Nexus Market Research, Inc.

Analysis of Onsite Audits in Existing Homes in Vermont

FINAL

Submitted to:
Vermont Department of Public Service

Submitted by:
Nexus Market Research, Inc.
RLW Analytics, Inc.
Dorothy Conant

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22 Haskell Street, Cambridge, MA 02140
Phone: (617) 497-7544 Fax: (617) 497-7543
www.nexusmarketresearch.com

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Executive Summary

A total of 156 onsite audits were conducted at existing single-family homes in Vermont, with 123 conducted at owner occupied single-family homes and 33 at single-family rental homes. The audits collected data on the general construction of the home, insulation, windows, heating and cooling equipment, water heating, ducts, appliances, and lighting. In addition, 103 homes underwent blower door testing to measure air leakage through the building shell and 19 homes underwent duct blaster testing to measure air leakage through supply and return ducts installed in unconditioned spaces.

The remainder of this section provides an overview of the key findings of the onsite audits.

ES.1 Home Characteristics

Statewide, nearly all the owner occupied homes are detached single family homes (98%). As might be expected, Burlington has significantly fewer detached (74%) owner occupied homes than the state as a whole. There is a more even split among rental homes between detached (55%) and attached (45%) dwellings in the state. Below are additional details regarding the existing homes that received inspections.

- The average heated area for owner occupied homes is 2,213 square feet and the median is 2,032 square feet; for rental homes the average and median is 1,350 square feet.

- Owner occupied homes statewide are, on average, about 60 years old with a median age of 48 years; and rentals are, on average, about 76 years old with a median age of 78 years. Owner occupied homes in North Chittenden are the newest homes; on average, they are about 39 years old.

- Statewide, more than two out of three owner occupied homes (71%) and rentals (70%) have full basements and 15%-20% of homes have partial basements. About one-third of the owner occupied homes (35%) and nearly one-half of the rentals (45%) have unconditioned full basements.

- Twenty percent of owner occupied homes and 6% of rental homes have a dedicated space for running a business or working from home.

- Slightly over one in ten owner occupied homes and 3% of rental homes have a swimming pool; a small number of pools are heated and have pump timers.

- Statewide, nearly every owner occupied home (97%) and all the rental homes (100%) are the primary residence of the owner or tenant, occupied year round.

Compared to the 2006 American Community Survey for Vermont, the owner occupied onsite homes are similar in terms of house type (detached vs. attached), home age, heating fuel, and

occupancy. This indicates that the onsite sample of owner occupied homes is representative of all owner occupied homes in Vermont.

ES.2 Insulation

Wall Insulation. Nearly two-thirds of owner occupied existing homes have 2x4 construction for conditioned/ambient walls and about one-quarter use a mixture of 2x4 and 2x6 construction. Three-quarters of rental homes have 2x4 construction and 21% have 2x6 construction.

Over three-fourths of owner occupied homes have fiberglass batts installed in at least some walls and 13% have blown-in cellulose installed in at least some walls. Nearly one-half of rental homes have cellulose insulation in the walls and 36% have batts. One percent of owner occupied homes (10% in North Chittenden and 7% in Burlington) and 9% of rental homes have no wall insulation.

The current RBES minimum requirement for wall insulation in new homes is R-19[1]; about 27% of owner occupied homes and 21% of rental homes meet or exceed this standard. This figure is highest in the North Chittenden (35%) and Newport/Derby region (32%) and lowest in St. Albans (6%). For both owner occupied homes and rental homes in Vermont, the average R-value and the median R-value for conditioned/ambient wall insulation is about R-12 and R-11, respectively.

Ceiling Insulation. About one-half of existing homes in Vermont have flat ceilings with the joists covered with insulation and one in five have a combination of covered flat joists and cathedral ceilings. The ceilings in the remaining homes are flat ceilings with the joists not covered with insulation and/or cathedral ceilings.

Flat Ceilings. Sixty percent of owner occupied homes with flat ceilings have 2x6 construction and 29% have 2x8 construction. Forty-five percent of rental homes are 2x6 construction and 39% are 2x8 construction.

Most owner occupied homes have fiberglass insulation in the flat ceilings (59%), followed by cellulose (30%). Rental homes also predominantly have fiberglass insulation (45%) or cellulose (39%). The RBES minimum for flat ceilings in new homes is R-38; only 7% of owner occupied homes and 22% of rental homes meet or exceed this standard. A higher percentage of homes in North Chittenden (21%) and Burlington (19%) contain R-38 or higher insulation; 6% of homes in St. Albans have no insulation in their flat ceilings. The average R-value for flat ceiling insulation in owner occupied homes is about R-27 and for rental homes is R-29.

[1] The current version of RBES applies to new homes built after January 2005. Thus, it does not apply to this sample of existing homes, all of which were built at least five years ago according to the homeowners. However, we believe that RBES provides a useful benchmark with which to compare the results of the onsite inspections, particularly for insulation levels.

Cathedral Ceilings. Forty-five percent of owner occupied homes and five of ten rental homes with cathedral ceilings utilize 2x8 construction. Thirty-nine percent of owner occupied homes with cathedral ceilings utilize 2x6 construction.

Fiberglass batts is the predominant insulation in cathedral ceilings, installed in over three-quarters of owner occupied homes and nine of ten rental homes. All homes with cathedral ceilings have insulation installed. However, only 9% of the owner occupied homes and two of ten rental homes with cathedral ceilings meet or exceed the RBES standard of R-30 insulation. The average R-value is almost R-21 for owner occupied homes and R-23 for rental homes.

Floor Insulation. RBES requires insulation levels of R-30 for floors over unconditioned spaces in new homes, and none of the owner occupied homes with floors over unconditioned spaces met this standard. Of the 59 owner occupied homes with floors over unconditioned basements, 21% of the floors were insulated. Twenty-two percent of the 27 homes with floors over partially conditioned basements have insulation and 61% of the homes with floors over crawl spaces have insulation installed (average R-value of R-16).

