efficiency of specific types of residential heating and cooling equipment installed in New York. Market channels and specification practices for these technologies were also characterized.

¹ Prior to the creation of the E2 Working Group, the former Evaluation Advisory Group held a similar role on this study.

This investigation looks at the market differences throughout the State for major heating, water heating, and central air conditioning systems. Data and discussion are provided wherever the sample sizes are not sufficiently large to consider that data representative of the strata.

The study focused on units installed in single-family homes and multifamily buildings that include one to four dwelling units, or in townhouse-type configurations where individual units have their own heating systems. Multifamily units with five or more units typically have central systems served by the commercial programs, and were not part of this assessment. According to the property manager/owner survey responses, almost three-fourths (73 percent) of multifamily buildings with five or more units have central heating systems.

The information gleaned from this study will be used by NYSERDA, the DPS, New York program administrators, and other stakeholders to set more accurate baselines for evaluation purposes and help inform program planning.

The project has three main components:

- **Residential Baseline Study.** The evaluation team conducted a comprehensive statewide baseline study of the residential market across a broad range of customer segments and energy measures, including (1) new and existing single-family buildings (one to four units), and (2) new and existing multifamily buildings (five units or more), including dwelling units, common areas, and whole buildings. Data were first collected through a combination of Web and telephone surveys. On-site inspections and data collection was then completed for a sample of the Web and telephone survey respondents along with residential contact sample lists from other sources as described in the methodology volume.
- **HVAC Market Assessment.** Data were collected in baseline study surveys and on-site inspections, contractor interviews, and distributor sales reports to assess the market for non-electric heating, air conditioning, and water heating equipment. Data on the baseline efficiency of new equipment installed in New York State were gathered during HVAC contractor interviews and from D&R International (D&R) which reported New York State-specific Heating, Air-conditioning and Refrigeration Distributors International (HARDI) sales data for 2013. This information will be used to set more accurate baselines for calculating program energy savings.
- **Residential Potential Study.** The data for the baseline analysis and the HVAC market assessment were then used for the potential analysis. The analysis identified the technical, economical, and achievable residential energy efficiency opportunities in New York over the next three and five years (2016 and 2018, respectively) relative to base year 2013.

This Volume 3 provides the highlights of the HVAC market assessment. Other volumes describe the residential baseline study for the single-family home segment (Volume 1), multifamily baseline results (Volume 2), potential analysis (Volume 4), and Volume 5 is the methodology and data tables.

1.2 Methodology

The methodology for the entire Residential Statewide Baseline study is in the Methodology and Data Tables, Volume 5. This section summarizes the methodology, data comparisons and data weighting for the HVAC Market Assessment. The HVAC contractor population and sample for telephone surveys were identified through a website (<http://companies.findthebest.com/>). The HVAC contractors sample was segmented into small contractors (1–10 employees) and large contractors (more than 10 employees). In addition, when a sufficient number of data points were available, data were also reported by three climate zones as shown in Figure 1 and Table 1.

Figure 1. New York State Climate Zone Map

Colors on the map correspond to climate zones shown in Table 1.

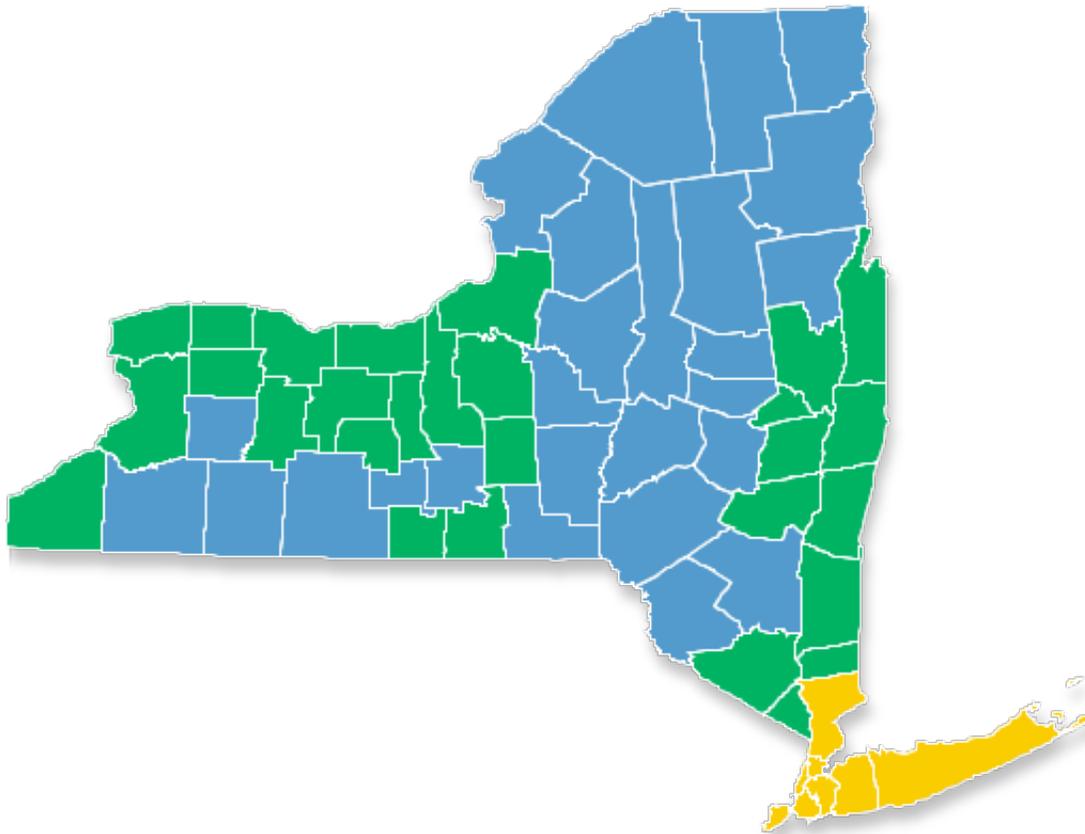


Table 1. New York State Climate Zone by County

Source: <http://energycode.pnl.gov/EnergyCodeReqs/?state=New%20York>

Climate Zone 4			
Bronx	Nassau	Queens	Suffolk
Kings	New York	Richmond	Westchester
Climate Zone 5			
Albany	Erie	Ontario	Saratoga
Cayuga	Genesee	Orange	Schenectady
Chautauqua	Greene	Orleans	Seneca
Chemung	Livingston	Oswego	Tioga
Columbia	Monroe	Putnam	Washington
Cortland	Niagara	Rensselaer	Wayne
Dutchess	Onondaga	Rockland	Yates
Climate Zone 6			
Allegany	Franklin	Montgomery	Sullivan
Broome	Fulton	Oneida	Tompkins
Cattaraugus	Hamilton	Otsego	Ulster
Chenango	Herkimer	Schoharie	Warren
Clinton	Jefferson	Schuyler	Wyoming
Delaware	Lewis	St. Lawrence	
Essex	Madison	Steuben	

Data collection focused on surveying the general population of HVAC contractors doing business in New York State. Due to lower than expected response rates, 47 telephone surveys of the targeted number of 60 surveys were completed with HVAC contractors throughout New York State. One distributor appeared in the HVAC contractor sample list and was interviewed, but this case was excluded from the HVAC contractor responses.

In addition, to ensure a 90/10 confidence/precision statewide, other primary data collected for this study was included in the analysis. In particular, this market assessment used the data collected during the on-site inspection in new and existing homes for the baseline study. The on-site inspection data included information on types of heating and cooling systems, primary fuels, equipment age, efficiency levels, and frequency of servicing. As a result, the evaluation team was able to triangulate the data from self-reports of HVAC contractors on-site observations of the equipment types included in the HVAC market assessment.

On-site inspection data collection was completed with 179 new homes (built 2012 and after) and 521 existing homes (built before 2012). Data from the 521 on-site inspections of existing homes included 57 heating systems, 62 cooling systems, and 78 water heaters that had been installed in the past two years for this analysis of new equipment. Together, these sources yield an excellent data on HVAC equipment installed in the past two years in New York State. The sales of equipment by efficiency level for heating and cooling equipment reported for 2013 in the HVAC Contractor Surveys were also compared to New York State HARDI data provided to NYSERDA by D&R International.

Table 2 summarizes the primary and secondary data sources with relevant information specific to New York State (NYS) used for the HVAC market assessment.

Table 2. NYS Data Collection Activities for Task 7 HVAC Market Assessment²

Source Data	Format	Types of Data for Heating, Cooling, and Water Heating Equipment	Number of Completes/ Sample Points
HVAC Market Assessment Task 7: Contractors from the General Population	Telephone Surveys	Sales data by efficiency type, stocking practices, quality design, quality installation & maintenance practices, training/certification	(463) 35 with sales data plus 12 without sales data
Baseline Study Task 6A: Residential Home On-site Inspections	On-site Inspection Data Collection	Age and type of equipment, efficiency, servicing	521 Existing (57-78 new HVAC equipment) & 179 New Construction
D&R Heating, Air-conditioning and Refrigeration Distributors International (HARDI)	2013 Sales Data Collection	Market size estimates, efficiency and product characteristics (does not include water heating)	31% of HARDI Members in NYS

² Tetra Tech also reviewed the results of the New York Statewide Residential Gas High-Efficiency Heating Equipment Programs Evaluation of 2009-2011 Programs report dated August 5, 2014. The study included surveys of HVAC distributors and participating contractors. The distributors surveyed did not provide annual sales data. Given the difference in timeframe and sample group of contractors (participants instead of general population), the results could not be directly compared.

³ This count of completes excludes the self-identified distributor interviewed as part of our data collection effort. The distributor is excluded from the analysis for the report remainder.

1.3 New York State Statistics

The 2013 annual market size estimates were based on a stock-replacement model, developed by D&R International (D&R) using existing HVAC equipment stock data from the Energy Information Administration's 2009 Residential Energy Consumption Survey. D&R estimated 2013 equipment sales by dividing the total stock by an average lifetime of the equipment to determine the number of probable replacements in a given year. HVAC equipment in new housing was estimated from U.S. Census data and added to annual sales. D&R also developed a heat pump adjustment factor to account for heat pumps replacing some air conditioners, particularly in the cooling dominated regions. Table 3 includes the D&R equipment sales estimates for New York State in 2013.

Table 3. 2013 Market Size Estimates for Heating and Cooling Equipment in New York State

Source: D&R International Sales Data Estimates for NYSERDA

Market Size Estimates	
Estimated 2013 Central AC Sales in NYS	96,760
Estimated 2013 Central Heat Pump Sales in NYS	22,960
Estimated 2013 Furnace Sales in NYS	104,960
Natural Gas	95,940
Fuel Oil	9,020
Estimated 2013 Boiler Sales in NYS	100,860
Natural Gas	59,860
Fuel Oil	41,000

To confirm the estimates provided by D&R, Tetra Tech used a combination of U.S. Census, Residential Statewide Baseline Study telephone and Web survey and on-site inspection data, and equipment life to develop annual sales estimates for the 2013 timeframe, as follows:

- **Natural gas and oil furnaces and boilers annual sales:** total annual new equipment installs and replacements were estimated by the evaluation team using 2009 Residential Energy Consumption Survey New York State statistics (RECS),⁴ and survey and on-site inspection data for the Residential Baseline Study. The evaluation team estimates were within 7 percent of the sales reported by D&R with 221,000 and 206,000, respectively.

⁴ The U. S. Energy Information Administration (EIA) administers the Residential Energy Consumption Survey (RECS) to a nationally representative sample of housing units. Specially trained interviewers collect energy characteristics on the housing unit, usage patterns, and household demographics.

- **Central air conditioner annual sales:** The 2009 Residential Energy Consumption Survey⁵ (RECS) data for New York State indicated that the number of central air conditioners (including heat pumps) less than two years old was about 200,000 or about 100,000 were less than a year old. This result compares to 119,720 units for annual sales estimated by D&R. The telephone and Web survey responses indicated that 12.6 percent of the central air conditioners and heat pumps in single-family homes were less than two years old. This percentage compares closely to 13.3 percent in the 2009 RECS data for central air conditioning in New York State homes.
- **Water heater annual sales:** The 2009 RECS data for New York State estimated that 900,000 main water heaters (about 12.7 percent) in all New York State residential homes (single-family and multifamily dwelling units) are less than two years old, or about 450,000 water heaters were less than a year old. The Single-Family Survey responses show that 13.7 percent of all primary water heaters are less than two years old, which compares closely to the 2009 RECS data.

Despite differences in the timeframe for the RECS data, those results along with the surveys and the on-site inspection data for the residential baseline study generally confirm that the D&R annual HARDI sales estimates for 2013 are reasonable.

1.4 Summary of Key Findings

The small contractor group is the largest opportunity for influencing the market for high efficiency HVAC equipment. The vast majority of HVAC contractors who supply heating, cooling, and water heating equipment to residential customers in New York State are small contractors (1 to 10 employees). These small contractors represent about 90 percent of the businesses that install HVAC equipment in the State. On average, a large contractor (with more than 10 employees) will install about four times as many heating systems annually as a small contractor. At the same time, due to the large number of small contractors, the small contractor group still account for an estimated two-thirds of the total annual sales of heating systems in New York State.

Among the large contractors, over 90 percent, or twice as many as the small contractors, said they receive some training. Small contractors reported in the HVAC Market Assessment Survey that they are less likely to attend training and become certified in equipment installation practices. It is important to reach these small contractors in order to transform the market for more efficient HVAC equipment.

⁵ <http://www.eia.gov/consumption/residential/data/2009/>

Both large and small contractors feel that they are very proficient in all key quality design and installation practices including proper sizing. At the same time, HVAC Contractor Survey responses indicate both large and small contractors can improve on the amount of testing done to ensure heating and cooling systems are operating most efficiently at time of installation and servicing. Small contractors were less likely to perform tests that include building ventilation calculations, duct leakage tests, and duct pressurization tests. Large contractors were also less likely to conduct duct leakage and duct pressurization tests, and measure water flows.

General awareness of federal standards for energy efficiency equipment was low among surveyed HVAC contractors. Most of the large and small contractors said they were NOT aware of new federal standards that may affect the manufacturing of energy efficient non-electric heating and water heating equipment.

1.4.1 Natural Gas and Oil Furnaces and Boilers

The types of non-electric heating equipment being installed vary for new construction and new equipment (likely replacements) in existing homes. Ducted furnaces are more prevalent in new construction while new equipment installed in older homes is more often boilers than furnaces. Over half of the new ducted furnaces installed are high efficiency at Tier 3: 94% AFUE (Annual Fuel Utilization Efficiency) and above, based on secondary and primary sources of New York State data used for this assessment. At the same time, natural gas boilers are less likely to be high efficiency. Small contractors reported that half of their installations of natural gas boilers were less than Tier 1: 85–89% AFUE efficiency.

Large contractors also reported on average that about one out of five natural gas furnaces were conversions from oil-fired furnaces. About one-quarter of the contractors reported they are now observing an increase in the number of furnaces and boilers being replaced early. Although the estimates for the percentage of increase had a very wide range, a little over half reported increases in the 5 to 25 percent range for both furnaces and boilers.

New technologies to control heating and cooling are showing a significant market share. At the same time, a few contractors reported potential market barriers for two new technologies that should be researched by program administrators if included in their programs. Two or more contractors reported reducing sales of Wi-Fi communicating thermostats due to considerable training needs for customers on their operation. At least one contractor noted during the survey that all new boilers come with reset

controls. If the existing unit does not have reset controls, the contractor explained that it is safer to simply replace the entire boiler unit. At least one contractor raised issues that adding the controls to old systems could void the warranty while new systems typically included these controls with the equipment. Boiler reset controls should be reviewed by program administrators for future programs.

Promotion and education to increase the number of annual tune-ups could also provide additional energy savings. Based on the single-family on-site inspections, about 58 percent of homes that had furnaces and boilers indicated during the on-site inspection that the equipment had been serviced in 2013 and 2014. Homes with steam or water boilers were more likely (65%) than those with a furnace (50%) to have had their equipment serviced in 2013 or 2014.

1.4.2 Central Air Conditioners and Heat Pumps

Central air conditioning is the most prevalent primary cooling system type in new construction homes representing about 75 percent of the cooling equipment types. For existing homes with new air conditioning equipment, central air conditioning represents about one-third (32 percent) of the units, and room air conditioning is close at 28 percent of the new cooling equipment installed in the past two years. Existing homes replacing or installing new systems are typically limited by availability of ductwork in the home, which may account for the greater number of mini-split systems present. Mini-split systems represent 12 percent of new cooling systems in existing homes versus less than one percent of new construction cooling equipment.

There appears to be considerable energy efficiency potential in the central air conditioning market. Data from multiple sources consistently reported that more than 80 percent of the central air conditioning systems statewide were not high efficiency (less than 14.5 SEER [Seasonal Energy Efficiency Rating⁶]), which did not meet Tier 1 efficiency. Less than 15 percent of the recent equipment sales is very high efficiency Tier 3 (16 SEER and above). In addition, only two of the HVAC contractors surveyed felt that there was an increase in the early retirement of systems, thus there are opportunities for savings from programs that promote early retirement with efficient equipment.

⁶ Seasonal Energy Efficiency Rating (SEER) is the measure of equipment energy efficiency over the cooling season. It represents the total cooling of a central air conditioner or heat pump (in Btu) during the normal cooling season as compared to the total electric energy input (in watt-hours) consumed during the same period.

Energy Efficiency Rating (EER) is the Air-Conditioning and Refrigeration Institute standardized rating, which reports central air conditioning efficiency at 80 degrees F indoors and 95 degrees F outdoors. This rating measures steady-state efficiency -- that is, the efficiency of the air conditioner once it is up and running

Similar to heating equipment, there is an opportunity to achieve additional energy savings through the promotion and education about annual tune-ups of cooling systems. Based on the single-family on-site inspections, about 40 percent of homes with central air conditioners indicated during the on-site inspection that the equipment had been serviced in 2013 or 2014. This number compares to 71 percent of homes with an air source or ground source heat pump.

1.4.3 Water Heating

Storage type water heaters dominate the market with natural gas being the most prevalent fuel choice followed by electricity and propane. Natural gas water heaters are also picking up market share from oil-fired water heaters. Large contractors, in particular, indicated an average of nearly 20 percent of natural gas water heaters sold in the past 12 months were oil-to-natural gas conversions. Small contractors estimated a smaller (11 percent) oil-to-natural gas conversion sales rate in the past 12 months on average. Only a small percent (2 percent or less) of new water heaters are heat pump water heaters.

New federal standards for water heaters take effect on April 16, 2015. The data reported by HVAC contractors surveyed for this analysis indicates that the majority of tankless water heater units sold and/or installed in 2013 appear to already meet the new federal standards. Similarly, the HVAC contractors report efficiency levels for 2013 sales of natural gas storage water heaters that meet the new 2015 federal standard although the on-site inspection data collection for units sold 2012 and after do not confirm those results.