Of the 20 rental homes with floors over unconditioned basements, only 10% had insulation installed. None of the rental homes met the RBES requirement for floor insulation levels.

Foundation Wall Insulation. Foundation walls in new homes that are 50% or more above grade are required by RBES to have insulation levels of R-19 or greater. About one-half of owner occupied homes with these foundation walls have insulation, though only 7% meet the RBES standard. Of those homes with insulated foundation walls, most have fiberglass batts. In owner occupied homes, the average and median R-value is about R-11.

ES.3 Windows and Doors

Double pane windows (27%) and a combination of single pane and double pane windows (32%) are the most common type of windows installed in owner occupied homes. Seven percent of owner occupied homes and 30% of rental homes only have single pane windows installed. An additional 45% of owner occupied homes and 27% of rental homes have at least some single pane windows installed.

Owner Occupied Homes. Double pane clear windows account for 44% of total glass area in owner occupied homes, double pane low-e windows account for 28%, and single pane windows account for 26%

In these owner occupied homes, nearly four-fifths (77%) of the total square footage of all types of window glass does not have storm windows, because they are mostly double pane windows. However, about four-fifths (78%) of the total square footage of single pane windows has storm windows.

Rental Homes. In rentals, double pane clear windows account for 28% of total glass area and single pane windows account for 45% of total glass area. Overall, the total square footage of window glass in rentals is about evenly split between the area with (48%) and without (52%) storm windows, due to the predominance of single pane windows with storm windows.

Glazing Percentage. On average, slightly over one-tenth of the exterior wall area in homes is glazed—in both owner occupied homes (13%) and rentals (11%). The RBES requirement for glazing percentage varies from 12% to 18%, depending upon the other features incorporated into the home and the compliance method.

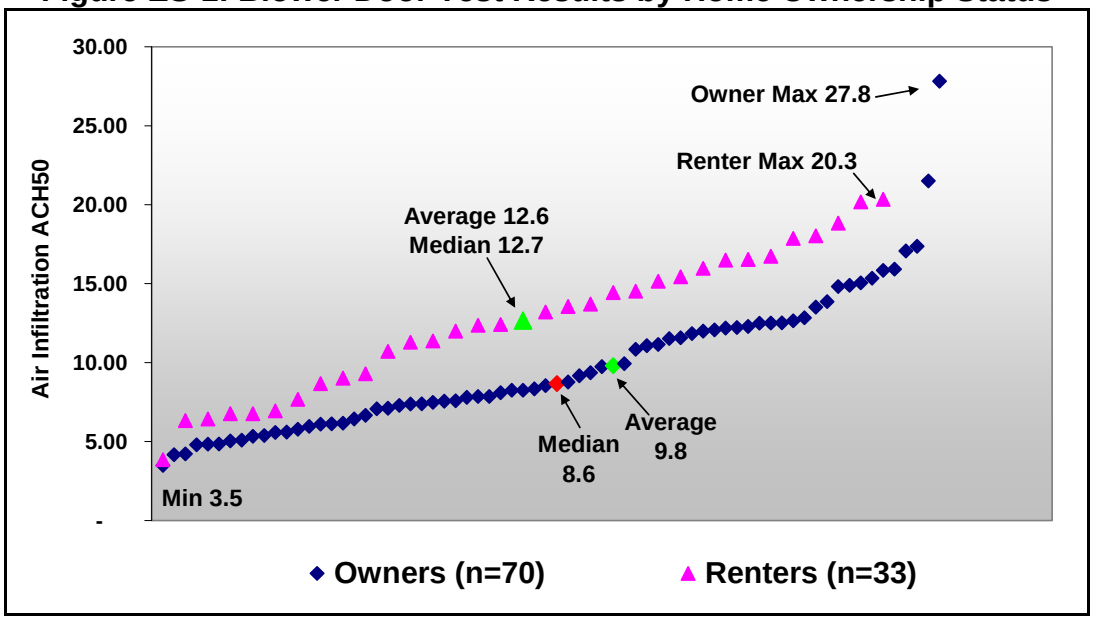
Owner occupied homes tend to have a higher glazing percentage than rentals, as 26% of owner occupied homes statewide have windows constituting a 16% or higher ratio of window-to-wall area. In contrast, a miniscule fraction (3%) of the rentals have windows constituting a 16% or higher ratio of window-to-wall area.

ES.4 Building Shell Leakage

A sample of 103 homes were subjected to blower door tests of air infiltration at 50 Pascals. The test results yielded an average of 10.7 air changes per hour statewide, with a median of 9.9. As a point of comparison, the ENERGY STAR homes program requires newly constructed homes in Vermont to have less than 5.0 ACH50.

Owner occupied homes are, on average, more air tight than the rental homes. In the sample of owner occupied homes, the test results yielded an average of 9.8 and a median of 8.6 air changes per hour (Figure ES-1). In the sample rentals, the test results yielded an average of 12.6 and a median of 12.7 air changes per hour. Among the targeted regions, the sample of homes in North Chittenden were the most air tight on average (average 8.5 ACH50, median 8.1 ACH50); and those in Newport/Derby were the least air tight (average 13.0 ACH50, median 12.2 ACH50).

Figure ES-1: Blower Door Test Results by Home Ownership Status



ES.5 Heating and Air Conditioning

Statewide, about three out of five homes—both owner occupied and rentals—depend on oil as the primary heating fuel; about one in five owner occupied homes and one in four rentals use natural gas as the primary heating fuel. North Chittenden (60%) and Burlington (89%) are significantly more likely than the state as a whole to have gas as the primary heating fuel, due to the availability of utility gas.

Forty-three percent of owner occupied homes have a sole boiler, while about 20% have a boiler plus another system and about 20% have a furnace. In rental homes, 42% to 45% have a single boiler or furnace installed. Two-thirds of the owner occupied homes with a single heating system have hot water boilers, and about one-third have furnaces. Slightly over one-half of rental homes have furnaces, and 44% have hot water boilers.

The average age of boilers and furnaces is 13 years and 14 years, respectively; the median age is eight or ten years for boilers and ten years for furnaces.

Temperatures and Controls. Statewide, close to three out of four owner occupied homes (71%) and about four out of five rentals (79%) have manual thermostats. Programmable thermostats are installed in about one in four owner occupied homes (24%) and nearly one in five rentals (18%) statewide. Among owner occupied homes, those in Burlington (52%) are significantly more likely than the state as a whole to have programmable thermostats with those in Newport/Derby (9%) significantly less likely.

Supplemental Heating Systems. Statewide, substantially more owner occupied homes (57%) than rentals (24%) have a single fireplace or stove. Wood is the fuel for most fireplaces or stoves.

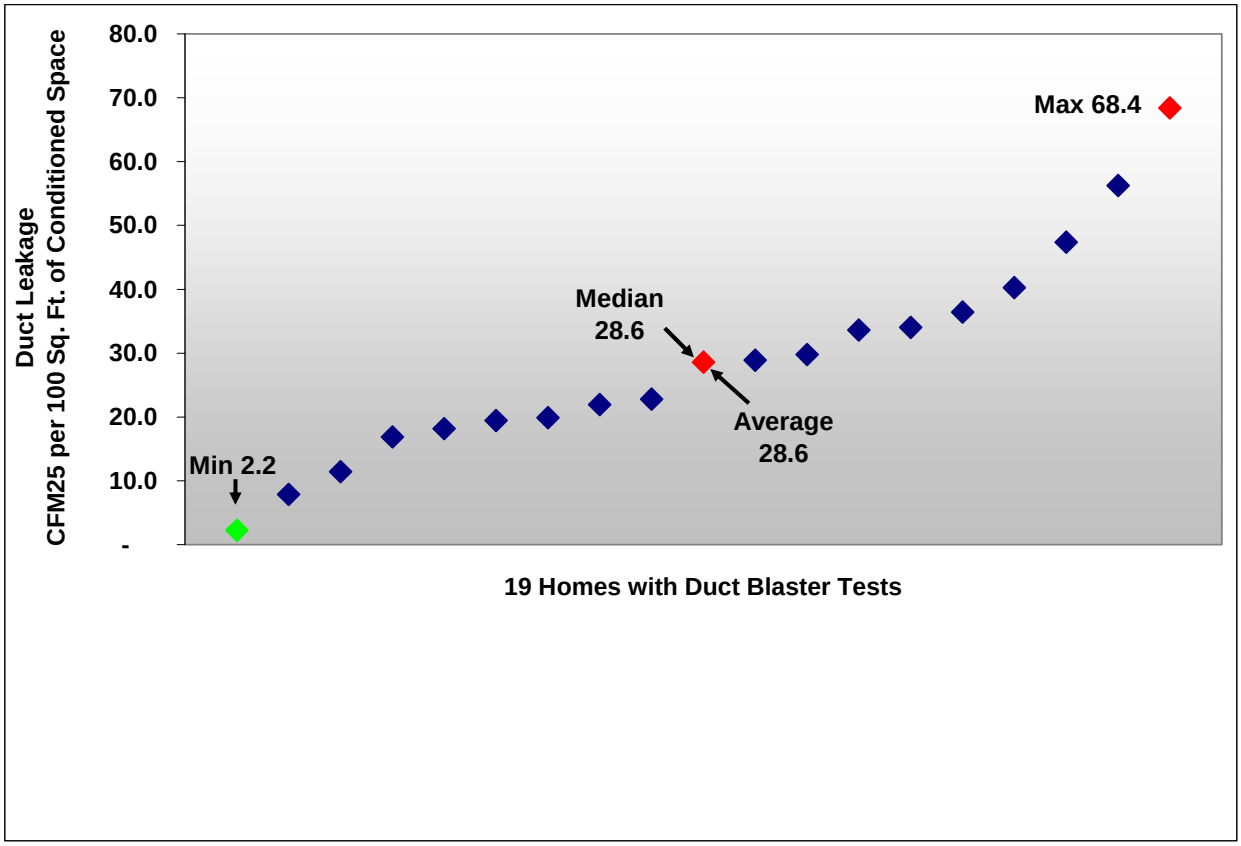
Statewide, around four out of five owner occupied homes (78%) and rentals (85%) do not have any portable space heaters. Among those that do, the majority have electric space heaters.

Air Conditioning. Statewide, about one in three owner occupied homes (34%) and two out of five rentals (42%) have at least one window air conditioning unit. Most of these owner occupied homes (23%) and rentals (27%) have a single window air conditioner. Two homes had central air conditioning.

Ducts. Of the 156 homes audited, 57 (37%) have ducts installed in the home. Of these 57 homes with ductwork, about 70% have duct runs in unconditioned space.[2] Duct seams are sealed in only five of the forty homes with ducts in unconditioned space. Ducts are insulated in only four of the forty homes with ducts in unconditioned space.

Figure ES-2 displays the result of duct blast testing at 19 owner occupied homes. The average and median duct leakage was 28.6 CFM25 per 100 square feet of conditioned space. To put this in perspective, the requirement for ENERGY STAR new homes in Vermont is less than 4.0 CFM25 per 100 square feet of conditioned space.

Figure ES-2: Duct Blaster Test Results



[2] Auditors defined conditioned space as intentionally heated space.

ES.6 Water Heating

About one-half of owner occupied homes (53%) have stand alone tank water heaters, while the other half have a water heater integrated with their space heating system (i.e., boiler), either with a storage tank or a tankless coil system. Nearly three-quarters of rental homes (73%) have stand-alone water heaters.