2 Key Findings

2.1 HVAC Market Profiles

The HVAC contractor population and sample for telephone surveys were identified through a website (<http://companies.findthebest.com/>). Using the findthebest database, the evaluation team was able to identify more than 18,000 contractors that meet the target group profile⁷ for the HVAC market assessment. In addition, the database includes, and could be sorted by, the number of employees and annual sales volume. Tetra Tech reviewed other HVAC contractor list sources, but a number of these other sources were not comprehensive. For example, some sources limited their lists to HVAC businesses with North American Technician Excellence (NATE) certification. The www.yellowpages.com was also fairly comprehensive, but did not include data to indicate company size.

The sample of HVAC contractors surveyed was compared to the totals from the population source as shown in Table 4 for New York State. Slightly more than 90 percent of the HVAC contractors listed in the database are considered small businesses with one to 10 employees. There were 18 large contractors and 28 small contractors who completed telephone surveys. If all 18 large contractors answered a question, the confidence and precision would be 90/20, and for 28 small contractors the confidence and precision would be 90/16.

Although <http://companies.findthebest.com/> was an excellent source for the statewide group of HVAC contractors, the company size (by number of employees) was not always accurate in the database. In climate zone 5, for example, the interviewers had a difficult time in finding a sufficient number of HVAC contractors considered small contractors (0-10 employees) to agree to a telephone survey although the database showed many more small contractors than large contractors. As a result, once a contractor was on the telephone, the interviewer completed the telephone survey even if they were identified in the database as a small contractor but were determined during the telephone survey to be a large contractor (with 10 or more employees). The interviewers found close to 20 percent of the contractors were not correctly listed by number of employees, which also made it impossible to accurately weight the small

⁷ The target group included HVAC Contractors who sell, install, or service air conditioners, heat pumps, furnaces, boilers, or water heaters for single-family residential customers in the state of New York. The source was <http://companies.findthebest.com/> and the location was set as New York State and the companies were filtered by flagging Specialty Trade Contractors > Building Equipment Contractors > Plumbing, Heating, and Air-Conditioning Contractors in the Construction category.

and large contractors. As a result, the two groups of HVAC contractors—small and large—are left unweighted and presented separately in the data tables to show differences between the two sizes of contractor firms. In each table included in this report, the number of HVAC contractor respondents are listed along with the confidence and precision level. For example, if all 18 of the large contractors answered a question, the data is at a 90/20 confidence and precision level. By combining all of the data sources, the data will show where results are consistent from all sources and therefore should be considered reliable.

Table 4. Population of HVAC Contractors in New York State

Source: companies.findthebest.com/ Construction: Specialty Trade Contractors > Building Equipment Contractors > Plumbing, Heating, and Air-Conditioning Contractors

Climate Zone	Population of New York State HVAC Contractors		HVAC Contractor Survey responses	
	Large Contractors (more than 10 employees)	Small Contractors (1–10 employees)	Large Contractors	Small Contractors
Climate zone 4	1,338	13,160	8	8
Climate zone 5	302	2,802	9	5
Climate zone 6	46	582	1	15

Other key characteristics of the HVAC contractors surveyed for the HVAC Market Assessment are summarized in Table 5.

Table 5. HVAC Contractor Survey Respondent Business Profile

Large contractors with 18 respondents are 90/20 confidence/precision and small contractors with 28 are 90/16 confidence/precision.

Source: HVAC Contractors surveys

Category	Large Contractors	Small Contractors	All
Total HVAC Contractor Businesses in New York State	1,686	16,544	18,230
Total Respondents	18	28	468
Average number of Full Time/Part Time and Seasonal Employees in NYS (FTE/PTE)	21 FTE 1 PTE	4 FTE 0.5 PTE	11 FTE 0.5 PTE
Average number of Years Business Provided HVAC Services to Customers in NYS	44	27	35
Percent of HVAC Contractors Very Familiar or Somewhat Familiar with CEE and ENERGY STAR® Tiered Efficiency Levels	67%	64%	65%
Percent of HVAC Contractors that install Natural Gas or Oil-Fired Furnaces	83%	79%	80%
Percent of HVAC Contractors that install Natural Gas or Oil-Fired Boilers	100%	96%	98%
Percent of HVAC Contractors that install Natural Gas/Oil Storage Water Heaters	94%	96%	96%
Percent of HVAC Contractors that install Natural Gas Tankless (Instantaneous) Water Heaters	100%	89%	93%
Percent of HVAC Contractors that install Central Air Conditioners	83%	75%	78%
Percent of HVAC Contractors that install Heat Pumps	72%	71%	72%
Percent of HVAC Contractors that install WiFi Communicating Thermostats	78%	54%	63%
Percent of HVAC Contractors that install Boiler Reset Controls	94%	79%	85%

2.2 Residential Natural Gas and Oil-Fired Furnaces and Boilers

2.2.1 Sales and Efficiency Data

This section summarizes and compares the data from the HVAC Contractor Surveys, D&R HARDI, and residential baseline on-site inspections for natural gas and oil-fired boilers sold recently. Each table lists the sample size in terms of the total number of HVAC contractors reporting sales data and the total number of units that the reporting contractors said they sold in 2013. The percentages of the reported sales

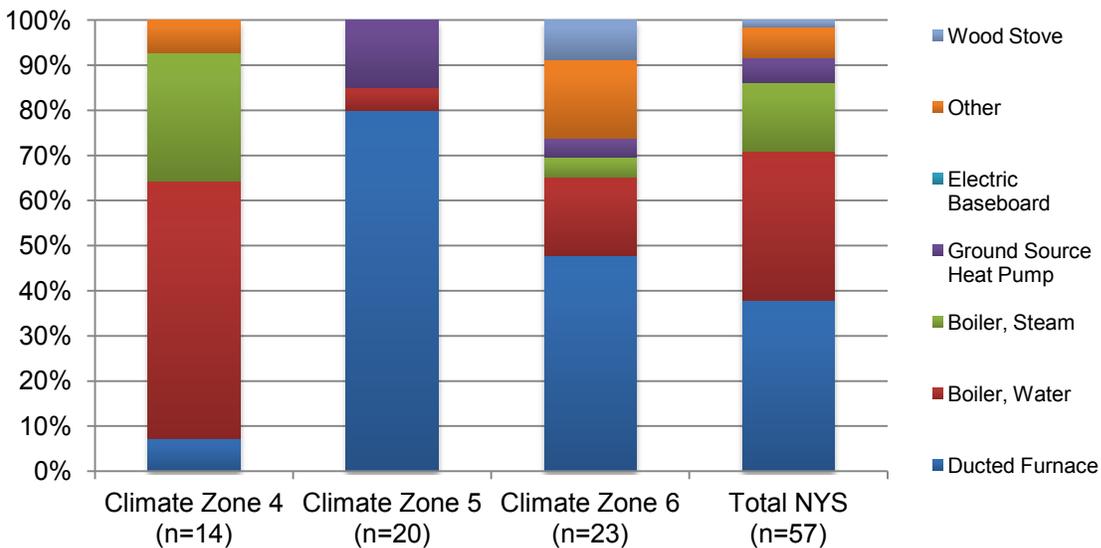
⁸ Tetra Tech completed 47 HVAC Contractor Surveys; however, one respondent identified himself as an area distributor. For analytic purposes of this particular volume, we have largely excluded the distributor respondent.

by efficiency levels (or tiers) are provided for each group of responding contractors—large and small. For comparison purposes, where available, the D&R HARDI data is provided for this equipment showing estimated total sales in New York State for 2013 and the percentages by efficiency levels that were reported by the sample of HARDI data distributors for New York State. The results from on-site inspections are also reported where there are a sufficient number of sample points for that heating equipment type.

Based on the on-site inspection data collection in 658 new and existing single-family homes, approximately 12.2 percent of primary heating equipment systems were installed in 2012 or later. This number suggests that about 6.1 percent of the primary heating equipment is replaced each year. The type of heating systems installed, based on the on-site inspection data, is primarily ducted furnaces and water boilers (about 70 percent). For those two types of most common primary heating systems, new construction is more likely to have furnaces that require ductwork (about 55 percent of heating equipment) compared to existing homes with new heating systems (about 37 percent) (Figure 2 and Figure 3).

Figure 2. Type of New Heating Equipment (2012 and after) in Existing Homes

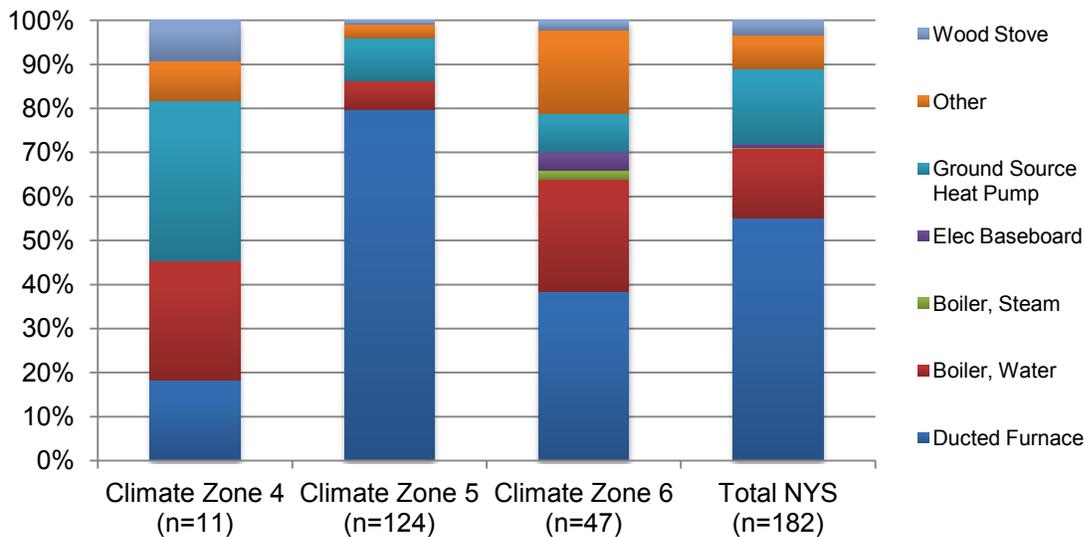
Source: Single-family On-site Inspections Homes Built Before 2012



There are some very distinct differences by climate zone for heating equipment installed in new homes. Climate zone 5 has a much higher percentage of ducted furnaces with twice as many as the other two climate zones. At the same time, climate zone 4 has a much higher percentage of boilers—four times as many as the other two climate zones.

Figure 3. Type of Heating Equipment in New Homes (Built 2012 or later)

Source: Single-family On-site Inspections New Construction



The data from multiple sources were compared to assess the level of efficiency for natural gas furnaces. The sources included the HVAC Contractor Survey, single-family home on-site data collection for the baseline study, and D&R HARDI data.

The minimum federal standards for non-weatherized gas furnaces manufactured after May 1, 2013 must meet 90% AFUE⁹, while ENERGY STAR¹⁰ promotes higher efficiency than the federal standard at 95% AFUE and above. As shown in Table 6, the results from all sources were consistent in that over 50 percent of the recent equipment sales is Tier 3: 94% AFUE and above. The D&R HARDI data

⁹ Annual Fuel Utilization Efficiency (AFUE) is the percentage of the heat in the incoming fuel which is converted to space heat instead of being lost.

¹⁰ http://www.energystar.gov/index.cfm?c=furnaces.pr_crit_furnaces

indicated that more than one-third of the units sold statewide in New York State by the distributors who participated in HARDI were less than 90% AFUE, although the HVAC Contractor Surveys and on-site inspection observations showed that the percentage of equipment at that efficiency level may be much lower at 5 to 6 percent.

Table 6. Residential Natural Gas Furnaces (<225,000 Btu/h) Units Sold in 2013

The sample sizes for contractors and on-site data collection in existing homes with new equipment would meet an 80/20 confidence/precision. At the same time, there is consistency in reports from all at Tier 3 and higher.

Source: HVAC Contractor Surveys (Vars: Type, SF1_1_Total thru SF1_1_t3), Single-family Home On-site Inspection Data Collection, and D&R HARDI Data

Data Source	Total Sales Reported by Respondents	Not High Efficiency: Less than 90% AFUE	Tier 1: 90-92% AFUE	Tier 2: 92.1-93% AFUE	Tier 3: 94% AFUE and above
Large Contractors (n=13)	2,567	6%	8%	18%	69%
Small Contractors (n=15)	742	5%	3%	9%	83%
On-site Inspection Data Collection Existing Homes (Equipment 2012 and Later)	Based on 14 Units	16.3%	7.3%	14.5%	61.9%
On-site Inspection Data Collection New Construction (2012 and Later)	Based on 86 Units	1.1%	5.6%	20.9%	72.5%
Statewide (D&R) HARDI Data on Total Annual Sales	95,940	34.5%	4.8%	92.1%-94.9% AFUE: 8.8%	95% AFUE and above: 51.9%

The number of residential oil-fired furnaces installed in the past two years was much smaller statewide than other types of primary heating equipment. According to D&R HARDI annual sales estimates, less than 10 percent of all non-electric furnaces sold in 2013 were oil-fired compared to natural gas. And overall, in new homes (2012 and after), the on-site inspection data collection found 5 percent were fueled by oil for any type of heating system. With the small percentage of oil-fired systems being sold, only a handful of new oil-fired furnaces (2012 and after) were observed while on-site for the inspection; this sample size is too small to be used as a comparison to the HVAC Contractor Survey data.

The federal 2013 standard for oil-fired furnaces is 83% AFUE while ENERGY STAR qualifying products are at Tier 1: 85% AFUE. The majority of sales (86 percent) by large contractors reported during the survey was Tier 1: 85% AFUE and above, while the opposite was true of small contractors who reported much fewer sales with 30 percent at Tier 1: 85% AFUE and above. HARDI distributors reported all their sales in the 78.9–89.9% AFUE range without any further breakouts (Table 7).

Table 7. Residential Oil-Fired Furnaces (<225,000 Btu/h) Units Sold in 2013

Source: HVAC Contractor Surveys (Vars: Type, SF1_2_Total thru SF1_2_t1) and D&R HARDI Data

Data Source	Total Sales Reported by Respondents	Not High Efficiency: Less than 85% AFUE	Tier 1: 85% AFUE and above
Large Contractors (n=13)	78	14%	86%
Small Contractors (n=15)	22	70%	30%
Statewide, D&R HARDI Data on Total Annual Sales	9,020	78.9%-89.9% AFUE: 100.0%	

Natural gas hot water boilers must meet a 2012 federal standard of 82% AFUE while the criteria for ENERGY STAR is Tier 1: 85% AFUE. According to the more than 2,900 Single-family telephone and Web surveys completed for the baseline study, approximately 5 percent of new homes installed boilers of any type as their primary heating system. With the small number of boilers installed for new equipment, the Residential Baseline Study on-site inspection sample was very small and not used for comparison to the HVAC Contractor Survey results. Shown in Table 8, the HARDI data from distributors was consistent with large contractor survey results in showing that about 18 percent of the 2013 sales were Tier 3: 94% AFUE and above. At the same time, D&R HARDI showed a much higher percentage of sales (64 percent) than the 3 percent reported by large contractors in the not high efficiency or less than 85% AFUE range.

Table 8. Residential Natural Gas Boilers (<300,000 Btu/h) Units Sold in 2013

Note that large contractors meet 80/20 while small contractors meet 90/20 confidence/precision in this table.

Source: HVAC Contractor Surveys (Vars: Type, SBI_1_Total thru SBI_1_t3) and D&R HARDI Data

Data Source	Total Sales Reported by Respondents	Not High Efficiency: Less than 85% AFUE	Tier 1: 85%-89% AFUE	Tier 2: 90%-93% AFUE	Tier 3: 94% AFUE and Above
Large Contractors (n=14)	2,722	3%	10%	69%	18%
Small Contractors (n=20)	469	51%	14%	31%	5%
Statewide, D&R HARDI Data on Total Annual Sales	59,860	64.2%	10.5%	7.3%	18.1%

The 2012 federal standard for oil-fired boilers is 84% AFUE while ENERGY STAR is at the Tier 1: 85% AFUE level. Oil-fired boilers were less prevalent than natural gas boilers statewide. The D&R HARDI distributors and the large contractors in the HVAC Contractor Survey reported most were Tier 1: 85% AFUE and above. Once again, the small contractors, whose sales by individual contractors are much smaller, reported the majority of their sales (72 percent) were not high efficiency at less than 85% AFUE for oil-fired boilers (Table 9).

Table 9. Residential Oil-Fired Boilers (<225,000 Btu/h) Units Sold in 2013

Note that large contractors meet 80/20 and small contractors meet 80/15 confidence/precision in this table.

Source: HVAC Contractor Surveys (Vars: Type, SBI_2_Total thru SBI_2_t1) and D&RHARDI Data

Data Source	Total Sales Reported by Respondents	Not High Efficiency: Less than 85% AFUE	Tier 1: 85% AFUE and Above
Large Contractors (n=14)	73	15%	85%
Small Contractors (n=19)	27	72%	28%
Statewide, D&R HARDI Data on Total Annual Sales	41,000	4.8%	95.2%

2.2.2 Efficiency Levels (Tiers) Recommended by Contractors

The HVAC contractors, both large and small contractors, reported that they generally recommended products that were Tier 1 efficiency and above. About 70 percent or more said they recommended the highest efficiency possible—Tier 3 for natural gas furnaces, and Tier 1 for oil furnaces—whenever possible. Small contractors were more likely than large contractors to report that they recommended furnaces and boilers that were not high efficiency or less than Tier 1. In particular, eight of the 28 small contractors surveyed indicated they typically recommended boilers that were not high efficiency (Figure 4 and Figure 5).