Statewide, 37% of owner occupied homes have water heaters that use oil, 31% use electricity, and 19% use natural gas. There are strong regional differences due to the availability of natural gas, with 85% of Burlington homes and 65% of North Chittenden homes using natural gas for water heating. Roughly one-quarter to one-third of rental homes have natural gas or electric water heaters.

Statewide, slightly over one in ten homes have water heaters wrapped with insulation. RBES requires R-14 insulation for water heater tank wraps in new homes except where the warranty is voided by installing a tank wrap; none of the homes had R-14 insulation wraps. Ten of the 28 owner occupied homes with electric stand alone water heaters have wrapped tanks; three of the eleven rental homes with electric stand alone water heaters have wrapped tanks.

Statewide, one out of five owner occupied homes (20%) and about one in seven (15%) rentals have insulation on their water heater piping. Among the owner occupied homes that do have water heater piping insulation, 86% have insulation with an R-value of 2.0.

Low Flow Shower Heads and Faucet Aerators. Statewide, more than one-half of owner occupied homes (56%) and over two out of three rentals (70%) do not have any low flow shower heads. Statewide, owner occupied homes (84%) are significantly more likely than rentals (61%) to have faucet aerators.

ES.7 Appliances

All of the homes visited have at least one refrigerator and a range with an oven. Nearly all owner occupied homes (99%) have a clothes washer, compared to 85% of rental homes. Over nine in ten owners but less than three quarters of renters have a clothes dryer while eight in ten owners but only a bit over a quarter of renters have a dishwasher. Separate freezers are found in one-third of owner occupied homes and almost one-fifth of renter-occupied homes. Second working refrigerators are found in one-quarter of owner occupied homes, but few rental homes. Separate freezers and second refrigerators are less common in Burlington than in other regions.

ENERGY STAR Appliances. In owner occupied homes, refrigerators are most likely to be ENERGY STAR-labeled (23%), followed by dishwashers (18%) and clothes washers (17%). Appliances in homes occupied by renters are, in all cases, less likely to be ENERGY STAR-labeled.

Refrigerators. Close to six in ten refrigerators are less than 10 years old; three out of ten are less than five years old. Seventeen percent of refrigerators in owner occupied homes are estimated to be 20 years or older.

Separate Freezers. Separate freezers are older than other appliances; close to one-third of separate freezers in owner occupied homes are at least 20 years old.

Dishwashers. More than two-thirds of dishwashers in owner occupied homes are under 10 years old; one-third are under five years old. Twelve percent of dishwashers in owner occupied homes are 20 years or older.

Clothes Washers. Close to two-thirds of clothes washers are under 10 years old; few are twenty years or older. About two-thirds of clothes washers in owner occupied homes and over 90% of models in rental homes are top-loading.

Clothes Dryers. About one-half of clothes dryers are under ten years old, and 10%-14% are over twenty years old. More than four in five clothes dryers in owner occupied homes and almost all clothes dryers in rentals use electricity.

Televisions and Peripherals. About nine in ten homes have at least one TV set; six in ten have at least two. Nearly 90% of TVs are cathode ray tube models; about 12% of TVs are LCD, projection, or plasma models. Most TV monitors are under 30 inches in size; about 10% of TVs are over 40" in size. The most common TV peripherals are both VCRs and DVD players, which are installed in nearly two-thirds of TVs.

Computers. About eight in ten homes have at least one computer and about two-thirds also have at least one printer. About two-thirds of computers have LCD monitors, the remaining one-third are CRT. Most computer monitors are between 16 and 20 inches in size; 60% of monitors in owner occupied homes are in this size range.

ES.8 Lighting

CFL bulbs, including both screw-in and pin-based, were installed at almost 90% of owner occupied homes, with the lowest saturation in Burlington (78%). Seventy percent of rental homes also have CFLs installed. Overall, about one-quarter of owner occupied homes and 15% of rental homes have CFLs in storage.

In owner occupied homes, an average of 9.5 and median of 6 CFL bulbs are installed, representing 19% of all incandescent and CFL bulbs installed. In rental homes, an average of 4.0 and median of 3 CFL bulbs are installed, representing 15% of all incandescent and CFL bulbs installed.

About two-thirds of owner occupied homes have T12 fluorescent tube fixtures installed and one-quarter have T8 tube or circline fluorescent fixtures installed. Fewer rental homes have fluorescent fixtures installed; one-third have T12 fixtures and 12% have T8 fixtures.

ES.9 Owner Survey

Energy Use. About one-half of respondents consider fixing their windows or installing energy-efficient windows as a way to save energy in their homes. Adding insulation to various parts of the home including the attic, basement, floors and walls is also considered a way to save energy by a one-third or more of respondents. The high cost of making such changes is an obstacle for a majority of respondents. A little over one-third of respondents also consider a lack of time as an obstacle.

Thermal Comfort. Eighty-two percent of respondents from owner occupied households and 84% from renter occupied households report being satisfied with the thermal comfort in their homes. Respondents from owner occupied households who are not satisfied with the thermal performance of their homes cite the poor distribution of heat in their homes (28%), the lack of enough heat (33%) and the cold drafts due to inefficient windows (28%).
Respondents were asked about the one thing they would most like to change in order to improve the thermal performance of their homes. Most often, respondents would like to improve the heat distribution in their homes.

CFLs. Of the 154 respondents, 27 did not have any CFLs installed in their homes, although they were all familiar with CFLs when the interviewer showed them an actual CFL bulb. Of these 27 respondents, 25 have thought about using CFLs while the remaining two have not. Over one-quarter of these respondents from owner occupied households say the high cost of CFLs is the primary obstacle; another 24% have 'not gotten around to it.' A few respondents suggest the provision of free bulbs or coupons as possible ideas to encourage their use.

Freezers and Refrigerators. Of the 68 respondents (of 154 total respondents) who have secondary refrigerators or freezers, 25% claim to have considered removing them at some point. Almost one-half of these respondents say they need their freezers or refrigerators for additional storage or extra capacity.
Almost one-third of the respondents who have not considered removing their secondary freezers or refrigerators say that there is nothing that would convince them to do so.
Heating Systems. Six of the eight respondents with oil or natural gas heating systems that are judged by the on-sites to be old and/or inefficient report having considered a replacement. Four of these six respondents claim that the high cost of a replacement is the reason for not making the switch to an energy efficient system.

Attic Insulation. Twelve respondents with less than R-19 attic insulation were asked if they had considered adding attic insulation; eight respondents claim to have considered such additions. High costs and the lack of time are the two most common reasons why the remaining four respondents have not considered adding attic insulation.

Wall Insulation. Seven of the respondents from households with no exterior wall insulation have considered adding wall insulation while three have not considered it. The high cost of insulation and the lack of time are the two most common reasons why respondents without exterior wall insulation have not considered its installation.

Air Sealing. Thirteen respondents with infiltration levels exceeding 0.7 ACHnat report having considered doing air sealing while two report not having thought of doing any air sealing. A number of respondents (four of ten) report that the high cost of replacing windows has kept them from taking any action.

Floor Insulation. Twenty three respondents with uninsulated floor areas over their porch, garage, or crawl space were asked if they had considered adding floor insulation. Nine of the respondents report having considered adding floor insulation. Three of these nine respondents report that the high cost of adding the insulation has kept them from doing so while three cite a lack of time.

1 Introduction

A total of 156 existing home onsite audits were conducted in Vermont, with 123 conducted at owner occupied single-family homes and 33 at single-family rental homes. In order to gather information on opportunities for improving energy efficiency in existing homes, existing homes are defined as those homes aged five years or older according to the homeowners. In addition, single-family homes are defined to include the following types of homes:

- Detached single-family home
  - Constructed on-site using a foundation; usually built with wood framing, but also could be built from brick, metal, or another material
  - Modular home that is built at a factory in separate units then assembled and set onto a foundation.
- Townhouse or duplex, with a wall separating the units from basement to roof, and with separate utilities for each unit

This definition of single-family homes excludes the following types of homes:

- Two, three, or four family building—with no basement walls separating the units, or with one water and sewer bill for the whole building
- Part of a building with five or more units
- Mobile home that was built at a factory and delivered as a single unit, often known as single or double-wide trailers

1.1 Onsite Audit Data Collection

On-site sample recruitment and scheduling was performed by RLW Analytics, Inc. (RLW) staff following the introduction to the on-sites through the telephone survey of 418 homeowners. The following steps were undertaken to minimize customer intrusion, improve recruiting rates, and minimize bias in the selection of homes visited.

- *Advance Notice.* The pool of potential recruits was provided advance notice through the telephone surveys.
- *Use of incentives.* An incentive of $50 was offered to customers, with $100 available for those whose homes undergo optional diagnostic testing.
- *Confirmation Calls.* Each scheduled appointment was called at some point 48 hours before the visit to confirm the appointment.

On-Site Inspection Data Collection. The primary objective of the on-site audit is to collect data on the following home features:

- General information including; approximate square footage, number of stories, size of conditioned space in main home and basement, fireplace quantity, seasonal use.
- Envelope features on thermal boundary of home including; wall, ceiling and floor insulation locations and types (from rated values on product, or else estimated from visual inspection), window type, locations and ratings (from window labels if available; else estimated from visual inspection).
- Heating and Cooling equipment including; make and model, age, type, location, fuel used, size, and efficiency rating.
- Water heating equipment including; make and model, age, type, fuel used, location, size, and efficiency rating.
- Appliances present at the home including dishwashers, clothes washers, dryers, ovens, refrigerators, freezers, room air conditioners, televisions, and computers. Data collected includes make and model, type, age, general use, approximate age and where available we will also gather appliance size and efficiency.
- Duct insulation including whether it is on the supply or return ducting, its location (conditioned vs. unconditioned space), insulation type and estimated R value.
- Type of duct sealing, if any.
- Main area lighting fixture inventory including all plug-in fixtures. This inventory includes a count by type of bulb and fixture, wattages, control types, and number of sockets.

Measurement of Building Shell Leakage with a Blower Door Test. In order to measure air leakage through the building shell, we conducted blower door tests at 103 of the 156 existing single-family homes. Each telephone survey respondent who volunteered for the on-site audit was offered an additional $50 (in addition to the standard $50 incentive) if they allowed diagnostic testing, which included blower door and duct blaster testing, where appropriate. In order to ensure a representative sample across regions, blower door tests were targeted for owner occupied homes in each of the four GT regions and the remainder of the state. In the end, blower door tests were conducted at 70 of the 123 owner occupied homes and at all 33 rental homes

Measurement of Duct Leakage with a Duct Blaster. Auditors conducted duct blaster tests at 19 of the existing single-family homes that had duct runs in unconditioned spaces; auditors defined conditioned space as intentionally heated space. Because only a small proportion of the existing homes in Vermont have forced air heating or cooling systems and only a portion of these homes have ductwork in unconditioned spaces, RLW attempted to perform duct blaster testing at all 40 homes that qualified and where the homeowner agreed to the diagnostic testing. When an auditor discovered on site that a home had qualifying ductwork but had not been interested in the diagnostic testing during the recruitment phase, the owner was again offered an additional $50 in an attempt to gain approval. All 19 of the homes that received duct blaster testing are owner occupied homes.

Brief Paper Survey of Homeowner. The onsite audit includes a short paper survey with the homeowner in order to assess obstacles to improving the efficiency of their home based on the findings of the onsite inspection.