Figure 4. Which Efficiency Levels (Tiers) Do HVAC Contractors Typically Recommend to Customers for Furnaces

Source: HVAC Contractor Surveys (Vars: Type, SF2 and SB2)

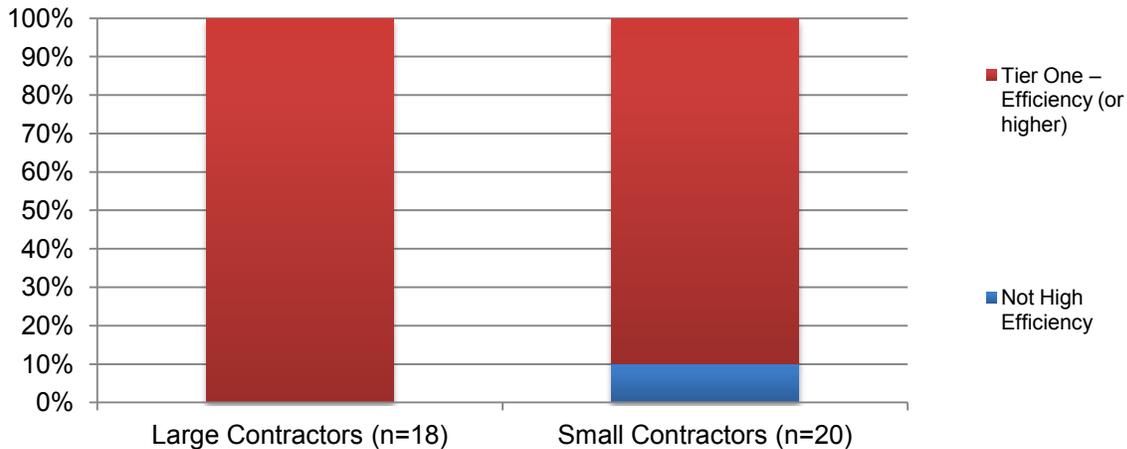
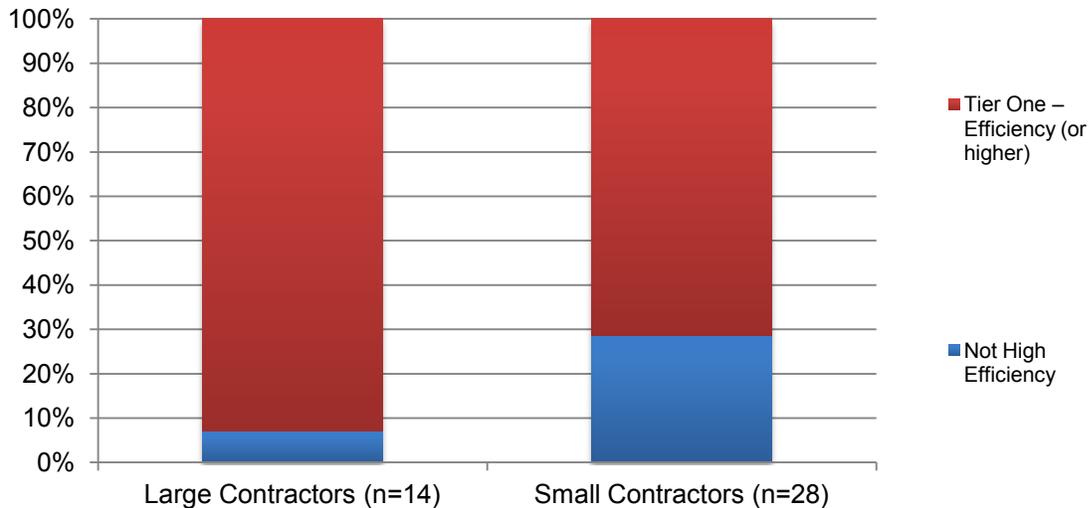


Figure 5. Which Efficiency Levels (Tiers) Do HVAC Contractors Typically Recommend to Customers for Boilers

Source: HVAC Contractor Surveys (Vars: Type, SF2 and SB2)



2.2.3 Stocking Practices

The majority of HVAC contractors—both large and small—are most likely to order furnaces from distributors or manufacturers instead of maintaining a stock (Table 10). The results indicate that there is a need to work with the distributors to promote high efficiency units. More small contractors, than large contractors, reported that they maintain a stock of natural gas and oil-fired furnaces. More research would be needed to determine why that would be true for small contractors. Small contractors may have installed more less-efficient equipment such as boilers and oil-fired furnaces. Small contractors also report less awareness of energy efficiency programs, which may be another factor in not installing as much high efficiency equipment as large contractors.

Table 10. Number of Contractors Mentioning Each Stocking Practice for Natural Gas and Oil-Fired Furnaces

Multiple responses were allowed for answer to survey question. Note that large contractors meet 80/20 while small contractors meet 80/15 confidence/precision in this table.

Source: HVAC Contractor Surveys, (Vars: Type, SF3_1 thru SF3_OTHER)

Data Source	Number that Maintain a Stock	Number that Purchase Directly from Store	Number that Order from Distributor	Number that Order from Manufacturer
Large Contractors (n=15)	2	1	10	3
Small Contractors (n=21)	6	1	16	2

2.2.4 Oil to Natural Gas Conversions, Annual Servicing, and Efficiency Trends

The HVAC contractors were asked what percentage of the natural gas furnaces and natural gas boilers sold in the past 12 months in New York State were oil-to-natural gas conversions. Large contractors reported higher percentages of oil-to-natural gas conversions—over 20 percent for natural gas furnaces. Small contractors reported 14 percent for these same conversions (Table 11).

Table 11. Oil to Natural Gas Conversions

Source: HVAC Contractors Survey SF6 and SB6

	Large Contractors Average Percentage of 2013 Units Sold	Small Contractors Average Percentage of 2013 Units Sold
Conversions from Oil to Natural Gas: Natural Gas furnaces (n=35)	22%	14%
Conversions from Oil to Natural Gas: Natural Gas boilers (n=42)	17%	13%

HVAC contractors were also asked if they had observed any increase in the number of units of equipment that are now being retired early versus replaced on failure. About one-quarter of the HVAC contractors (n=11) said they noticed an increase in furnace equipment retirement. A little over half reported increases for early replacement of furnaces in the 5 to 25 percent increase range. The amount of increase for early retirements of boilers also ranged widely among respondents (n=9). Again, a little more than half reported increases in the 5 to 25 percent range for early retirement of boilers.

The large contractors sold an average of 19 Wi-Fi communicating thermostats and installed slightly fewer with an average of 17 in the past 12 months. Small contractors sold and installed an average of seven to eight Wi-Fi communicating thermostats in the past 12 months. Although anecdotal, at least two contractors noted concerns about the Wi-Fi communicating thermostats in that customers face challenges operating them. According to one contractor, training of customers on the new technology is a burden, which may present an opportunity to provide training support to customers for the contractors. One contractor has stopped selling them, while another contractor was mostly installing Wi-Fi thermostats in commercial buildings, but has not done any installs in 2014 due to all the post-install issues. The same contractor mentioned going back to the site to replace Wi-Fi communicating thermostats with a basic thermostat unit.

As shown in Table 12, more of the large contractors sold boiler reset controls (24 boiler reset controls per contractor, on average) in the past 12 months while much fewer of them (nine boiler reset controls per contractor, on average) did the installation. The small contractors had one respondent who claimed to have sold and installed over 600 boiler reset controls, which made the average at 39 sold and installed for that group. Without the one outlier, the average is closer to 12 boiler reset controls sold on average in the past 12 months by the small contractor group. At least one contractor noted during the survey that all new boilers come with reset controls. If the existing unit does not have reset controls, the contractor explained that it is safer to simply replace the entire boiler unit. To add a reset control to an existing unit could possibly void the equipment warranty or pose a risk of the contractor being blamed if the old unit fails. For those customers interested in energy efficiency, the new boiler with the reset control is an easy sell according to the contractor.

Table 12. Wi-Fi Communicating Thermostats and Boiler Reset Controls Sales and Installs

Source: HVAC Contractor Surveys

Sales and Installs in the Past 12 Months	Large Contractors (n=12)		Small Contractors (n=22)	
	Total	Average Per Contractor	Total	Average Per Contractor
Wi-Fi Communicating Thermostats Sold	223	19	164	7
Wi-Fi Communicating Thermostats Installed	200	17	168	8
Boiler Reset Controls Sold	289	24	865	39
Boiler Reset Controls Installed	109	9	865	39

Based on the single-family on-site inspections, about 58 percent of homeowners who had furnaces and boilers indicated during the on-site inspection that the equipment had been serviced in 2013 and 2014. Homeowners with steam or water boilers were more likely (65%) than those with a furnace (50%) to have had their equipment serviced in 2013 or 2014.

2.3 Residential Central Air Conditioners and Heat Pumps

2.3.1 Sales and Efficiency Data

This section summarizes and compares the data from the HVAC Contractor Surveys, D&R HARDI, and residential baseline on-site inspections for air conditioning and heat pumps that are two years old or less. This section provides data on the sample size in terms of the total number of HVAC contractors reporting sales data and the total number of units that the reporting contractors said they sold in 2013. The percentages of the reported sales by efficiency levels (or tiers) are provided for each group of responding contractors—large and small. For comparison purposes, where available, the D&R HARDI data is provided for that equipment showing estimated total sales in New York State for 2013 and the percentages by efficiency levels that were reported by the sample of HARDI data distributors for the state. The results from on-site inspections are also reported where there are a sufficient number of sample points for that cooling equipment type.

Based on the on-site inspection data for air conditioning equipment from 494 new and existing single-family homes, and presented in Figure 6 and Figure 7, approximately 19.6 percent of primary cooling equipment systems were installed in 2012 or later. That suggests that about 9.8 percent of the primary cooling equipment is replaced each year. Central air conditioning is the most prevalent primary cooling system type in new construction at about 75 percent of the cooling equipment types. For existing homes with new air conditioning equipment, central air conditioning represents about one-third (32 percent), and room air conditioning is close at 28 percent of the new equipment manufactured in the past two years. Once again, existing homes are typically limited by availability of ductwork in the home, which may account for the greater number of mini-split systems (12 percent in existing home new equipment versus less than one percent in new construction). Climate zone 5 has a much higher percentage of central air conditioning in new homes compared to the other climate zones. At the same time, the sample sizes for climate zones 4 and 5 are much smaller and may not be representative.

Figure 6. Type of Cooling Equipment in New Homes (Built 2012 or after)

Note that climate zone 4 should not be considered representative due to the small number of sample points at 80/20 confidence/precision, climate zone 6 is close to 90/15 confidence/precision.

Source: Single-family On-site Inspection Data for New Homes

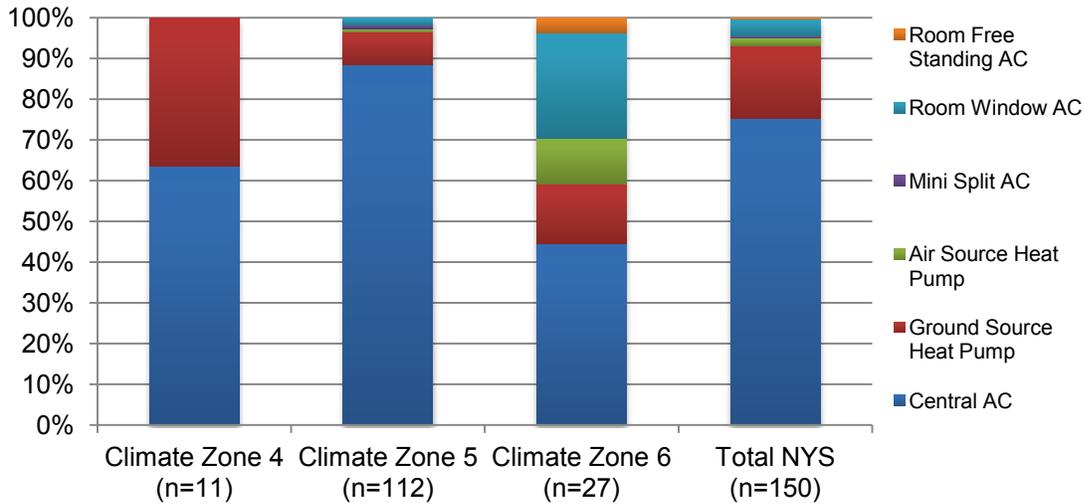
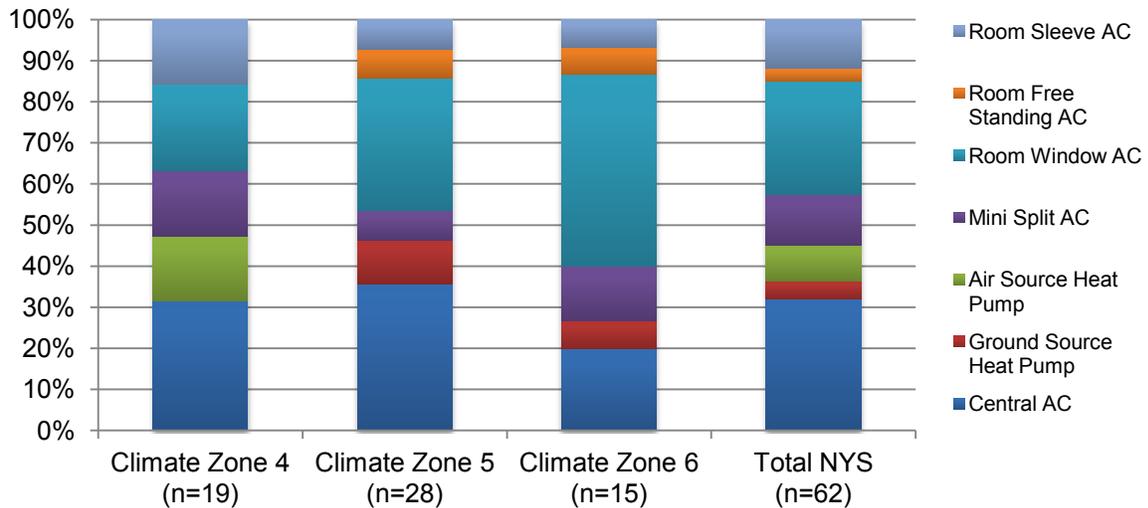


Figure 7. Type of New Cooling Equipment (2012 and After) in Existing Homes

Source: Single-family On-Site Inspection Data for Existing Homes Built Before 2012



The data from multiple sources were compared to assess the level of efficiency for central air conditioning and heat pumps. The sources included the HVAC contractor survey, single-family home on-site data collection for the baseline study, and D&R HARDI data.

The 2013 federal standard for central air conditioning (split systems and single packaged) is 13 SEER, whereas the minimum ENERGY STAR qualifying criteria is Tier 1: 14.5 SEER. As of January 1, 2015, the federal standard for packaged systems will increase to 14 SEER, which is still below the ENERGY STAR qualifying minimum standard. The results from all sources were consistent in that more than 80 percent of the central air conditioning systems were not high efficiency (less than 14.5 SEER), and less than 15 percent of the recent equipment sales is very high efficiency Tier 3: 16 SEER and above (Table 13). The on-site inspection data and D&R HARDI data reported is for all central air conditioners, regardless of type, but most of the sales reported by HVAC contractors are split systems so the other sources likely represent primarily split systems.

Table 13. Residential Central Air Conditioner Units—Split Systems Sold in 2013

Note that all samples meet the 80/20 confidence/precision with at least 11 data points; 17 data points meet 90/20.

Source: HVAC Contractor Surveys (Vars: Type, AC1_I_Total thru AC1_I_t3) and D&R HARDI Data

	Total Sales Reported by Respondents	Not High Efficiency: Less than 14.5 SEER/12 EER	Tier 1: 14.5-14.9 SEER/12.0-12.4 EER	Tier 2: 15.0-15.9 SEER/12.5-12.9 EER	Tier 3: 16 SEER/13 EER and Above
Large Contractors (n=13)	1,662	68%	8%	9%	15%
Small Contractors (n=26)	392	86%	1%	2%	10%
On-site Inspection Data Collection Existing Homes (Equipment 2012 and later) All Central Air Conditioners	Based on 17 Units	81.9%	13.8%	0%	4.3%
On-site Inspection Data Collection New Construction (2012 and Later) All Central Air Conditioners	Based on 115 Units	87.4%	9.9%	0.7%	2.0%
Statewide, D&R HARDI Data on Annual Sales of Ducted Central Air Conditioners	87,374	13-13.99 SEER: 86% 14-14.99 SEER: 4.5%		0.1%	9.3%

Packaged systems for central air conditioners were mixed in terms of reported efficiency levels by large contractors and small contractors as shown in Table 14. The numbers of units sold were quite small compared to split system central air conditioners, which may account for the variability in the data.

Table 14. Residential Central Air Conditioner Units—Packaged Sold in 2013

Note that large contractors meet 80/20 while small contractors are close to 90/15, which would be n=31.

Source: HVAC Contractor Surveys (Vars: Type, AC1_2_Total thru AC1_2_t2)

Data Source	Total Sales Reported by Respondents	Not High Efficiency: Less than 14 SEER/ 11 EER	Tier1: 14 SEER/ 11 EER	Tier 2: Above 14 SEER/11 EER
Large Contractors (n=13)	17	6%	24%	70%
Small Contractors (n=26)	40	55%	11%	34%

The 2013 federal standard for split system and packaged heat pumps is 13 SEER and 7.7 HSPF.¹¹ Tier 1: 14 SEER is the minimum qualifying efficiency level for ENERGY STAR for packaged heat pumps, which will become the federal standard in January 2015 for both split system and packaged heat pumps.

The number of heat pumps that were included in the on-site inspection data was less than 20 units and was not useful for comparison by types of heat pumps. Efficiency levels of the split system heat pumps reported by HVAC contractors compare well to the data for ducted heat pumps provided by D&R HARDI with about one-third of the 2013 sales being in Tier 2 and above levels (Table 15).

¹¹ Heating System Performance Factor (HSPF) is a heat pump's estimated seasonal heating output in Btu divided by the amount of energy that it consumes in watt-hours.

Table 15. Residential Heat Pumps Units—Split Systems Sold in 2013

Note that large contractor responses of 11 meets 80/20 confidence/precision while small contractors are about 90/17 with 25 responses.

Source: HVAC Contractor Surveys (Vars: Type, HP1_1_Total thru HP1_1_t2) and D&R Data

	Total Sales Reported by Respondents	Not High Efficiency: Less than 14.5 SEER/12 EER/8.2 HSPF	Tier 1: 14.5-14.9 SEER/12.0-12.4 EER/8.2-8.4 HSPF	Tier 2: 15 SEER/12.5 EER/8.5 HSPF and Above
Large Contractors (n=11)	370	63%	4%	33%
Small Contractors (n=25)	429	63%	4%	33%
Statewide, D&R HARDI Data on Sales of All Ducted Heat Pumps	2,342	13-13.99 SEER: 57.6% 14-14.99 SEER: 8.0%	34.4%	

Table 16. Residential Heat Pump Units—Packaged Sold in 2013

Note that large contractor responses of 11 meets 80/20 confidence/precision while small contractors are about 90/17 with 25 responses.

Source: HVAC Contractor Surveys (Vars: Type, HP1_2_Total thru HP_2_t2) and D&R HARDI Data

Data Source	Total Sales Reported by Respondents	Not High Efficiency: Less than 14 SEER/ 11 EER	Not High Efficiency: 14 SEER/ 11 EER	Tier 2: Above 14 SEER/11 EER
Large Contractors (n=11)	10	50%	50%	0%
Small Contractors (n=25)	17	65%	35%	0%

Given the small number of HVAC contractors reporting sales for the mini-split heat pumps, it is difficult to make comparisons to the D&R HARDI data, which showed that most of these heat pumps were 15 SEER and above and exceed the ENERGY STAR minimum criteria of Tier 1: 14 SEER. Table 17 presents the D&R HARDI data reported by distributors. This data appears to be more accurate than the efficiency levels reported by the HVAC contractors. The technology is very efficient with a 30 percent greater efficiency than ducted systems. A review of equipment on manufacturer web-sites typically showed equipment with SEER levels of 15 or more.

Table 17. Residential Ductless Mini-Split Heat Pumps Sold in 2013

Note that contractors with 11 or more responses meet the 80/20 confidence/precision.

Source: HVAC Contractor Surveys (Vars: Type, HP1_3_Total thru HP1_3_t2) and D&R HARDI Data

Data Source	Total Sales Reported	Not High Efficiency: Less than 14 SEER/ 11 EER/8 HSPF	Tier 1:14 SEER/ 11 EER/8 HSPF	Tier 2: Above 14 SEER/11 EER/8 HSPF
Large Contractors (n=11)	10	50%	50%	0%
Small Contractors (n=14)	7	86%	14%	0%
Statewide, D&R HARDI Data on Sales of Ductless Heat Pumps	20,618	0.5%	14-14.99 SEER: 2.0%	15 SEER and Above: 97.5%

2.3.2 Efficiency Levels (Tiers) Recommended by Contractors

The HVAC contractors who installed central air conditioning or Heat Pump equipment were asked what efficiency level they typically recommended to customers. As seen in Figure 8, ten of 13 large contractors who responded to this question indicated they recommended Tier 1 or higher efficiency. All large contractors who responded about recommended efficiency level for heat pumps confirmed they recommend something higher—Tier 1 or above (Figure 9). Small contractors report they are slightly more likely to recommend central air conditioning units or heat pump equipment that are not high efficiency (less than Tier 1 efficiency).

Figure 8. Efficiency Levels (Tiers) that HVAC Contractors Typically Recommend to Customers for Central Air Conditioners

Source: HVAC Contractor Surveys (Vars: Type, AC2 and HP2)

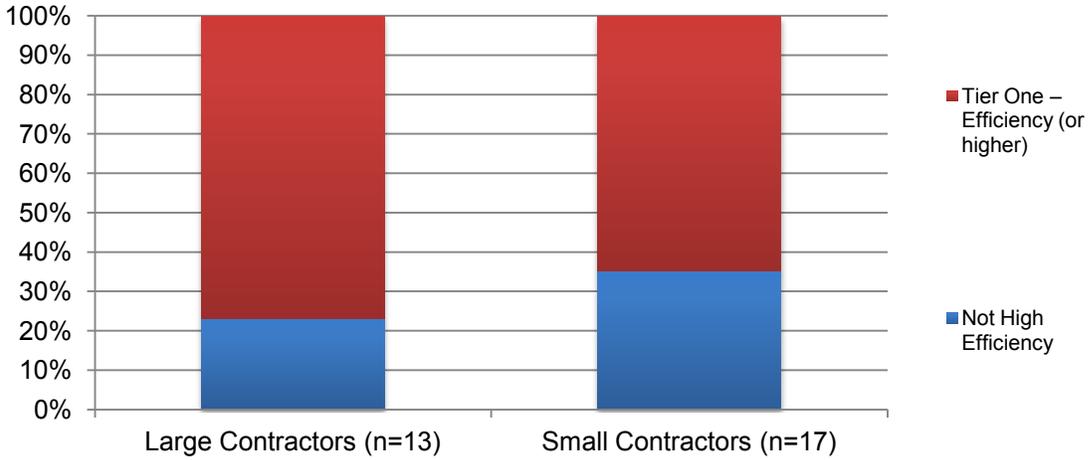
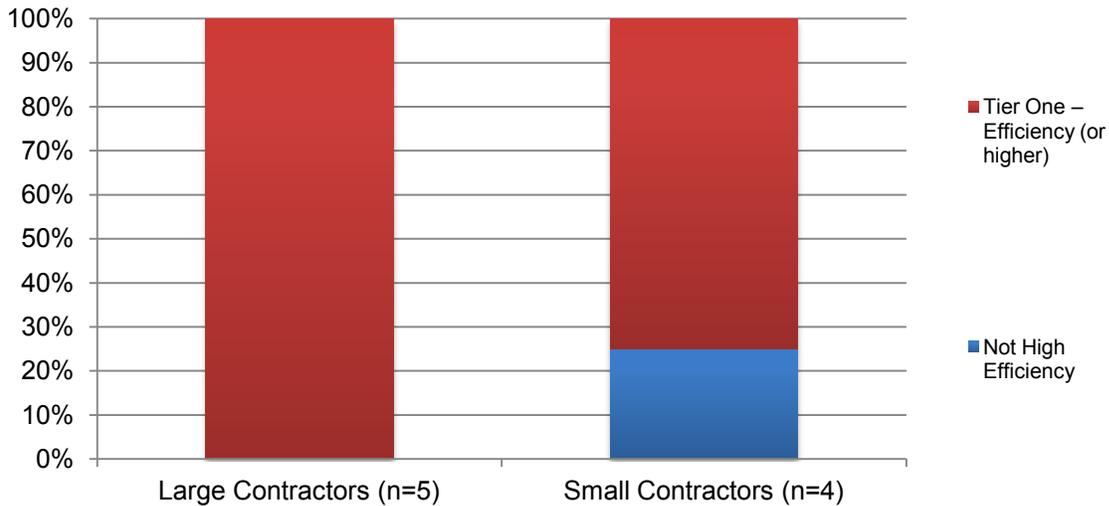


Figure 9. Efficiency Levels (Tiers) that HVAC Contractors Typically Recommend to Customers for Heat Pumps

Source: HVAC Contractor Surveys (Vars: Type, AC2 and HP2)



2.3.3 Stocking Practices for Central Cooling Equipment

As with heating equipment, only a few of the HVAC contractors maintain a stock of central air conditioners (Table 18) and heat pumps (Table 19). As with central air conditioners, heat pumps are more typically ordered from the distributor when needed. A few of the large contractors indicated they do maintain a stock of this equipment.

Table 18. Number Mentioning Each Stocking Practice for Central Air Conditioners

Source: HVAC Contractor Surveys, (Vars: Type, AC3_1 thru AC3_OTHER)

Data Source	Maintain a Stock	Purchase Directly from Store	Order from Distributor	Order from Manufacturer
Large Contractors (n=15)	3	0	11	2
Small Contractors (n=23)	3	0	13	3

Table 19. Number Mentioning Each Stocking Practice for Heat Pumps

Source: HVAC Contractor Surveys, (Vars: Type, HP3_1 thru HP3_OTHER)

Data Source	Maintain a Stock	Purchase Directly from Store	Order from Distributor	Order from Manufacturer
Large Contractors (n=6)	2	0	4	0
Small Contractors (n=6)	0	0	5	1

2.3.4 Early Retirement, Annual Service Rate, and Other Efficiency Trends

Only one large and one small contractor reported an increase in central air conditioning units being retired early (versus failure) within this survey. The large contractor reported that 20 percent more units are being replaced earlier, prior to replacement on failure; the small contractor reported a 10 percent unit sales impact from early central air conditioning retirement.

Based on the single-family on-site inspections, about 40 percent of homes that had central air conditioners indicated during the on-site inspection that the equipment had been serviced in 2013 or 2014. This result compares to 71 percent of homes with an air source or ground source heat pump.

2.4 Residential Water Heaters

2.4.1 Sales and Efficiency Data

This section summarizes and compares the data from the HVAC Contractor Surveys, and residential baseline on-site inspections for water heating equipment. Each table lists the sample size in terms of the total number of HVAC contractors reporting sales data and the total number of units that the reporting contractors said they sold in 2013. The percentages of the reported sales by efficiency levels (or tiers) are provided for each group of responding contractors—large and small. For comparison purposes, results from on-site inspections are also reported where there are a sufficient number of sample points for that water heating equipment type. D&R HARDI did not include data for water heaters.

Based on the on-site inspection data for water heating equipment from 686 new and existing single-family homes, approximately 15.1 percent of water heaters installed in 2012 or later. This result suggests that 7.5 percent of the primary water heaters are replaced each year. Storage tank water heating is the most prevalent water heater type in new construction (about 60 percent of the water heating equipment types). Given the small number of sample points in climate zone 4, it is not possible to draw any conclusions for new home equipment in that climate zone.

For existing homes with new water heating equipment, storage tank water heaters represent almost 75 percent of water heaters (Figure 12). For new construction, about 45 percent are natural gas water heaters with about 50 percent being split fairly evenly between electricity and propane gas. For new water heaters in existing homes, a larger portion, 65 percent are natural gas, followed next by electric water heaters at 18 percent, and propane gas water heaters at 11.5 percent (Figure 13). Climate zone 5 has a much higher percentage of storage water heaters with natural gas than the other two climate zones.

The data on water heater fuel and type is presented in Figure 10 and Figure 11 for information purposes. The number of single-family homes built after 2012 in the on-site inspection sample is very small with only nine homes and therefore does not appear to be representative of the population in that segment.

Figure 10. Type of Water Heaters in New Homes (Built 2012 and Later)

Note that climate zone 4 should not be considered representative of that population segment due to the small sample size.

Source: Single-family On-site Inspection Data for Homes Built Before 2012

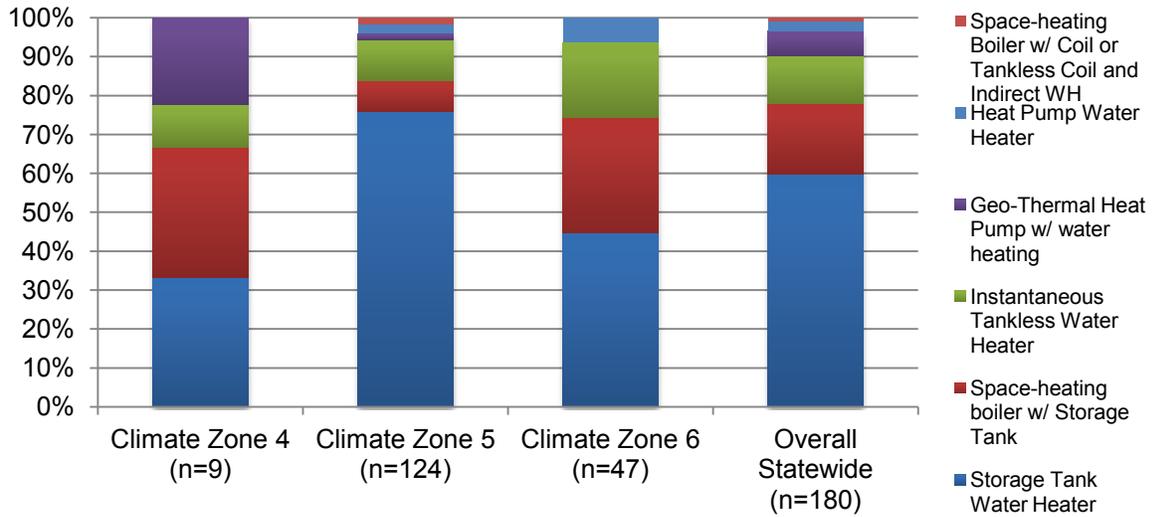


Figure 11. Water Heater Fuel in New Homes (Built 2012 and Later)

Note that climate zone 4 should not be considered representative of that population segment due to the small sample size.

Source: Single-family On-site Inspection Data for Homes Built Before 2012

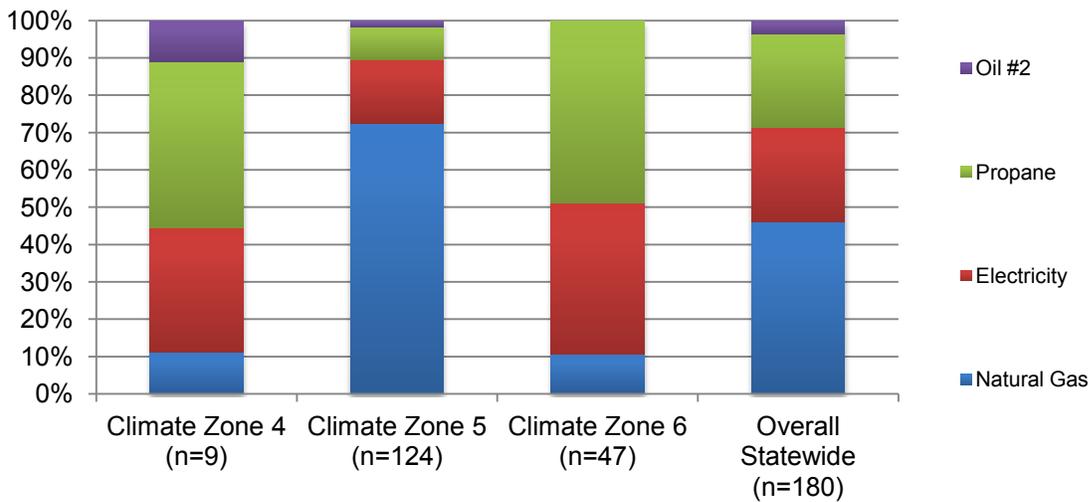


Figure 12. Type of New Water Heaters (2012 and Later) in Existing Homes

Note that climate zone 4 with 19 responses meets 80/15 confidence/precision

Source: Single-family On-site Inspection Data for Existing Homes

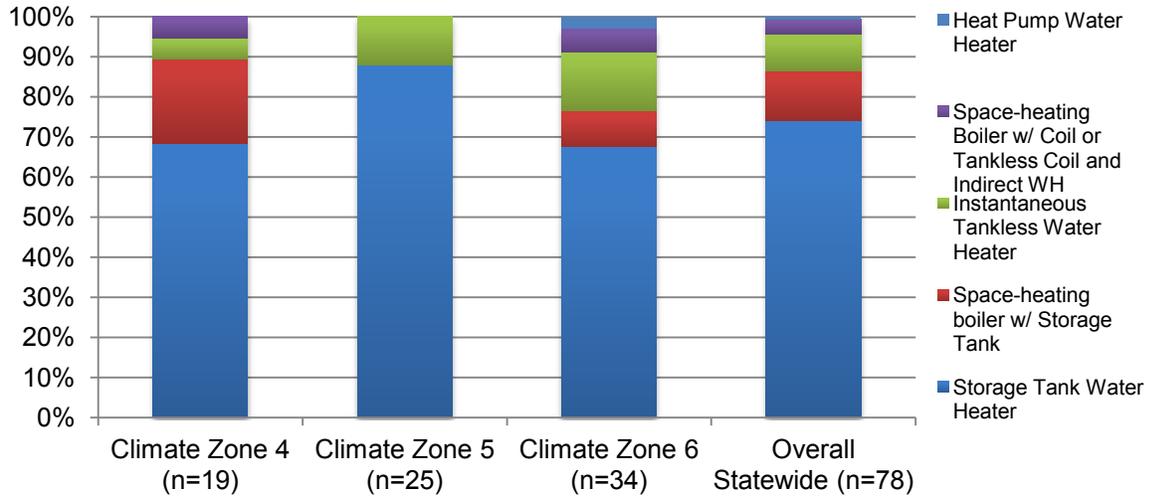
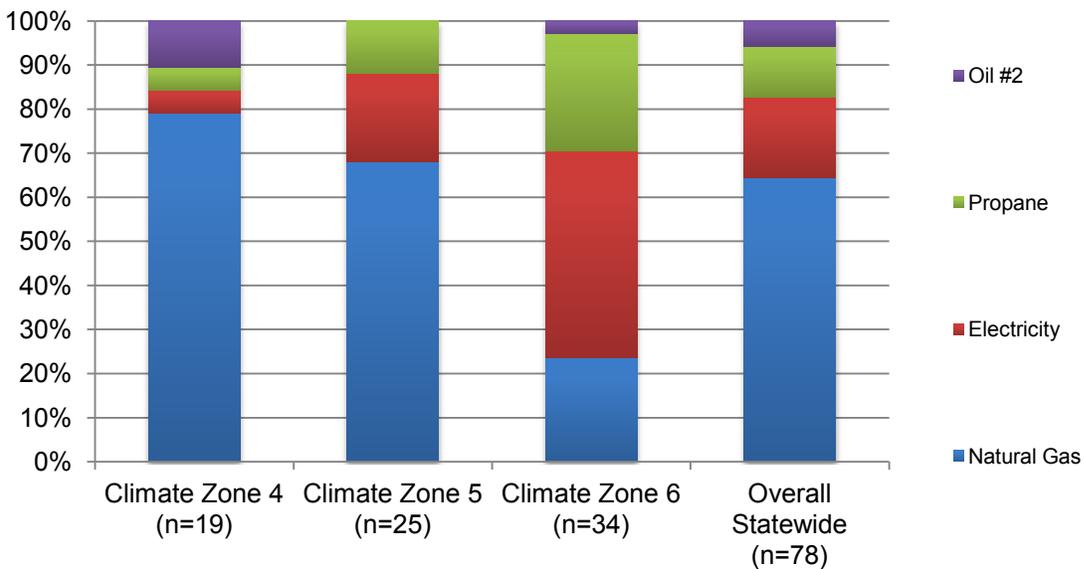


Figure 13. Fuel for New Water Heaters (2012 and Later) in Existing Homes

Source: Single-family On-site Inspection Data for Existing Homes



Residential water heaters must comply with the amended standards found in the Code of Federal Regulations,¹² by April 16, 2015. This information is also in the Electronic Code of Federal Regulations¹³. Table 20 gives the standards for the non-electric water heaters for comparison to current installation practices. Natural gas water heaters move from the 2004 standard of 0.67 to 0.675 Energy Factor¹⁴ (EF) for 20 gallon to 55 gallon water heaters, while 50 gallon oil-fired water heaters have a larger increase from 0.59 to 0.68 EF.

Table 20. Amended Energy Conservation Standards for Residential Water Heaters

V_s: Rated Storage Volume – the water storage capacity of a water heater (in gallons).

Product Class	Rated Storage Volume	Energy Factor (EF)
Natural Gas-fired Water Heater	≥20 gal and ≤55 gal	0.675 – (0.0015*V _s)
	> 55 gal and ≤100 gal	0.8012 – (0.00078* V _s)
Oil-fired Water Heater	≤50 gal	0.68 – (0.0019*V _s)
Instantaneous Natural Gas-fired Water Heater	< 2 gal	0.82 – (0.0019*V _s)

Based on the HVAC Contractor Survey respondents, it appears that the majority of natural gas-fired water heaters installed in 2013 will likely meet the new 2015 standard of 0.675 EF because it is only a small increase from 0.67 EF. The majority of the natural gas-fired water heaters installed in 2012 or later did not meet the new standards based on the primary data collected during the on-site inspections. At the same time, the data includes water heaters in 2012 and the trend indicates water heating distributors and manufacturers have just recently (2013 and later) begun to respond to the impending new standards.

The HVAC contractor data and the on-site observations in Table 21 compared closely for the percentage of natural gas water heaters that were installed recently at the Tier 2: 0.80 EF and above level (less than 9 percent). However, there were some differences in what was reported by HVAC contractors as percentage of natural gas storage water heaters for the Tier 1 efficiency level and for not high efficiency versus what was found in the on-site inspections. The on-site inspections reported that the majority of those water heaters were less than 0.67 EF, which is surprising because it would not meet the 2013 federal standard. No D&R HARDI data for water heaters were available to make comparisons to the other two sources.