Data cleaning. As part of the data review process, the NMR team reviewed the population of data in each field for reasonableness, cleaned skip patterns, and ensured all data are in consistent units. The NMR team reviewed individual input forms as necessary and discussed resolution of inconsistencies with the auditor who conducted the on-site inspection.

1.2 Sampling

Volunteers for the onsite audits were recruited from the telephone surveys of homeowners of owner occupied homes and rental homes in Vermont. The homeowner survey reports provide more detail on the method used to select the sample for those surveys.

In order to gather information on opportunities for improving energy efficiency in the single-family rental market, rental homes are defined as single-family homes aged five years or older and rented out for the entire year. This definition excludes vacation properties that may be rented out seasonally, and thus present fewer opportunities for energy efficiency due to less frequent occupation.

Geographic Regions. The DPS requested detailed information on the housing stock located in four separate geographic regions in Vermont, three of which are geographically targeted (GT) regions (Northern Chittenden, St. Albans, and Newport/Derby), plus the city of Burlington. Data from Efficiency Vermont (EVT) on the number of GT premises in each GT town were analyzed in order to identify towns that contain a large proportion of GT premises for inclusion in the telephone survey (which served to recruit homeowners for the onsite audits). Table 1–1 displays the GT region, the towns selected to represent each region, and the percent of GT accounts in each town.

Table 1–1: Towns Selected to Represent Geographically Targeted Regions

Region	Town	Number of Premises	Number of GT Premises	GT Premise Ratio
Newport/Derby	Brownington	120	70	58%
Newport/Derby	Derby	6,398	2,111	33%
Newport/Derby	Newport	9,396	2,776	30%
No. Chittenden	Colchester	8,469	8,280	98%
No. Chittenden	Essex	3,961	3,482	88%
No. Chittenden	Essex Junction	5,553	5,125	92%
No. Chittenden	Winooski	3,479	3,385	97%
St. Albans	Georgia	2,052	1,737	85%
St. Albans	Milton	4,903	4,336	88%
St. Albans	Saint Albans	7,754	6,362	82%

Four of the six towns located in the Northern Chittenden region were included in the survey; these four towns represent 99% of the GT premises in the Northern Chittenden region. Three of the six towns located in the Newport/Derby region were included in the survey; these three towns represent 95% of the GT premises in the Newport/Derby region. Three of the thirteen towns located in the St. Albans region were included in the survey; these three towns represent 79% of the GT premises in the St. Albans region.

Sampling Error. In developing the on-site sample design, we drew from experience in similar studies in determining a coefficient of variation; however, at this stage in the study we are able to utilize actual coefficients from this study to estimate the final precisions of key home characteristics. The equations to estimate the required sample size based upon known data relationships are as follows:

$$n_0 = \left(\frac{z \times CV}{R} \right)^2 \qquad n_1 = \left(\frac{n_0}{1 + \frac{n_0}{N}} \right)$$

where,

n_0 = the required sample size before adjusting for the size of the population,
z = a constant based on the desired level of confidence, e.g., 1.645 for the 90% level of confidence,
CV = Coefficient of variation describing the level of variability within the data,

R = the desired relative precision,
n_1 = the required sample size after adjusting for the size of the population using the *finite population correction factor*,
N = the population size, i.e., the number of sample points in a particular treatment group.

The coefficient of variation is of central importance to determining the final precisions. A primary objective of this study is to document the existing building and equipment status of single-family existing homes by feature. Since there is no single variable that quantifies a home's construction features and this study provides results for multiple variables, we identified results that we believe are influential in the determination of a home's overall efficiency. Table 1–2 lists some of these key parameters that were measured at the home visits in Vermont along with the coefficient of variation associated with these measurements. Based on these coefficients, we used the poorest -- 0.44 -- to provide a sense of the precision around the final sample size and results for each region.

Table 1–2: Coefficients of Variation for Key Residential Measurements

Parameter	Coefficient of Variation
Wall Insulation (R Value)	0.44
Heating system (efficiency)	0.06
Infiltration (ACHnat)	0.43
Ceiling Insulation (R Value)	0.35
Duct LTO (CFM/kBTU)	0.44

Table 1–3 shows the final precision calculations for both the single-family existing homes segment overall and by geographically targeted region. At the 90% confidence interval, the precisions associated with the targeted regions range from ± 17.6% to ± 11.6% using a CV of 0.44. For the statewide owner occupied sample the actual precision is better than ± 7% relative precision. A total of 33 site visits were performed with single family renters with a precision of approximately ±13%.

Table 1–3: Sample Design by Region and Sub Segment

Geographic Area	z	CV	n	N	RP
Northern Chittenden	1.645	0.44	20	21,565	+/- 16.2%
St. Albans	1.645	0.44	17	14,635	+/- 17.6%
Newport/Derby	1.645	0.44	22	5,134	+/- 15.4%
Burlington	1.645	0.44	27	10,232	+/- 13.9%
Remainder of VT	1.645	0.44	37	160,338	+/- 11.9%
Subtotal, Owner Occupied VT SF Existing Homes			123	211,904	+/- 6.5%
All VT SF Renter Occupied Existing Homes (n=33)					+/- 13.0%

1.3 Weighting

Because we over-sampled homes in the four GT regions, in order to estimate the statewide results for the owner occupied homes we weight the results from the four GT regions and the remainder of Vermont. The weight for each of the five regions is developed by dividing the proportion of single-family homes in the population by the proportion of completed onsites in each segment. Table 1–4 displays the estimated number and percent of single-family homes and onsites, as well as the calculated weight. Note that these weights are used only when estimating owner occupied results for the entire state; results for each of the four regions is presented unweighted. In addition, the owner occupied statewide results are presented unweighted in certain tables if the sample size in any of the regions is too low.