¹² 10 CFR 430.32(d)

¹³ <http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR>

¹⁴ Energy Factor (EF) is an annual measure of the useful energy coming out of a water heater, divided by the amount of energy going in to the water heater to heat the water.

Table 21. Residential Natural Gas Storage Water Heaters Sold in 2013

Note that large contractors are at the 80/20 confidence/precision while on-site inspection data for existing new equipment with 31 units is at the 90/15 confidence/precision.

Source: HVAC Contractor Surveys (Vars: Type, SW1_1_Total thru SW1_1_t2), percent On-site Data Collection

Data Source	Total Sales Reported by Respondents	Not High Efficiency: Less than 0.67 Energy Factor (EF)	Tier 1: 0.67–0.79 EF	Tier 2: 0.80 EF and Above
Large Contractors (n=14)	7,649	5%	89%	6%
Small Contractors (n=17)	647	24%	70%	6%
On-site Inspection Data Collection Existing Homes (Equipment 2012 and Later) Natural Gas Storage Water Heaters	Based on 31 Units	94.9%	5.1%	0%
On-site Inspection Data Collection New Construction (2012 and Later) Natural Gas Storage Water Heaters	Based on 82 Units	61.3%	29.9%	8.8%

There is a small percentage of oil storage water heaters installed in the past two years (less than 6 percent). There were not enough new oil storage water heaters in the on-site inspections to make a comparison to the HVAC contractor reports. The new standard for oil-fired storage water heaters manufactured starting April 16, 2015, will be 0.80 EF, which is quite a bit higher than the 0.59 EF that currently qualifies for Tier 1 (Table 22).

Table 22. Residential Oil Storage Water Heaters Sold in 2013

Note that large contractors meet 80/20 while small contractors meet 90/20 confidence/precision.

Source: HVAC Contractor Surveys (Vars: Type, SW1_1_Total thru SW1_1_t2)

Data Source	Total Sales Reported by Respondents	Not High Efficiency: Less than 0.59 Energy Factor (EF)	Tier 1: 0.59 EF and Above
Large Contractors (n=14)	19	21%	79%
Small Contractors (n=17)	5	100%	0%

The data reported by HVAC contractors and collected from the on-site inspections of 686 new and existing single-family homes were fairly consistent for natural gas tankless water heaters. With the exception of a few natural gas tankless water heaters installed in existing homes in 2012 and later, the majority (97 percent or more) met the Tier 1: 0.82 and above efficiency. As of April 16, 2015, 0.82 EF becomes the new federal standard, which meets current ENERGY STAR criteria. It appears that most units are already meeting the federal standard although the 2010 standard that was in place is much lower at 0.62 EF (Table 23).

Table 23. Residential Natural Gas Water Heaters Tankless Sold in 2013

Note that existing homes included in the on-site inspections with new water heaters are based on 7 units, which is very small and does not meet the 80/20 confidence/precision met by both contractor groups. New homes are at 80/15 or better.

Source: HVAC Contractor Surveys (Vars: Type, SW1_3_Total thru SW1_3_t1), On-site Inspection Data Collection

Data Source	Total Sales Reported by Respondents	Not High Efficiency: Less than 0.82 Energy Factor (EF)	Tier 1: 0.82 EF and Above
Large Contractors (n=14)	290	3%	97%
Small Contractors (n=14)	92	0%	100%
On-site Inspection Data Collection Existing Homes (Equipment 2012 and Later) Natural Gas Tankless Water Heater	Based on 7 Units	16%	84%
On-site Inspection Data Collection New Construction (2012 and Later) Natural Gas Tankless Water Heater	Based on 23 Units	3.3%	96.7%

The on-site inspections for single-family homes did not specifically identify water heaters as condensing water heaters. The majority of large contractors and small contractors said they installed Tier 1: 0.80 EF and above efficiency for this equipment (Table 24).

Table 24. Residential Natural Gas Water Heaters-Condensing Sold in 2013

Note that contractors have more than 11 responses to meet 80/20 confidence/precision.

Source: HVAC Contractor Surveys (Vars: Type, SW1_4_Total thru SW1_4_t1)

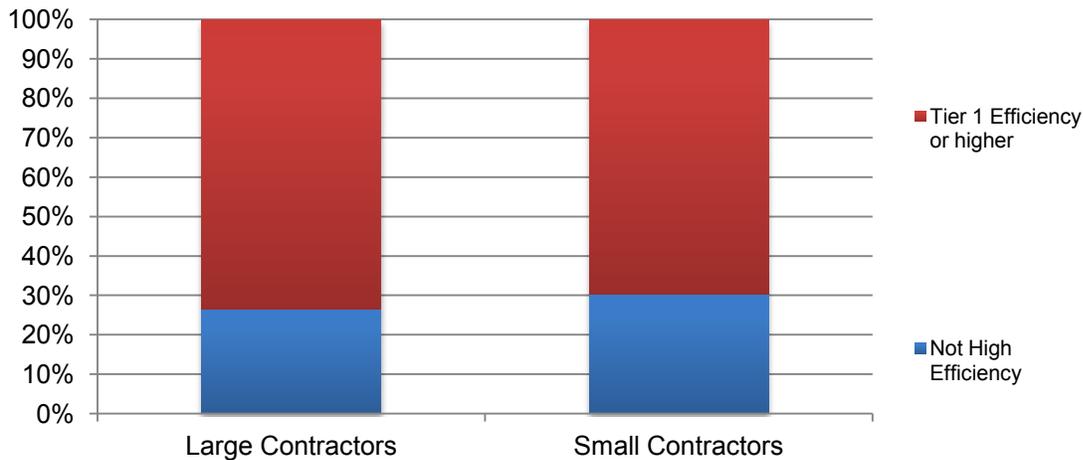
Data Source	Total Sales Reported by Respondents	Not High Efficiency: Less than 0.80 Energy Factor (EF)	Tier 1: 0.80 EF and Above
Large Contractors (n=13)	146	45%	55%
Small Contractors (n=14)	40	11%	89%

2.4.2 Efficiency Levels (Tiers) Recommended by Contractors

Seventy-three percent (11 of 15) of large contractors who recommend residential water heaters recommend Tier 1 or above efficiency levels. A similar proportion of small contractors (70 percent, or 16 of 23 contractors) recommend something higher than the standard level water heater efficiency (Figure 14).

Figure 14. Efficiency Levels (Tiers) of Residential Water Heaters HVAC Contractors Typically Recommend to Customers

Source: HVAC Contractor Surveys (Vars: Type, SW2)



2.4.3 Stocking Practices

The majority of HVAC contractors indicated that they order water heaters from distributors on a case-by-case basis. However, a few, primarily large contractors, maintain a stock of water heaters (Table 25).

Table 25. Number of HVAC Contractors Mentioning Each Stocking Practice for Residential Water Heaters

Does not add to total contractors because multiple responses were allowed.

Source: HVAC Contractor Surveys, (Vars: Type, SW3_1 thru SW3_OTHER)

Data Source	Maintain a Stock	Purchase Directly from Store	Order from Distributor	Order from Manufacturer
Large Contractors (n=16)	5	0	13	1
Small Contractors (n=26)	2	0	20	1

2.4.4 Oil to Natural Gas Conversions and Efficiency Trends

Large contractors indicated that an average of nearly 20 percent of natural gas water heaters they have sold in the past 12 months were oil-to-natural gas conversions; however, only a very small percentage (2 percent) are heat pump water heaters. Small contractors estimated a smaller (11 percent) oil-to-natural gas conversion sales rate in the past 12 months on average, with only one percent being heat pump water heaters.

Large contractors reported not seeing much of an early retirement increase when it comes to water heaters. Large contractors reported no movement on early retirement of tankless water heaters. Responses among small contractors were highly similar (Table 26).

Table 26. Recent Trends in Water Heater Sales

Source: HVAC Contractor Surveys, (Vars: Type, SW6, SW7)

	Large Contractors Percent of 2013 Units Sold	Small Contractors Percent of 2013 Units Sold
Conversions from Oil to Natural Gas	18%	11%
Heat Pump Water Heaters Sales	2%	1%

2.5 Quality Design, Installation, and Maintenance

2.5.1 Training and Certification

The HVAC contractors were asked which industry sources they primarily used as references to ensure quality installation of residential HVAC equipment. Table 27 lists widely recognized primary sources among HVAC contractors. Large contractors more frequently mentioned a recognized industry source as a primary reference compared to small contractors. North American Technician Excellence (NATE)¹⁵ received the most mentions among surveyed contractors, with three large contractors and two small contractors reporting it as a primary resource.

Contractors of all sizes were more likely to indicate another reference (“Other”) to ensure quality installations. Sixteen respondents mentioned the manufacturer as their other source of information. Six respondents mentioned building codes and NYSERDA as other sources of training and certification.

Seven large contractors and eight small contractors answered that they had no particular industry source they considered for a reference.

Table 27. Primary Sources Used as References to Ensure Quality Installations

Multiple responses were allowed. Note that large contractors are very close to 90/20 and small contractors are close to 90/15 confidence/precision levels.

Source: HVAC Contractor Surveys, (Vars: Type, IM1_1 through IM1_7)

Primary Sources	Number of Large Contractors Mentioned (n=16)	Number of Small Contractors Mentioned (n=28)
Air Conditioning Contractors of America (ACCA)	1	0
American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)	2	2
Plumbing, Heating-Cooling Contractors National Association (PHCC)	2	0
North American Technician Excellence (NATE)	3	2
Building Performance Institute (BPI)	2	2
Other (Manufacturer, Codes, NYSERDA)	11	18
None	7	8

¹⁵ North American Technician Excellence (NATE) is the leading nonprofit certification program for technicians in the heating, ventilation, air-conditioning, and refrigeration (HVACR) industry that is supported by the entire industry.

A majority of HVAC contractors surveyed indicated that their firm requires HVAC technicians to attend training courses on energy efficiency, quality maintenance, and quality installation. Most of the large contractors (13 of 15 or 87 percent) indicated their firm does require some training. A slightly smaller proportion of small contractors—80 percent, or 20 of 25—also report training is required by their firm (Table 28).

Three large contractors specifically reported requiring electrical or plumbing training. Electrical training was also mentioned by two small contractors surveyed. HVAC contractors overall, regardless of business size, most frequently indicated some “Other” training requirement that primarily included manufacturer training or internal training. The vast majority mentioned training by manufacturers and equipment distributors.

Table 28. Types of Training Required and Organization

Multiple responses were allowed. Note that large contractors exceed 80/20 confidence/precision while small contractors exceed 80/15.

Source: HVAC Contractor Surveys, (Vars: Type, IM2_1 through IM2_6)

Training Courses/Organization	Number of Large Contractors Mentioned (n=15)	Number of Small Contractors Mentioned (n=25)
Electrical	3	2
Plumbing	3	0
Air Conditioning Contractors of America (ACCA)	2	0
Air Conditioning, Heating, and Refrigeration Institute (AHRI)	1	0
Utility Sponsored Training	2	0
Other (Manufacturer Training/Internal Training)	9	18

Nearly all (93 percent) of the 15 large contractors require their technicians to obtain industry certification, while only about half (52 percent) of the small contractors hold the same requirement. Industry certification is most often received through the U.S. Environmental Protection Agency. Other industry certifications are noted in Table 29. Nearly one-third of the respondents who offered an “Other” answer indicated refrigerant certification was required by their firm; all but one of these respondents reported installing central air conditioners.

Table 29. Types of Certification Required and Organization

Multiple responses allowed. Note that large contractors exceed 80/20 confidence/precision while small contractors exceed 80/15.

Source: HVAC Contractor Surveys, (Vars: Type, IM3_1 through IM3_4)

Types of Certification	Number of Large Contractors Mentioned (n=15)	Number of Small Contractors Mentioned (n=25)
North American Technician Excellence (NATE)	1	2
Building Performance Institute (BPI)	1	0
EPA HVAC Certification	4	1
Other (Refrigerant Certification, Manufacturer, Utility, National Oil Heat Research Alliance or NORA)	7	9

The HVAC contractors were also asked to rate their firm in terms of skill level for various quality design elements for HVAC equipment. The elements appear in Table 30. The ratings are based on a scale of 1 to 5, where 1 = not at all proficient, and 5 = extremely proficient. Both large and small contractors report, on average, that they are “very” or “extremely proficient” at all quality design elements we asked about. Large contractors, in particular, indicated they were extremely proficient in diagnosing techniques for ensuring adequate system refrigerant.

Table 30. Rating of Proficiency in Quality Design Elements by HVAC Contractors

Note that large contractors exceed 80/20 confidence/precision while small contractors exceed 80/15.

Source: HVAC Contractor Surveys (Vars: Type, DI_A through DI_4)

Quality Design Element	Large Contractors Average Rating (n=15)	Small Contractors Average Rating (n=25)
Practices, techniques, and experiences with sizing new systems	4.67	4.64
Designing, installing, replacing, and fixing air distribution systems	4.14	4.35
Recommending and specifying system efficiencies	4.67	4.60
Diagnosing techniques for ensuring adequate system refrigerant charging	5	4.50

2.5.2 Installation and Servicing Practices

HVAC contractors were asked how often they perform various tests when installing or servicing HVAC equipment. The frequency was based on a scale of 1 to 5, where 1 = usually not done, and 5 = always done. Table 31 lists the practices or tests contractors to rate on frequency in which they are performed, along with the average rating for each test among large and small contractors.

Small contractors were less likely to perform tests including building ventilation calculations, duct leakage tests, and duct pressurization tests. Large contractors were also less likely to conduct duct leakage and duct pressurization tests, and measure water flows. Ensuring the HVAC system has the proper refrigerant charge is always done according to the responses of a large portion of both small and large contractors alike.

Table 31. Rating of Frequency of Performing Various Tests During Installation/Servicing of Equipment

Scale of 1 to 5, where 1 = usually not done, and 5 = always done. Note that large contractors exceed 80/20 confidence/precision while small contractors exceed 80/15.

Source: HVAC Contractor Surveys, (Vars: Type, D2_A through D2_H, and D3_A through D3_D)

Test or Procedure	Large Contractors Average Rating of Frequency Performed (n=13)	Small Contractors Average Rating of Frequency Performed (n=21)
Conduct building ventilation calculations	4.15	2.22
Conduct heat loss and heat gain load calculations	4.14	4.13
Ensure equipment is properly sized and selected prior to installation	4.79	4.71
Confirm heating and cooling equipment are properly matched systems using industry-recognized product certification databases such as AHRI, CEE, or OEM performance data	4.62	4.17
Verify the airflow through the indoor blower unit (e.g., furnaces, fan coil, air handler) is within acceptable CFM ranges	4.31	4.37
Verify the water flow through indoor heat exchangers are within acceptable ranges (refers to boilers)	4.00	4.09
Ensure the HVAC system has the proper refrigerant charge	5.00	4.79
Conduct duct leakage tests	2.77	2.84
Conduct duct pressurization tests	2.15	1.89
Measure airflows	4.08	3.42
Measure water flows	2.86	3.13

2.6 Impacts of Efficiency Programs and Standards

2.6.1 Familiarity and Use of Energy Efficiency Programs in New York State

Less than 10 percent of the large HVAC contractors are not at all familiar with energy efficiency programs in New York State. The majority (93 percent) of large contractors indicated they were somewhat familiar or very familiar with energy efficiency programs in New York State. Slightly more than one-third of the small contractors are not at all familiar with the programs (Table 32).

Table 32. Familiarity with Energy Efficiency Programs in New York State

Note that large contractors exceed 80/20 confidence/precision while small contractors exceed 80/15.

Source: HVAC Contractor Surveys, (Vars: Type, PA1)

Data Source	Not at All Familiar	Somewhat Familiar	Very Familiar
Large Contractors (n=15)	7%	73%	20%
Small Contractors (n=24)	37.5%	37.5%	25%

The programs most often mentioned by large contractors were most often named only by utility or implementer, such as National Grid or NYSERDA programs. A few large contractors were able to recall full program names, such as NYSERDA's Multifamily or High Efficiency Heating programs. Among large contractors who sell equipment through an energy efficiency program, the average percent of equipment that large contractors sold or rebated through the programs was 63 percent.

Two-thirds of small contractors who confirmed some familiarity with energy efficient programs in New York State most often mentioned NYSERDA programs. Other utilities/implementers named were National Grid, NYSEG, and Con Ed. Small contractors reported actual program names with far lower frequency than large contractors. The average percent of equipment sold or rebated through the programs, according to small contractors who sold equipment through these programs was 55 percent.

2.6.2 Standards and Other Factors Influencing High Efficiency Equipment Sales

General awareness of federal standards for energy efficiency equipment was low among surveyed HVAC contractors. Most of the large and small contractors said they were not aware of new federal standards that may affect the manufacturing of energy efficient non-electric heating and water heating equipment in New York State. Among the six large and five small contractors (40 percent and 19 percent, respectively) who were aware of new State standards, comments varied widely about which manufacturing standards would change, and what the contractors understood to be the impacts of these changes. Two specifically mentioned that they understood furnaces at an 80 percent efficiency level would soon be phased out.

Nineteen of the 31 contractors were not aware of new federal standards that may affect the manufacturing of energy efficient non-electric heating and water heating equipment in New York State. The same contractors were also not aware that new federal standards for water heaters would be going into effect within the next year. It is likely that the distributors and manufacturers are aware of the standards since much of the equipment installed in 2013 already meets those standards.

The majority of large contractors and small contractors expect the proportion of sales of high efficiency equipment to increase in the next two years for all equipment types. Interestingly, the percentage of small contractors expecting the portion of energy efficient equipment to increase was much lower for furnaces, boilers, and water heating equipment. For equipment such as natural gas furnaces, small contractors report higher numbers for high efficiency equipment installations already, which may be one explanation for them not expecting an increase in high efficiency equipment in the next two years (Table 33).

Table 33. HVAC Contractors that Expect the Portion of Energy Efficient Equipment to Increase

Source: HVAC Contractors Survey SF4

	Furnaces (n=34)	Boilers (n=43)	Central ACs (n=38)	Water Heaters (n=42)
Large Contractor	86%	69%	53%	75%
Small Contractor	65%	52%	57%	50%

The reasons mentioned most often by the two groups of contractors are provided in Table 34. The reason given most often by the HVAC contractors was that customers will demand higher efficiency, followed by utility or State rebates and incentives. Federal standards were not considered a major factor for the increase by the HVAC contractors themselves.

Table 34. Reasons Given Most Often for Greater Portion of Energy Efficiency Sales in the Future

Source: HVAC Contractors Survey SF4.

	Furnaces (n=29)	Central Air Conditioners (n=28)	Boilers (n=30)	Water Heaters (n=25)
Customers will demand higher efficiency	19	12	16	16
Utility or state rebates and incentives	10	5	11	7
Equipment Costs will come down for EE Equipment	4	1	4	2
HVAC businesses will be better informed or educated on high efficiency	4	4	4	4
Improved or new tech available	4	4	6	5
New federal standards for minimum efficiency of manufactured units	3	3	1	2
Federal tax credits	2	0	2	0

Appendix A: Detailed Methodology

A.1 Objective

The HVAC Market Assessment is a key component of the statewide residential baseline study. The purpose of the HVAC Market Assessment is to identify the baseline conditions for residential non-electric heating and water heating equipment, central air conditioning, and heat pumps in New York State. The market assessment describes where the market is now (based on equipment sold or installed in 2012 and later) and what percent of the equipment currently being sold is high efficiency. This information was used to establish more accurate baselines for calculating program energy savings and to support program planning in New York State.

Data to support the market assessment were collected in Web or telephone surveys, on-site inspections, contractor interviews, and distributor sales reports to determine the baseline efficiency of specific types of residential heating and cooling equipment installed in New York. Market channels and specification practices for these technologies were also characterized. This investigation looked at the market differences throughout the State. When a sufficient number of data points are available, the data are presented for the three climate zones.

The study focused on units installed in single-family homes and in multifamily buildings with 1 to 4 units, or in townhouse type configurations where individual units have their own heating systems. Multifamily units with five or more units typically have central systems served by the commercial equipment contractors, and were not part of this assessment. The purposes of the HVAC contractor interviews were to determine the efficiency level of equipment currently being installed and gauge common practices in the HVAC installer and service market. Additionally, the interviews examined levels of awareness with respect to problems resulting from over sizing, leaky ducts, air distribution system design, and charging deficiencies. Elements of common practice explored included, but were not limited to:

- Practice, techniques, and experiences with sizing new systems and retrofit systems.
- Designing, installing, replacing, and fixing air distribution systems.
- Recommending and specifying system efficiencies.
- Diagnosing techniques for ensuring adequate system refrigerant charging.

Data were provided to NYSERDA from D&R International through an agreement with Heating Air-conditioning & Refrigeration Distributors International (HARDI). D&R provided estimates of annual sales data for 2013 for central air conditioners, central heat pumps, furnaces, and boilers. The HARDI data was used to estimate the percentage sales by efficiency level for those equipment types. In addition, 2009 U.S. Census data and telephone and Web surveys reporting type and age of equipment were used to confirm the annual HARDI sales data reported by D&R. Further, equipment type and efficiency levels of equipment reported from the on-site inspection data for new single-family homes and new equipment (2012 and later) were also used as a comparison to HVAC contractor survey reports and HARDI data.

The approach included a combination of cold calling by a Tetra Tech scheduler and emailing, when email addresses were available. The calling began May 5, 2014, by one of Tetra Tech's senior interviewers. Due to the low response rate after one month of calling, Tetra Tech revised the letter requesting participation. NYSERDA mailed these letters in early June 2014. A few additional HVAC Contractor Surveys were completed that seemed to be helped by the mailing. Due to very low response rates, calling was suspended as of July 14, 2014, for the summer season, when the HVAC contractors were very busy and non-responsive. On September 8, 2014, calling resumed for HVAC contractor interviews with a team of consultants and experienced interviewers, a streamlined survey instrument, additional sample, and a more compelling script for the letter and email introduction. The HVAC contractor calling continued through September 25, 2014.

The decision was made to not include a financial incentive (e.g., a gift card) to the HVAC contractors for completing the survey. They were offered an aggregate summary of the key results of the HVAC Contractor Surveys as a non-financial incentive.

A.2 Sampling Strategy

The source of the HVAC contractor population and sample for telephone surveys were identified through <http://companies.findthebest.com/>. Using <http://companies.findthebest.com/>, the evaluation team was able to identify more than 18,000 contractors within New York State who fit into the target group for the HVAC market assessment. In addition, the database included, and could be sorted by, the number of employees and annual sales volume. Tetra Tech reviewed other HVAC contractor list sources, but a number of these other sources were not comprehensive. For example, some limited their lists to those HVAC businesses with NATE (North American Technician Excellence) certification. The <http://www.yellowpages.com/> was also fairly comprehensive but did not include data to indicate company size.

The initial sample was drawn from <http://companies.findthebest.com/> database from each of the three climate zones. Slightly more than 90 percent of the population of HVAC contractors listed in the database are considered small businesses with 0–10 employees.

The sampling strategy established targets of 20 (10 small and 10 large) for each climate zone with at least one large contractor and one small contractor in each of the 10 regions to ensure statewide representation. If there were multiple climate zones in a region, the targets included at least one from each climate zone in the region. The targets were somewhat proportional to the population of residential homes, which should be somewhat representative of the equipment sold in that county or region. The sampling was adjusted for locations such as North Country where there are few, if any, large HVAC businesses.

The HVAC contractor sample lists were developed manually by pulling up individual counties in the <http://companies.findthebest.com/> database because the system did not allow for a download of a list of contractors. Counties with the largest populations of residential households were drawn first to provide the largest number of HVAC contractor sample. The final number of contractors are shown in Table A-1.

Table A-1. Population of HVAC Contractors in New York State

Source: companies.findthebest.com/ Construction: Specialty Trade Contractors > Building Equipment Contractors > Plumbing, Heating, and Air-Conditioning Contractors

Climate Zone	Population of NYS HVAC Contractors		HVAC Contractor Survey Responses	
	Large Contractors (more than 10 employees)	Small Contractors (0–10 employees)	Large Contractors	Small Contractors
Climate zone 4	1,338	13,160	8	8
Climate zone 5	302	2,802	9	5
Climate zone 6	46	582	1	15
Total	1,686	16,544	18	28

Although <http://companies.findthebest.com/> was deemed the most comprehensive data set, there were still a high number of ineligible in the sample drawn from that database. Ineligible businesses included: (a) sold commercial equipment only, (b) did not sell any of the equipment in the HVAC assessment, (c) out of business or retired, or (d) deceased. Over 20 percent of the large contractors were ineligible for the study as shown in Table A-2.

Table A-2. Total Sample Count and Ineligible Subset Count by Climate Zone

Type	Climate Zone 4			Climate Zone 5			Climate Zone 6			Overall Statewide		
	Sample Count	Ineligible Count	Ineligible Percent	Sample Count	Ineligible Count	Ineligible Percent	Sample Count	Ineligible Count	Ineligible Percent	Sample Count	Ineligible Count	Ineligible Percent
Large	300	64	21%	89	21	24%	83	22	27%	472	107	23%
Small	186	16	9%	133	12	9%	111	15	14%	430	43	10%
Total	486	80	16%	222	33	15%	194	37	19%	902	150	17%

A.3 Response Rates

After one month of calling, Tetra Tech's senior interviewer had completed eight interviews with three more interviews that still needed the HVAC contractor to send in the equipment sales and efficiency data. To calculate a very rough response rate in early July, the response rate was about three percent (17 completes/640 sample).

As of July 9, 18 full completes and nine partial completes (needing sales and efficiency data tables) were done with 284 hours, so over 10 hours of interviewer time per complete. The total hours including recruiting were over 400 for this task.

As of July 14, 2014, the HVAC contractor calling was suspended until September 8, 2014, because the summer cooling season was at its peak and the response rates were minimal.

The response rates continued to be very low through the survey as shown in this summary that reported on one of the last months of calling, which was September 2014. Tetra Tech was using experienced consultants and interviewers to do the calling with the following results:

- Made over 1,000 unique calls in September.
- Completed 19 total interviews, and collected another three partial interviews.
- Partial completes typically are missing sales data, which was especially difficult for small business owners to produce.

Table A-3 highlights the difficulty of contacting and completing calls with this particular population when calling resumed in September.

Table A-3. HVAC Contractor Calling September 2014 Response Rates

	Climate Zone 4 – Large & Small Contractors	Climate Zone 5 – Large & Small Contractors	Climate Zone 6 – Large & Small Contractors	Overall Statewide
Number of cases attempted	367	124	121	612
New cases not attempted	33	0	0	33
Number of calls made	469	201	402	1,072
Number of emails/faxes sent	13	50	30	93
Cases finalized	244	6	28	278
Completed interviews	11	4	4	19
Completed Interview - partial	0	1	2	3
Hours used	46	24	56	126
Response rate	3.0%	4.0%	5.0%	3.6%

The overall barriers to completing HVAC Contractor Surveys were identified by the interviewers:

- Contractors *very rarely* returned any voicemails or emails.
- Contractors in general are active, in the field, and focused on customer service. It is difficult to get their attention or time.
- Interviewers were at the mercy of weather or other active times that created windows of contractor unavailability (due to customer call volume or field work).

The specific barriers for small HVAC contractor firm included:

- The owner is often the **only** person with key data. These owners are often (a) extremely busy, and (b) in the field all day.
- Small HVAC contractors are difficult to reach and their cell number was not available in the sample file. This presented challenges in reaching key contacts during the day. Getting cell numbers of contractors from answering machines or services occasionally yielded a completed survey after additional dials.
- Small businesses within the sample files frequently use answering services. Messages left with these services or contacts were not returned.

The specific barriers for large HVAC contractor firms included:

- Key interviewees at large HVAC companies are often difficult to reach because he or she is not the individual answering the phone; calls are often fielded by a receptionist. The interviewer often did not get to have that initial conversation with a large HVAC contractor in question. Messages are rarely returned.
- Companies that appear to be “large” (more than 10 employees) in the sample file (from FindtheBest) were not large contractors. They did not have enough employees to qualify as a completed “large” interview (that problem was especially apparent in climate zone 6).
- Large companies in the sample file were often commercial-only businesses, and not ultimately eligible for this study. Again, this barrier was especially apparent in climate zone 6.

A.4 Weighting

The Tetra Tech evaluation team attempted to weight the responses by using the size of the HVAC contractor (one to 10 employees for small and over 10 employees for large contractors) and the number of each of those businesses in each county. When the weights were applied to the annual sales reported by the HVAC contractors and rolled up, the total sales appeared to be two to four times what was being reported for 2013 HARDI annual sales by D&R International. The conclusion was that the HVAC contractors likely over-reported their annual sales since the HARDI data was confirmed as reasonable by other sources. For that reason, the decision was made to simply report unweighted responses by the two types of businesses—large and small contractors.

A.5 Data Limitations and Suggestions for Future Studies

The following were elements of the methodology that worked well for the HVAC Market Assessment:

- The FindtheBest database was effective in identifying the complete population of HVAC contractors throughout New York State. The database allowed for stratifying by large contractors and small contractors. In addition, the population could be summarized by county and subsequently by climate zone.
- The approach of using triangulation of various data sources—HVAC Contractor Surveys, HARDI data, and on-site inspection data collection at single-family homes—was effective in confirming data and identifying questionable results.

Some of the data limitations and suggested changes for future studies are as follows:

- More resources should be devoted to developing sample lists from FindtheBest including pre-screening to ensure size of business and eligibility.
- Emails and mailings should be sent out, preferably from NYSERDA, to introduce HVAC contractors to the study and engage their cooperation. A possible value proposition may be complimentary passes to training sessions.
- The annual sales data may have been overstated by individual HVAC contractors. Future studies should continue to include HARDI data for annual sales and possibly for efficiency levels. Water heaters should be added if possible.
- The survey covered many different topics and was at least a half hour or longer, depending on the number of equipment types, out of the busy day for an HVAC contractor. A separate survey should be conducted to gather just the information on sales and efficiency levels of installed equipment in the future, especially as new equipment standards are announced and implemented. In addition, repeating that portion of the survey and a few other questions would allow NYSERDA to track market effects from market transformation activities.

Appendix B: HVAC Contractors Instrument

NYSERDA RESIDENTIAL BASELINE STUDY – HVAC CONTRACTOR SURVEY CODEBOOK

NOTE:

- Variable names are in bold type.
- A code of (-1) means that the data was not gathered for a particular question in the July fielding period because the question had been updated.
- A code of (-2) means that the data was not gathered for a particular question in the September fielding period because the question had been updated.
- A code of (-6) means programmed skip or an expected missing (i.e., a skip that was purposely programmed based, or the respondent was not expected to answer a question based on previous survey data responses.
- A code of (-8) means don't know.
- A code of (-9) means refused or missing.
- Questions were asked of all respondents unless indicated otherwise.

CONTRACTOR	Contractor company name
CITY	Contractor location – city (in the State of New York)
TYPE	Small (<=10 employees) or large (>10 employees)
COUNTY	County where the HVAC contractor is located
CLIMATE ZONE	Climate zone where the HVAC contractor is located
CASEID	Unique case identifier

TELEPHONE INTRODUCTION

INTRO Hello, my name is [NAME] and I'm calling on behalf of NYSERDA. We are conducting a study about the residential HVAC market. In particular, we are interested in natural gas and oil-fired heating equipment and water heaters, central air conditioning and heat pumps sold and installed in the state of New York.

I1 Are you the person most familiar with your company's heating and cooling equipment sales, installation, servicing and maintenance practices in the state of New York?

- 1 Yes *[SKIP TO C1]*
- 2 No
- 8 Don't know

I2 Is there another contact we should speak to who may be familiar with the company's heating and cooling equipment sales, products and services?

- 1 Yes *[GET CONTACT NAME AND BEGIN INTERVIEW AGAIN]*
- 2 No *[TERMINATE]*
- 8 Don't know *[TERMINATE]*

INTRO_1 I'm with Tetra Tech, an independent research firm. This is not a sales call; we are contacting HVAC professionals on behalf of the New York State Energy Research and Development Authority (NYSERDA) in order to learn more about the residential HVAC market in the state of New York. The information will be used to develop programs in New York State to promote the sale and installation of efficient HVAC equipment. Do you sell or install heating and cooling equipment for residential homes in New York State?

[IF NOT, TERMINATE THE SURVEY AND RECORD DISPOSITION. OTHERWISE, CONTINUE]

While we are on the phone, may I email or fax you a letter now from NYSERDA explaining the study and listing the categories of equipment that we will ask about. (Ask for email and/or fax)

[IF THEY PREFER TO COMPLETE THE ENTIRE SURVEY ON THEIR OWN, ASK]:

We can also email or fax you the full survey, and we would like to follow-up with you within the next 10 days to see if you have been able to complete the survey or have any questions. When is the best day and time to reach you?

Please be assured that the information you provide will be kept confidential to the extent permitted by law. NYSERDA's analysis will only use summary level data and will not identify individual respondents or firms. Your participation in this study is very important to ensure any new energy efficiency programs will help you provide the most value in serving your customers.

Would it be okay if I recorded our conversation to make sure that I'm capturing all the necessary information?

[*READ IF NEEDED*: If you would like to talk with a representative of NYSERDA to verify this study, please call 1-877-NYSMART (1-877-697-6278), or email at info@nyserdera.ny.gov, or visit the web-site at <http://www.nyserdera.ny.gov/energystudyinfo>.]

HVAC CONTRACTOR COMPANY INFORMATION

We will be asking questions about your company's sales and installation of central air conditioning, non-electric heating equipment such as natural gas and oil-fired furnaces, boilers, and water heaters.

C1 Does your company sell, install, or service air conditioners, heat pumps, furnaces, boilers, or water heaters for single-family residential customers in the state of New York? By single-family residential, I mean residential dwellings that include 1 to 4 living units in the building.

- 1 Yes
- 2 No [*THANK AND TERMINATE*]

C2a PHASE ONE (July) QUESTION ONLY: What types of equipment do you sell for single-family (1 to 4 unit) homes? [*READ CATEGORIES; SELECT ALL THAT APPLY*]

For C2a_1 through C2a_9

- 0 Does not sell equipment type
- 1 Does sell equipment type
- 2 Question not asked during September fielding

- C2a_1** Residential furnaces
- C2a_2** Residential boilers
- C2a_3** Storage tank water heaters
- C2a_4** Tankless water heaters
- C2a_5** Central air conditioners
- C2a_6** Heat pumps
- C2a_7** Wi-Fi Communicating Thermostats
- C2a_8** Boiler Reset Controls
- C2a_9** None

C2b What types of equipment do you sell and install in single-family (1 to 4 unit) homes? I'll read a list of equipment and please indicate whether or not you install each type.

[READ CATEGORIES; SELECT ALL THAT APPLY]

For C2b_1 through C2b_9

- 0 Does not sell and install equipment type
- 1 Does sell and install equipment type

- C2b_1** Residential furnaces
- C2b_2** Residential boilers
- C2b_3** Storage tank water heaters
- C2b_4** Tankless water heaters
- C2b_5** Central air conditioners
- C2b_6** Heat pumps
- C2b_7** Wi-Fi Communicating Thermostats
- C2b_8** Boiler Reset Controls
- C2b_9** None

C2c PHASE ONE (July) QUESTION ONLY: What types of equipment do you repair or maintain in single-family (1 to 4 unit) homes? [READ CATEGORIES; SELECT ALL THAT APPLY]

For C2c_1 through C2c_7

- 0 Does not repair equipment type
- 1 Does repair equipment type
- 2 Question not asked during September fielding

C2c_1 Residential furnaces

C2c_2 Residential boilers

C2c_3 Storage tank water heaters

C2c_4 Tankless water heaters

C2c_5 Central air conditioners

C2c_6 Heat pumps

C2c_7 Wi-Fi Communicating Thermostats

C3 PHASE ONE QUESTION ONLY: Approximately what percent of your residential business (in terms of % of jobs) is? (PROBE: All three categories should add up to 100%)

C3_1 % residential, single-family homes defined as 1- to 4-family buildings, including free-standing homes and townhouses [IF ZERO, THANK AND TERMINATE]

C3_2 % multifamily low-rise buildings with 5 or more units in 3 stories or less

C3_3 % multifamily high rise buildings with more than 4 stories and 5 or more units

C4 Approximately how long has your company been providing HVAC services to customers located in the State of New York?

C4_1 Months

C4_2 Years

C4_3 Other response

C5 In what New York State Counties are your residential single-family home customers located?