Table 1–4: Weighting Scheme for Owner Occupied Onsite Audits

Region	Estimated Number of Single-Family Homes	Percent of Homes	Number of Completed Owner Occupied Onsites	Percent of Owner Occupied Onsites	Owner occupied Weight
Burlington	10,232	4.8%	27	22.0%	0.22
Newport/Derby	5,134	2.4%	22	17.9%	0.14
Northern Chittenden	21,565	10.2%	20	16.3%	0.63
St. Albans	14,635	6.9%	17	13.8%	0.50
Remainder of VT	160,338	75.7%	37	30.1%	2.52

The results for the single-family rental homes are presented separately from the owner occupied results because they represent a different market segment and because different sampling schemes were used to construct the sample for the telephone surveys (which served to recruit volunteers for the onsites). In addition, the results for the rental onsites are not weighted due to the low sample size (33).

2 Home Characteristics

Statewide, nearly all the owner occupied homes are detached single family homes (98%) (Table 2–1). As might be expected, Burlington has significantly fewer detached (74%) owner occupied homes than the state as a whole. On the other hand, there is a more even split among rentals between detached (55%) and attached (45%) dwellings; and statewide, rentals (45%) are much more likely than owner occupied homes (2%) to be attached dwellings.

According to the 2006 American Community Survey (ACS) for Vermont, detached homes represent 96% of single-family owner occupied homes and 91% of single-family rental homes.[3]

Table 2–1: Types of Homes
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Detached	95%	94%	95%	74%	98%	55%
Attached	5%	6%	5%	26%	2%	45%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Statewide, nearly three-fifths (57%) all the owner occupied homes have two to two-and-a-half stories; and two-fifths (40%) have three or more stories (Table 2–2).[4] Newport/Derby (68%) and Burlington (63%) have significantly more homes with three or more stories than the state as a whole; in Burlington, this may be due to the prevalence of attached homes in the sample. Rentals (33%) are less likely than statewide owner occupied homes (57%) to have two to two-and-a-half stories.

Table 2–2: Number of Stories of Homes
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
One to One-and-a-half	20%	6%	0%	4%	3%	12%
Two to Two-and-a-half	50%	65%	32%	33%	57%	33%
Three or more	30%	29%	68%	63%	40%	55%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

[3] Note that the rental homeowner telephone survey (and thus the subsequent on-site audits) targeted single-family homes rented out for the entire year. The ACS defines renter-occupied homes as all occupied housing units which are not owner occupied, whether they are rented for cash rent or occupied without payment of cash rent. Thus the ACS likely includes seasonal rental homes, which may explain the discrepancy.
[4] Basements are counted as one story.

Most owner occupied homes statewide are either colonial (39%) or ranch style (37%) residences (Table 2–3). Nearly one-half of the rentals (48%) are colonial homes; and, relative to owner occupied homes, there are fewer ranch-style homes among the rentals (18%). Owner occupied homes in Newport/Derby (73%) and Burlington (59%) are significantly more likely to be colonials than the state as a whole.

Table 2–3: Type of House

(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Colonial	40%	47%	73%	59%	39%	48%
Ranch	50%	29%	23%	22%	37%	18%
Contemporary	5%	6%	0%	4%	11%	12%
Cape	0%	12%	5%	4%	9%	9%
Log Cabin	0%	0%	0%	0%	2%	0%
Duplex	0%	0%	0%	7%	0%	6%
Quad	0%	0%	0%	4%	0%	3%
Other/Missing	5%	6%	0%	0%	1%	3%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Owner occupied homes statewide are, on average, about 60 years old with a median age of 48 years; and rentals are, on average, about 76 years old with a median age of 78 years (Table 2–4). Owner occupied homes in North Chittenden are the newest homes; on average, they are about 39 years old.

Table 2–4: Age of Home

(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Newest	7	7	10	12	5	8
Oldest	98	143	133	128	208	158
Average	39	55	61	56	60	76
Median	37	39	53	57	48	78
Number of Homes	20	17	22	27	123	33

* The average is weighted for the Owner Occupied Statewide column; all other results are unweighted.

Table 2–5 displays the age of owner occupied homes in this study versus the age of owner occupied homes from the 2006 ACS for Vermont. The distribution of homes by age range is very similar.

Table 2–5: Comparison of Home Age from On-site Audits and American Community Survey

Home Age	Owner Occupied Homes	
	On-site Audits*	ACS 2006
1939 or earlier	27%	27%
1940 to 1959	14%	11%
1960 to 1979	22%	27%
1980 to 1989	15%	17%
1990 to 1999	16%	13%
2000 or later	5%	6%
Number of Homes	105	182,389

* On-site data are weighted.

Statewide, the large majority of owner occupied homes (92%) and nearly all the rental homes (97%) are stand-alone properties (Table 2–6). Homes in North Chittenden (20%) and St. Albans (18%) are most likely to be in a housing development.

Table 2–6: Location of Home

(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Housing Development	20%	18%	0%	15%	8%	3%
Stand-alone Property	80%	82%	100%	85%	92%	97%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

The average heated area for owner occupied homes is 2,213 square feet and the median is 2,032 square feet. For rental homes, the average and median is 1,350 square feet (Table 2–7).

Table 2–7: Square Feet of Heated Area

(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Minimum	847	886	1,008	683	683	667
Maximum	3,348	3,103	3,874	3,240	4,550	2,661
Average	1,923	2,092	2,242	1,854	2,213	1,350
Median	1,920	2,080	2,198	1,781	2,032	1,350
Number of Homes	20	17	22	27	123	33

* The average is weighted for the Owner Occupied Statewide column; all other results are unweighted.

Basements. Statewide, more than two out of three owner occupied homes (71%) and rentals (70%) have full basements and 15%-20% of homes have partial basements (Table 2–8). About one-third of the owner occupied homes (35%) and nearly one-half of the rentals (45%) have unconditioned full basements.