[DO NOT READ LIST; SELECT ALL THAT APPLY]

For C5_1 through C5_OTHER

____ Name of county
0 No more counties mentioned

C5_1 First County Mentioned by Respondent

C5_2 Second County Mentioned by Respondent

C5_3 Third County Mentioned by Respondent

C5_4 Fourth County Mentioned by Respondent

C5_5 Fifth County Mentioned by

C5_OTHER Other County Mentioned by Respondent *[SPECIFY]*

FIPS Code	County	FIPS Code	County	FIPS Code	County	FIPS Code	County
<u>001</u>	<u>Albany County</u>	<u>033</u>	<u>Franklin County</u>	<u>065</u>	<u>Oneida County</u>	<u>097</u>	<u>Schuyler County</u>
<u>003</u>	<u>Allegany County</u>	<u>035</u>	<u>Fulton County</u>	<u>067</u>	<u>Onondaga County</u>	<u>099</u>	<u>Seneca County</u>
<u>005</u>	<u>Bronx County</u>	<u>037</u>	<u>Genesee County</u>	<u>069</u>	<u>Ontario County</u>	<u>089</u>	<u>St. Lawrence County</u>
<u>007</u>	<u>Broome County</u>	<u>039</u>	<u>Greene County</u>	<u>071</u>	<u>Orange County</u>	<u>101</u>	<u>Steuben County</u>
<u>009</u>	<u>Cattaraugus County</u>	<u>041</u>	<u>Hamilton County</u>	<u>073</u>	<u>Orleans County</u>	<u>103</u>	<u>Suffolk County</u>
<u>011</u>	<u>Cayuga County</u>	<u>043</u>	<u>Herkimer County</u>	<u>075</u>	<u>Oswego County</u>	<u>105</u>	<u>Sullivan County</u>
<u>013</u>	<u>Chautauqua County</u>	<u>045</u>	<u>Jefferson County</u>	<u>077</u>	<u>Otsego County</u>	<u>107</u>	<u>Tioga County</u>
<u>015</u>	<u>Chemung County</u>	<u>047</u>	<u>Kings County</u>	<u>079</u>	<u>Putnam County</u>	<u>109</u>	<u>Tompkins County</u>
<u>017</u>	<u>Chenango County</u>	<u>049</u>	<u>Lewis County</u>	<u>081</u>	<u>Queens County</u>	<u>111</u>	<u>Ulster County</u>
<u>019</u>	<u>Clinton County</u>	<u>051</u>	<u>Livingston County</u>	<u>083</u>	<u>Rensselaer County</u>	<u>113</u>	<u>Warren County</u>
<u>021</u>	<u>Columbia County</u>	<u>053</u>	<u>Madison County</u>	<u>085</u>	<u>Richmond County</u>	<u>115</u>	<u>Washington County</u>
<u>023</u>	<u>Cortland County</u>	<u>055</u>	<u>Monroe County</u>	<u>087</u>	<u>Rockland County</u>	<u>117</u>	<u>Wayne County</u>
<u>025</u>	<u>Delaware County</u>	<u>057</u>	<u>Montgomery County</u>	<u>091</u>	<u>Saratoga County</u>	<u>119</u>	<u>Westchester County</u>
<u>027</u>	<u>Dutchess County</u>	<u>059</u>	<u>Nassau County</u>	<u>093</u>	<u>Schenectady County</u>	<u>121</u>	<u>Wyoming County</u>
<u>029</u>	<u>Erie County</u>	<u>061</u>	<u>New York County</u>	<u>095</u>	<u>Schoharie County</u>	<u>123</u>	<u>Yates County</u>
<u>031</u>	<u>Essex County</u>	<u>063</u>	<u>Niagara County</u>				

SALES AND INSTALLATION OF EQUIPMENT BY EFFICIENCY LEVELS

AW How familiar are you with the Consortium for Energy Efficiency (CEE) and ENERGY STAR Tiered efficiency levels? These are generally categorized into two or three Tiers of efficiency levels. NYSERDA and many of the electric and natural gas utilities in New York State used these Tiers to establish rebate levels. Would you say you are very familiar, somewhat familiar, not too familiar or not at all familiar with these Tiered efficiency levels?

- 1 Very familiar
- 2 Somewhat familiar
- 3 Not too familiar
- 4 Not at all familiar
- 8 Don't know
- 9 Missing

SF1 I will be asking about your company's sales and installation of residential heating and cooling equipment that you indicated you sell and install in New York State. For each residential equipment type, we would like:

The total amount of the **residential units** you sold in 2013 by equipment category? *[RECORD IN TABLE BELOW]*

The percent or number sold and installed in 2013 at the different efficiency levels? *[RECORD IN TABLE BELOW]*

For **SF1_1_Total through SF1_2_T1** -- (Equip type: furnaces)

- _____ Number of units
- 6 Expected missing
- 9 Missing

SB1_1_Total through SB1_2_T1 – Equip type: boilers

SW1_1_Total through SW1_4_T1 – Equip type: water heaters

AC1_1_Total through AC1_2_T2 – Equip type: central air conditioners

HP1_1_Total through HP1_3_T2 – Equip type: heat pumps.

SF2 The efficiency level that you most recommend to your customers? *[RECORD IN TABLE BELOW]*

SF5 About how many of each type of equipment have you **serviced** in the past 12 months in New York State?

RESIDENTIAL NATURAL GAS AND OIL-FIRED FURNACES AND BOILERS

Equipment Type	Total Units Sold in 2013	Not High Efficiency	Qualify for Tier 1	Qualify for Tier 2	Qualify for Tier 3	Which of these three efficiency levels do you typically recommend to your customers to purchase? (CHECK ONE)	About how many residential units have you serviced in the past 12 months in New York State? (CHECK ONE)
Residential Gas Furnaces (<225,000 Btu/h)	#	#	#	#	#	Res. Gas Furnaces:	Res. Gas Furnaces:
	SF1_1_Total	Less than 90% AFUE SF1_1_stan	Greater than 90% AFUE but less than 92% SF1_1_T1	Greater than 92% AFUE but less than 94% SF1_1_T2	94% AFUE and above SF1_1_T3	<ul style="list-style-type: none"> Standard Eff: (Less than 90% AFUE) Tier 1: (90%<92%) Tier 2: (92%<94%) Tier 3 (94% and above) <p>SF2: Phase one (July); asked about residential furnaces <i>overall</i> only.</p> <p>SF2_1_REC: Phase two (Sept); asked about residential gas and oil furnaces separately</p>	0 None 1 Less than 5 2 5 to 20 3 21 to 50 4 51 to 100 5 More than 100 -1 Question not asked during July fielding -2 Question not asked during Sept fielding -6 Expected missing -8 Don't know -9 Missing <p>SF5: Phase one (July); asked about residential furnaces overall only</p> <p>SF5_1: Phase two (Sept); asked about residential gas and oil furnaces separately</p>
Residential Oil-fired Furnaces (<225,000 Btu/h)	#	#	#	NA	NA	Res. Oil-fired Furnaces:	Res. Oil-fired Furnaces:
	SF1_2_Total	Less than 85% AFUE SF1_2_stan	85% AFUE and above SF1_2_T1			<ul style="list-style-type: none"> Standard Eff: (Less than 85% AFUE) Tier 1: (85% and above) <p>SF2_2_REC</p>	0 None 1 Less than 5 2 5 to 20 3 21 to 50 4 51 to 100 5 More than 100 -1 Question not asked during July fielding -9 Missing <p>SF5_2</p>

RESIDENTIAL BOILERS

Residential Gas Boilers (<300,000 Btu/h)	#	#	#	#	#	Res. Gas Boilers:	Res. Gas Boilers:
	SB1_1_Total	Less than 85% AFUE SB1_1_stan	Greater than 85% AFUE but less than 90% AFUE SB1_1_T1	90% AFUE and Above SB1_1_T2	94% AFUE and above SB1_1_T3	<ul style="list-style-type: none"> Standard Eff: (Less than 85% AFUE) Tier 1: (86%<90%) Tier 2: (90%<93%) Tier 3: (94%+) <p>SB2: Phase one (July); asked about residential boilers overall only.</p> <p>SB2_1_REC: Phase two (Sept); asked about residential gas and oil boilers separately.</p>	0 None 1 Less than 5 2 5 to 20 3 21 to 50 4 51 to 100 5 More than 100 -1 Question not asked during July fielding -2 Question not asked during Sept fielding -8 Don't know -9 Missing <p>SB5: Phase one (July); asked about residential boilers overall only.</p> <p>SB5_1: Phase two (Sept); asked about residential gas and oil boilers separately, by type.</p>
Residential Oil Boilers (<225,000 Btu/h)	#	#	#	NA	NA	Res. Oil-fired Boilers:	Res. Oil-fired Boilers:
	SB1_1_Total	Less than 85% AFUE SB1_2_stan	85% AFUE and above SB1_2_T1			<ul style="list-style-type: none"> Standard Eff: (Less than 85% AFUE) Tier 1: (85%+) <p>SB2_2_REC</p>	0 None 1 Less than 5 2 5 to 20 3 21 to 50 4 51 to 100 5 More than 100 -1 Question not asked during July fielding -2 Question not asked during Sept fielding -8 Don't know -9 Missing <p>SB5_2</p>

RESIDENTIAL WATER HEATERS (WH)

Equipment Type	Total Units Sold in 2013	Not High Efficiency	Qualify for Tier 1	Qualify for Tier 2	Qualify for Tier 3	Which of these three efficiency levels do you typically recommend to your customers to purchase? (CHECK ONE)	About how many residential units have you serviced in the past 12 months in New York State? (CHECK ONE)
Residential Gas Water Heaters-- Storage	#	#	#	#	NA	Res. Gas Water Heater Storage:	Res. Gas Water Heater Storage:
	SW1_1_Total	Less than .67 EF SW1_1_stan	Greater than .67 EF but less than .80 EF SW1_1_T1	.80 EF and above SW1_1_T2		<ul style="list-style-type: none"> Standard Eff: (Less than .67 EF) Tier 1: (.68-.79 EF) Tier 2: (.80 EF and above) <p>SW2: Phase one (July); asked about residential water heaters overall only.</p> <p>SW2_1_REC: Phase two (Sept); asked about each residential water heater type separately.</p>	0 None 1 Less than 5 2 5 to 20 3 21 to 50 4 51 to 100 5 More than 100 -1 Question not asked during July fielding -2 Question not asked during Sept fielding -8 Don't know -9 Missing <p>SW5: Phase one (July); asked about residential water heaters overall only.</p> <p>SW5_1: Phase two (Sept); asked about residential water heaters separately, by type.</p>
Residential Oil Water Heaters-- Storage	#	#	#	NA	NA	Res. Oil Water Heater Storage	Res. Oil Water Heater Storage

RESIDENTIAL WATER HEATERS (WH) -- Continued

8.5		Less than .59 EF SW1_2_stan	.59 EF and above SW1_2_T1			<ul style="list-style-type: none"> Standard Eff: (Less than .59 EF) Tier 1: (.59 EF and above) SW2_2_REC	0 None 1 Less than 5 2 5 to 20 3 21 to 50 4 51 to 100 5 More than 100 -1 Question not asked during July fielding -8 Don't know -9 Missing SW5_2
Residential Gas Water Heaters-- Tankless (Instantaneous)	#	#	#	NA	NA	Res. Gas Water Heater Tankless:	Res. Gas Water Heater Tankless:
	SW1_3_Total	Less than .82 EF SW1_3_stan	.82 EF and above SW1_3_T1			<ul style="list-style-type: none"> Standard Eff: (Less than .82 EF) Tier 1: (.82 EF and above) SW2_3_REC	0 None 1 Less than 5 2 5 to 20 3 21 to 50 4 51 to 100 5 More than 100 -1 Question not asked during July fielding -8 Don't know -9 Missing SW5_3
Residential Gas Water Heaters-- Condensing	#	#	#	NA	NA	Res. Gas Water Heater Condensing:	Res. Gas Water Heater Condensing:
	SW1_4_Total	Less than .80 EF SW1_4_stan	.80 EF and above SW1_4_T1			<ul style="list-style-type: none"> Standard Eff: (Less than .80 EF) Tier 1: (.80 EF and above) SW2_4_REC	0 None 1 Less than 5 2 5 to 20 3 21 to 50 4 51 to 100 5 More than 100 -1 Question not asked during July fielding -8 Don't know -9 Missing SW5_4

RESIDENTIAL CENTRAL AIR CONDITIONERS (AC)

Equipment Type	Total Units Sold in 2013	Not High Efficiency	Qualify for Tier 1	Qualify for Tier 2	Qualify for Tier 3	Which of these three efficiency levels do you typically recommend to your customers to purchase? (CHECK ONE)	About how many residential units have you serviced in the past 12 months in New York State? (CHECK ONE)
Central Air Conditioners— Split Systems	#	#	#	#	#	Central AC Split Systems:	Central AC Split Systems:
	AC1_1_Total	Less than 14.5 SEER or Less than 12 EER AC1_1_stan	14.5 SEER but less than 15 SEER or 12 EER but less than 12.5 EER AC1_1_T1	15 SEER but less than 16 SEER or 12.5 EER but less than 13 EER AC1_1_T2	16 SEER and Above or 13 EER and Above AC1_1_T3	<ul style="list-style-type: none"> Standard Eff: (Less than 14.5 SEER/12 EER) Tier 1: (14.5-14.9 SEER/12-12.4 EER) Tier 2: 15.0-15.9 SEER/12.5-12.9) Tier 3: (16 SEER/13 EER+) <p>AC2: Phase one (July); asked about residential central air systems <i>overall</i>.</p> <p>AC2_1_REC: Phase two (Sept); asked about each residential central air units <i>separately</i> by type.</p>	<p>0 None</p> <p>1 Less than 5</p> <p>2 5 to 20</p> <p>3 21 to 50</p> <p>4 51 to 100</p> <p>5 More than 100</p> <p>-1 Question not asked during July fielding</p> <p>-2 Question not asked during Sept fielding</p> <p>-9 Missing</p> <p>AC5: Phase one (July); asked about residential central air units <i>overall</i> only.</p> <p>AC5_1: Phase two (Sept); asked about residential central air units <i>separately</i> by type.</p>
Central Air Conditioners-- Packaged	#	#	#	#	NA	Central AC Packaged Systems:	Central AC Packaged Systems:

RESIDENTIAL CENTRIAL AIR CONDITIONERS (AC) continued

	AC1_2_Total	Less than 14 SEER or Less than 11 EER AC1_2_stan	14 SEER or 11 EER but less than 12 AC1_2_T1	14 SEER and above or 12 EER and above AC1_2_T2		<ul style="list-style-type: none"> • Standard Eff: (Less than 14 SEER/11 EER) • Tier 1: (14 SEER/11 EER) • Tier 2: (Above 14 SEER/ Above 12 EER) AC2_2_REC	0 None 1 Less than 5 2 5 to 20 3 21 to 50 4 51 to 100 5 More than 100 -1 Question not asked during July fielding -9 Missing AC5_2
--	--------------------	--	---	--	--	--	--

AIR SOURCE HEAT PUMPS (HP)

Equipment Type	Total Units Sold in 2013	Not High Efficiency	Qualify for Tier 1	Qualify for Tier 2	Qualify for Tier 3	Which of these three efficiency levels do you typically recommend to your customers to purchase? (CHECK ONE)	About how many residential units have you serviced in the past 12 months in New York State? (CHECK ONE)
Heat Pumps— Split Systems	#	#	#	#	NA	Heat Pumps Split Systems:	Heat Pumps Split Systems:
	HP1_1_Total	Less than 14.5 SEER or Less than 12 EER or Less than 8.2 HSPF HP1_1_stan	14.5 SEER to less than 15 SEER or 12 EER to less than 12.5 EER or 8.2 HSPF to less than 8.5 HSPF HP1_1_T1	15 SEER or 12.5 EER or 8.5 HSPF HP1_1_T2		<ul style="list-style-type: none"> Standard Eff: (Less than 14.5 SEER/12) EER Tier 1: (14.5-14.9 SEER/12-12.4 EER) Tier 2: 15.0 SEER/12.5 EER and Above <p>HP2: SPECIAL NOTE: Phase one (July) did NOT record recommended efficiency levels overall for Heat Pumps.</p> <p>HP2_1_REC: Phase two (Sept); asked about each residential heat pumps <i>separately</i> by type</p>	0 None 1 Less than 5 2 5 – 20 3 21 – 50 4 51 – 100 5 More than 100 -8 DON'T KNOW <p>HP5: SPECIAL NOTE: Phase one (July); asked about residential heat pump servicing <i>overall</i>.</p> <p>HP5_1: Phase two (Sept); asked about residential heat pumps separately by type.</p>
Heat Pumps— Packaged Systems	#	#	#	#	NA	Heat Pumps Packaged Systems:	Heat Pumps Packaged Systems:
	HP1_2_Total	Less than 14 SEER or less than 11 EER or less than 8.0 HSPF HP1_2_stan	14 SEER or 11 EER or 8 HSPF HP1_2_T1	14+ SEER or 12+ EER or 8+ HSPF HP1_2_T2		<ul style="list-style-type: none"> Standard Eff: (Less than 14 SEER/11 EER) Tier 1: (14 SEER/11EER) Tier 2: (Above 14 SEER/ Above 12 EER) <p>HP2_2_REC</p>	0 None 1 Less than 5 2 5 – 20 3 21 – 50 4 51 – 100 5 More than 100 -8 DON'T KNOW <p>HP5_2</p>

AIR SOURCE HEAT PUMPS (HP)

Ductless Mini-Split Heat Pumps	#	#	#	#	NA	Ductless Mini-Split Heat Pumps:	Ductless Mini-Split Heat Pumps:														
	HP1_3_Total	Less than 14 SEER or less than 11 EER or less than 8.0 HSPF HP1_3_stan	14 SEER 11 EER 8 HSPF HP1_3_T1	14+ SEER 12+ EER 8+ HSPF HP1_3_T2		<ul style="list-style-type: none"> • Standard Eff: (Less than 14 SEER/11 EER) • Tier 1: (14 SEER/11EER) • Tier 2: (Above 14 SEER/ Above 12 EER) <p>HP2_3_REC</p>	<table border="0"> <tr><td>0</td><td>None</td></tr> <tr><td>1</td><td>Less than 5</td></tr> <tr><td>2</td><td>5 – 20</td></tr> <tr><td>3</td><td>21 – 50</td></tr> <tr><td>4</td><td>51 – 100</td></tr> <tr><td>5</td><td>More than 100</td></tr> <tr><td>-8</td><td>DON'T KNOW</td></tr> </table> <p>HP5_3</p>	0	None	1	Less than 5	2	5 – 20	3	21 – 50	4	51 – 100	5	More than 100	-8	DON'T KNOW
0	None																				
1	Less than 5																				
2	5 – 20																				
3	21 – 50																				
4	51 – 100																				
5	More than 100																				
-8	DON'T KNOW																				

SF3

Do you typically maintain a stock of the following residential equipment or do you order the needed equipment directly from stores, distributors, or manufacturers on a case-by-case basis?

- 1 Maintain a stock
- 2 Purchase directly from store *[WHICH ONES]*
- 3 Order from distributor *[WHICH ONES]*
- 4 Order from manufacturer representative *[WHICH ONES]*
- 5 Other *[SPECIFY]*
- 6 Expected missing
- 9 Missing

	1 Maintain a stock (Check Box)	2 Purchase directly from store (list which ones)	3 Order from distributor (list which ones)	4 Order from manufacturer representative (list which ones)	5 Other
SF3. Res. Natural Gas & Oil-fired Furnaces	SF3_1	SF3_2 SF3_2VERBATIM	SF3_3 SF3_3VERBATIM	SF3_4 SF3_4VERBATIM	SF3_OTHER
SB3. Res. Natural Gas & Oil Fired Boilers	SB3_1	SB3_2 SB3_2VERBATIM	SB3_3 SB3_3VERBATIM	SB3_4 SB3_4VERBATIM	SB3_OTHER
SW3. Res. Non-electric Water Heaters	SW3_1	SW3_2 SW3_2VERBATIM	SW3_3 SW3_3VERBATIM	SW3_4 SW3_4VERBATIM	SW3_OTHER
AC3. Res. Central AC	AC3_1	AC3_2 AC3_2VERBATIM	AC3_3 AC3_3VERBATIM	AC3_4 AC3_4VERBATIM	AC3_OTHER
HP3. Res. Heat Pumps	HP3_1	HP3_2 HP3_2VERBATIM	HP3_3 HP3_3VERBATIM	HP3_4 HP3_4VERBATIM	HP3_OTHER

SF4

For the equipment types that you sell and install, do you expect the proportion of sales of equipment that are high efficiency compared to standard efficiency to increase over the next two years? If yes, why do you think that will happen and for which equipment types? *[DO NOT READ LIST; SELECT ALL MENTIONED]*

- 1 Equipment costs will come down *[FOR WHICH EQUIPMENT TYPES]*
- 2 Customers will demand higher efficiency *[FOR WHICH EQUIPMENT TYPES]*
- 3 New Federal Standards for minimum efficiency of manufactured units *[FOR WHICH EQUIPMENT TYPES]*
- 4 Federal Tax Credits *[FOR WHICH EQUIPMENT TYPES]*
- 5 Utility or state rebates and incentives *[FOR WHICH EQUIPMENT TYPES]*
- 6 HVAC businesses will be better informed/educated on high efficiency
- 7 Improved or new technologies available *[FOR WHICH EQUIPMENT TYPES]*
- 8 Other *[SPECIFY]*

For all variables in the table below, values are as follows:

- 1 Yes
- 0 No
- 6 Expected Missing
- 8 Don't know
- 9 Missing

	SF4. Res. Natural Gas & Oil-fired Furnaces	SB4. Res. Natural Gas & Oil Fired Boilers	SW4. Res. Non-electric Water Heaters	AC4. Res. Central AC	HP4. Res. Heat Pumps
Expect high-efficiency sales to increase (Yes/No) If Yes – indicate reasons below:	SF4	SB4	SW4	AC4	<i>NA in dataset</i>

1 Equipment costs will come down	SF4_1	SB4_1	SW4_1	AC4_1	HP4_1
2 Customers will demand higher efficiency	SF4_2	SB4_2	SW4_2	AC4_2	HP4_2
3 New Federal Standards for minimum efficiency of manufacture d	SF4_3	SB4_3	SW4_3	AC4_3	HP4_3
4 Federal Tax Credits	SF4_4	SB4_4	SW4_4	AC4_4	HP4_4
5 Utility or state rebates and incentives	SF4_5	SB4_5	SW4_5	AC4_5	HP4_5
6 HVAC businesses will be better informed/ educated on high efficiency	SF4_6	SB4_6	SW4_6	AC4_6	HP4_6
7 Improved or new technologies available	SF4_7	SB4_7	SW4_7	AC4_7	HP4_7
8 Other	SF4_8	SB4_8	SW4_8	AC4_8	HP4_8
Other_Specif y	SF4_8_Specif y	SB4_8_Specif y	SW4_8_Specif y	AC4_8_Specif y	HP4_8_Specif y

OIL-TO-NATURAL GAS CONVERSIONS, EARLY RETIREMENT, AND OTHER SPECIAL EQUIPMENT

SF6 Approximately what percent of the natural gas furnaces that you sold in New York State in the past 12 months have been oil-to-natural gas conversions?

[*PROBE*: An oil to natural gas conversion refers to replacing an oil furnace with a natural gas furnace.]

_____ [*RECORD PERCENTAGE*]
-6 Expected missing
-9 Missing

SB6 Approximately what % of the natural gas boilers that you sold in New York State in the past 12 months have been oil-to-natural gas conversions?

_____ [*RECORD PERCENTAGE*]
-6 Expected missing
-9 Missing

SW6 Approximately what % of the natural gas water heaters that you sold in New York State in the past 12 months have been oil-to-natural gas conversions?

_____ [*RECORD PERCENTAGE*]
-6 Expected missing [*IF RESPONDENT DID NOT SELL FURNACES IN 2013*]
-9 Missing

SW7 Approximately what % of the natural gas or oil water heaters that you sell are heat pump water heaters?

_____ [*RECORD PERCENTAGE*]
-6 Expected missing [*IF RESPONDENT DID NOT SELL FURNACES IN 2013*]
-9 Missing

PA6 Have you observed any increase in the number of units of equipment that are now being retired early versus replaced on failure?

- 1 Yes
- 2 No
- 6 Expected Missing
- 8 Don't know
- 9 Missing

PA6a *[IF PA6=1]* For what types of equipment?

How large of an impact in terms of percentage of units? *[PROBE AND ENTER ZERO IF NO IMPACT]*

For PA6a_1 through PA6a_6

_____ % *[RECORD PERCENTAGE]*

PA6a_1 Residential furnaces

PA6a_2 Residential boilers

PA6a_3 Tank (storage) water heaters

PA6a_4 Tankless water heaters

PA6a_5 Central air conditioners

PA6a_6 Heat pumps

PA7 How many Wi-Fi Communicating Thermostats have you sold and installed in the past 12 months for residential homes in New York State?

For PA7_1 through PA7_2

_____ *[RECORD NUMBER]*

PA7_1 Number sold

PA7_2 Number installed

PA8 How many Boiler Reset Controls have you sold and installed in the past 12 months for residential homes in New York State?

For PA8_1 through PA8_2

_____ [RECORD NUMBER]

PA8_1 Number sold
PA8_2 Number installed

QUALITY INSTALLATION AND MAINTENANCE PRACTICES

IM1 *[IF INSTALL]* What industry sources do you primarily use as references to ensure quality installation of residential HVAC equipment? *[DO NOT READ LIST; SELECT ALL MENTIONED]*

For IM1_1 through IM1_7

- 1 Affirmative answer; source is used
- 2 No, or source not mentioned
- 6 Expected Missing
- 8 Don't know
- 9 Missing

IM1_1 Air Conditioning Contractors of America (ACCA)
IM1_2 American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
IM1_3 Plumbing, Heating-Cooling Contractors National Association (PHCC)
IM1_4 North American Technician Excellence,(NATE)
IM1_5 Building Performance Institute (BPI)
IM1_6 Other *[SPECIFY]*
IM1_7 None

IM1_6_specify Other industry source used as reference

[RECORD FIRST MENTIONS]

IM2 Does your firm require HVAC technicians attend training courses on energy efficiency, quality maintenance, or quality installation?

- 1 Yes
- 2 No
- 6 Expected Missing
- 8 Don't know
- 9 Missing

IM2_ *[IF IM2=1]* What type(s) of training(s) and from what organizations?

[DO NOT READ LIST; SELECT ALL THAT APPLY]

For IM2_1 through IM2_6

- 1 Affirmative answer; training is required
- 2 Answer not chosen

IM2_1 Electrical

IM2_2 Plumbing

IM2_3 Air Conditioning Contractors of America (ACCA)

IM2_4 Air-Conditioning, Heating, and Refrigeration Institute (AHRI)

IM2_5 Utility-sponsored Training on Efficient

IM2_6 Other *[SPECIFY]*

IM2_6_specify Other type of training.

IM3 Does your firm require HVAC technicians obtain industry certification?

- 1 Yes
- 2 No
- 6 Expected Missing
- 8 Don't know
- 9 Missing

IM3_ *[IF IM3=1] What type(s) of certification(s)?*
[DO NOT READ LIST; SELECT ALL THAT APPLY]

For IM3_1 through IM3_4

- 1 Affirmative answer; training is required
- 2 Answer not chosen

IM3_1 North American Technician Excellence,(NATE)

IM3_2 Building Performance Institute (BPI)

IM3_3 EPA HVAC Certification

IM3_4 Other *[SPECIFY]*

IM3_specify Other type of certification.

WE Thinking of all of the equipment that you sell or install such as furnaces, boilers, water heaters, central air conditioners and heat pumps; did any major weather events or other events affect your inventory or sales of high efficient equipment in 2013 in any way? (Probe on Hurricane Sandy in late 2012 and the unusually cold and long 2013–2014 Winter) If so, how were sales or installations or inventory affected?

- 1 Yes
- 2 No
- 3 Not Sure
- 9 Missing

WE_1 How were sales and inventory affected?

QUALITY DESIGN ASPECTS

D1 On a scale of 1 to 5, where 1 = not at all proficient, and 5 = extremely proficient, please rate how skilled your firm is in the following areas. How skilled is your firm in the area of:

For D1_A through D1_D

- 1 Not at all proficient
- 2 Not very proficient
- 3 Somewhat Proficient

4	Very Proficient
5	Extremely proficient
-8	Don't know
-9	Missing

D1_A	Practices, techniques and experiences with sizing new systems?
D1_B	Designing, installing, replacing and fixing air distribution systems?
D1_C	Recommending and specifying system efficiencies?
D1_D	Diagnosing techniques for ensuring adequate system refrigerant charging?

D2 When installing new residential HVAC (heating, ventilation, and cooling) equipment, on a scale of 1 to 5, where 1 = usually not done, and 5 = always done, please indicate how often you would perform the following tests. How often, using the scale of 1 to 5, would you:

[READ EACH ONE; RECORD RATING]

For D2_A through D2_H

- 1 Usually not done
- 2 Rarely done
- 3 Sometimes done
- 4 Often done
- 5 Always done
- 8 Don't know
- 9 Missing

D2_A Conduct building ventilation calculations

D2_B Conduct heat loss and heat gain load calculations for installations or replacements

D2_C Ensure the load equipment is properly sized and selected prior to installation

D2_D Confirm heating and cooling equipment are properly matched systems using industry-recognized product certification database such as AHRI, CEE, or OEM performance data

D2_E Verify the airflow through the indoor blower unit (e.g., furnaces, fan coil, air handler) is within acceptable CFM ranges

D2_F Verify the water flow through indoor heat exchangers are within acceptable ranges [*PROBE*: This refers to boilers.]

D2_G Ensure the HVAC system has the proper refrigerant charge

D2_H Conduct duct leakage tests

DISTRIBUTION SYSTEM

D3 When installing or servicing residential HVAC equipment, on a scale of 1 to 5, where 1 = usually not conducted, and 5 = always conducted, please indicate how often you would perform the following tests. How often, using the scale of 1 to 5, would you:

[READ EACH ONE; RECORD RATING]

For D3_A through D3_C

- 1 Usually not conducted
- 2 Rarely conducted
- 3 Sometimes conducted
- 4 Often conducted
- 5 Always conducted
- 8 Don't know
- 9 Missing

D3_A Conduct duct pressurization tests

D3_B Measure airflows

D3_C Measure water flows

IMPACTS OF EFFICIENCY PROGRAMS AND STANDARDS

PA1 How familiar are you with programs offered in New York State to promote energy efficient non-electric heating and water heating equipment? Are you:

- 1 Not at all familiar
- 2 Somewhat familiar
- 3 Very familiar
- 8 Don't know
- 9 Missing

PA2 *[If PA1>1, ASK]* Which programs are you familiar with in NYS that promote energy efficiency non-electric heating and water heating equipment?

[ASK FOR ENTITY OPERATING THE PROGRAM AND NAME OF PROGRAM; RECORD ALL MENTIONED]

PA3 *[IF PA1>1]* Approximately what percentage of the equipment that you sell is rebated or incentivized through each of these programs?

_____ % [RECORD PERCENTAGE FOR EACH PROGRAM MENTIONED]
-8 Don't know
-9 Missing (or Refused)

PA4 Are you aware of any new federal standards that may affect the manufacture of energy efficient non-electric heating and water heating equipment in New York State?

1 Yes
2 No
3 Not sure
-9 Missing (or Refused)

PA4a [If PA4=1, ASK] Which standards and what effect do you think these standards will have on your sales or installation of non-electric heating and water heating equipment? When will that occur? [RECORD VERBATIM]

PA5 [If (PA4=2 or 3) OR (PA4=1 and Water Heating Standards not mentioned in PA4_1) and they sell/install water heaters. ASK] Are you aware of new federal standards for water heaters going into effect next year?

1 Yes
2 No
3 Not sure
-6 Expected missing
9 Missing (or Refused)

PA5a [If PA5=1, ASK] What effect do you think the water heating standards will have on your sales or installation of non-electric heating and water heating equipment? When will that occur? [RECORD VERBATIM]

CONCLUSION

We're almost done. Can you tell me approximately how many full-time, part-time and seasonal employees work for your firm within New York State?

For CN1_1 through CN1_3

_____ *[RECORD NUMBER]*
-9 Missing or refused

CN1_1 Full-time
CN1_2 Part-time
CN1_3 Seasonal

Thank you for taking the time to respond to our survey. Your answers will be very valuable in helping improve energy efficiency programs for heating and cooling equipment in New York State!

CN2 Would you like to receive a brief summary of the highlights of the statewide results for this study at the conclusion of the project? *[IF SO, CONFIRM EMAIL AND/OR FAX NUMBER.]*

1 Yes _____
2 No _____

Appendix C. Letter to HVAC Contractors



Email subject line: Please help us design more effective programs for you and your customers

ID: <CaseID>

Dear <name>,

The New York State Energy Research and Development Authority (NYSERDA) is conducting a statewide study to understand the sales and installation practices of residential gas and oil heating equipment, water heaters, air conditioners, and heat pumps. Your company has been randomly selected to participate in this study to help design future energy efficiency programs for consumers in New York State.

I am an employee of Tetra Tech, an independent research firm hired by NYSERDA. I would like to gather some information from you about the efficiency level of equipment sold and installed, and typical maintenance and installation practices in New York State residences. Attached is a copy of the telephone interview guide that I will use. I will follow-up with you in the next few days to schedule a time that is convenient for you to complete the interview. If you would like to contact me, I can be reached at (PHONE) or email (EMAIL).

We understand this is a busy time of the year for you, so you may want to complete the attached interview in advance to reduce the time needed on the telephone. As an option, you can also fill in your responses and return the completed interview guide to me.

Please be assured that the information you provide will be kept confidential to the extent permitted by law. The analysis of survey results will not identify individual respondents or firms with their responses. All data will only be reported in aggregate form. At the conclusion of the study, we will provide you with a brief summary of the key findings for participating in this survey.

Should you have any questions about this study, please feel free to call NYSERDA customer service at 1-877-NYSMART (1-877-697-6278), email at info@nyserd.ny.gov, or visit the web-site at www.nyserd.ny.gov/energystudyinfo.

Sincerely,

(INTERVIEWER NAME AND CONTACT INFORMATION)

New York State Energy Research and Development Authority
HVAC Market Assessment Survey: Table of Equipment Types and Efficiency Categories

RESIDENTIAL CENTRAL AIR CONDITIONERS AND AIR SOURCE HEAT PUMPS

Equipment Type	TOTAL UNITS SOLD IN 2013	NOT HIGH EFFICIENCY	QUALIFY FOR TIER 1	QUALIFY FOR TIER 2	QUALIFY FOR TIER 3
Central Air Conditioners—Split Systems	#	# Less than 14.5 SEER or Less than 12 EER	# 14.5 SEER but less than 15 SEER or 12 EER but less than 12.5 EER	# 15 SEER but less than 16 SEER or 12.5 EER but less than 13 EER	# 16 SEER and Above or 13 EER and Above
Central Air Conditioners--Packaged	#	# Less than 14 SEER or Less than 11 SEER	# Greater than 14 SEER but less than 14 or Greater than 11 EER but less than 12	# 14 SEER and above or 12 EER and above	NA
Heat Pumps—Split Systems	#	# Less than 14.5 SEER or Less than 12 EER or Less than 8.2 HSPF	# 14.5 SEER to less than 15 SEER or 12 EER to less than 12.5 EER or 8.2 HSPF to less than 8.5 HSPF	# 15 SEER or 12.5 EER or 8.5 HSPF	NA
Heat Pumps—Packaged Systems	#	# Less than 14 SEER or less than 11 EER or less than 8.0 HSPF	# 14 SEER or 11 EER or 8 HSPF	# 14+ SEER or 12+ EER or 8+ HSPF	NA
Ductless Mini-Split Heat Pumps	#	# Less than 14 SEER or less than 11 EER or less than 8.0 HSPF	# 14 SEER 11 EER 8 HSPF	# 14+ SEER 12+ EER 8+ HSPF	NA

New York State Energy Research and Development Authority
HVAC Market Assessment Survey: Table of Equipment Types and Efficiency Categories

RESIDENTIAL GAS AND OIL-FIRED FURNACES

Equipment Type	TOTAL UNITS SOLD IN 2013	NOT HIGH EFFICIENCY	QUALIFY FOR TIER 1	QUALIFY FOR TIER 2	QUALIFY FOR TIER 3
Residential Gas Furnaces (<225,000 Btu/h)	#	# _____ Less than 90% AFUE	# _____ Greater than 90% AFUE but less than 92%	# _____ Greater than 92% AFUE but less than 94%	# _____ 94% AFUE and above
Residential Oil-fired Furnaces (<225,000 Btu/h)	#	# _____ Less than 85% AFUE	# _____ 85% AFUE and above	NA	NA

RESIDENTIAL BOILERS

Equipment Type	TOTAL UNITS SOLD IN 2013	NOT HIGH EFFICIENCY	QUALIFY FOR TIER 1	QUALIFY FOR TIER 2
Residential Gas Boilers (<300,000 Btu/h)	#	# _____ Less than 85% AFUE	# _____ Greater than 85% AFUE but less than 90% AFUE	# _____ 90% AFUE and Above
Residential Oil Boilers (<225,000 Btu/h)	#	# _____ Less than 85% AFUE	# _____ 85% AFUE and above	NA

RESIDENTIAL WATER HEATERS

Equipment Type	TOTAL UNITS SOLD IN 2013	NOT HIGH EFFICIENCY	QUALIFY FOR TIER 1	QUALIFY FOR TIER 2
Residential Gas Water Heaters--Storage	#	# _____ Less than .67 EF	# _____ Greater than .67 EF but less than .80 EF	# _____ .80 EF and above
Residential Oil Water Heaters--Storage	#	# _____ Less than .59 EF	# _____ .59 EF and above	NA
Residential Gas Water Heaters-Tankless (Instantaneous)	#	# _____ Less than .82 EF	# _____ .82 EF and above	NA
Residential Gas Water Heaters--Condensing	#	# _____ less than .80 EF	# _____ .80 EF and above	NA

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 1-877-NYSMART (1-877-697-6278) or
 email info@nyserda.ny.gov
 17 Columbia Circle
 Albany, New York 12203

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 1-800-454-5070 or email at
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