Table 2–8: Basement Type

(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
All Full Basements	**70%**	**71%**	**82%**	**81%**	**71%**	**70%**
100% Conditioned	20%	29%	23%	19%	20%	21%
Unconditioned	35%	29%	45%	37%	35%	45%
Partially Conditioned	15%	12%	14%	26%	16%	3%
All Partial Basements	**15%**	**18%**	**18%**	**15%**	**20%**	**15%**
Conditioned	0%	0%	5%	0%	2%	0%
Unconditioned	10%	12%	9%	7%	15%	15%
Partially Conditioned	5%	6%	5%	7%	3%	0%
All No Basement	**15%**	**12%**	**0%**	**4%**	**9%**	**15%**
Crawl space	10%	6%	0%	0%	3%	0%
Slab on Grade	5%	6%	0%	4%	5%	9%
Other	0%	0%	0%	0%	0%	6%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

In owner occupied homes with partially conditioned basements (both full and partial basements), about three-fifths (59%) of the basement area is conditioned and the average basement area is 930 square feet (Table 2–9). In rental homes with partially conditioned basements (both full and partial basements), nearly half (47%) of the basement area is conditioned and the average basement area is 720 square feet.

Table 2–9: Partially Conditioned Basements*

(homes with partially conditioned full basements or partial basements)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide	Statewide
Full - Partially Conditioned	**3**	**2**	**3**	**7**	**21**	**1**
Average Basement Area (sq. ft.)	971	1,243	1,007	708	943	720
Average of % Conditioning	56%	78%	48%	54%	57%	47%
Partial-Partially Conditioned	**1**	**1**	**1**	**2**	**6**	**0**
Average Basement Area (sq. ft.)	1,250	720	1,152	765	885	NA
Average of % Conditioning	50%	50%	75%	73%	64%	NA
All Partially Conditioned	**4**	**3**	**4**	**9**	**27**	**1**
Average Basement Area (sq. ft.)	1,041	1,069	1,043	721	930	720
Average of % Conditioning	55%	69%	54%	58%	59%	47%
Number of Homes	20	17	22	27	123	33

* All results are unweighted.

Home Offices. Twenty percent of owner occupied homes and 6% of rental homes have a dedicated space for running a business or working from home (Table 2–10).

Table 2–10: Home Office

(all homes)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Yes	10%	12%	23%	33%	20%	6%
No	90%	88%	77%	67%	80%	94%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

Eighty-five percent of these home offices are between 100 and 200 square feet in size (Table 2–11).

Table 2–11: Home Office Size

(homes with home offices)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Less than 100 square feet	0	0	2	1	2%	1
100 to 200 square feet	1	1	3	7	85%	1
Over 200 square feet	1	0	0	1	13%	0
Number of Home Offices	2	1	5	9	24	2

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

Swimming Pools. Slightly over one in ten owner occupied homes and 3% of rental homes have a swimming pool; a small number of pools are heated and have timers on their pumps (Table 2–12).

Table 2–12: Swimming Pools

(all homes)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Homes with swimming pools	10%	24%	5%	7%	13%	3%
Homes with heated pools	5%	0%	0%	0%	2%	0%
Homes with pools that have pump timers	0%	12%	5%	0%	5%	0%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

Occupancy. Statewide, nearly every owner occupied home (97%) and all the rental homes (100%) are the primary residence of the owner or tenant, occupied year round[5] (Table 2–13).

Table 2–13: Occupancy

(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Primary	100%	94%	95%	100%	97%	100%
Mainly Winter	0%	0%	0%	0%	2%	0%
Weekends (year round)	0%	6%	5%	0%	1%	0%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

[5] Note that the sample of rental homes includes only those homes rented year-round.

Owner occupied homes have, on average, 2.6 nighttime occupants and 1.4 occupants on workdays (Table 2–14). These figures are consistent with the 2006 ACS, where owner occupied households in Vermont had an average of about 2.5 people. Rental homes statewide have, on average, 2.4 nighttime occupants and 0.9 occupants on workdays.

Table 2–14: Nighttime & Workday Occupants
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Occupants, Nights:						
Average	2.7	2.9	2.3	3.0	2.6	2.4
Median	2	3	2	2	n.a.	2
Occupants, Workdays:						
Average	1.7	1.2	2.0	1.4	1.4	0.9
Median	1	1	2	1	n.a.	1
Number of Homes	20	17	22	27	123	33

* The average is weighted for the Owner Occupied Statewide column; all other results are unweighted.

3 Insulation

The auditors determined the type and thickness of ceiling insulation through visual inspection in about nine out of ten homes; they relied on homeowner reports if visual inspection was not possible. R-values were estimated based on the insulation type and thickness. If the auditor was not reasonably certain of making a reliable estimate, the insulation data field was left blank. In homes with different insulation R-values in different areas, the average R-value was calculated using the method prescribed in the RBES manual.

Wall insulation was visible in less than one-tenth of homes. Therefore, at the majority of homes, the auditor visually determined the wall type and thickness and asked the homeowner about the insulation type and thickness. In many instances (about one-quarter) the homeowner was certain, and that was taken as the correct answer. If the homeowner knew that insulation had been blown into the stud cavities (for about one-tenth to one-fifth of homes), it was clear that the insulation was cellulose and that the thickness was the space of the wall stud cavities. In homes where the wall insulation was not visible and the homeowner did not know about the insulation in walls, the auditor attempted to determine how well the walls were insulated by comparing relative temperatures of the surfaces of exterior and interior walls, as determined by hand contact. On cold days, this method was effective in determining whether there was little or substantial insulation present. Even homeowners who were not certain about insulation thickness usually could confirm the findings of the hand test. With this information the auditor was able to roughly estimate the insulation R-value and make an educated guess at the type.

Because auditors were unable to perform a full visual inspection of insulation in most cases, they were unable to accurately determine the condition of insulation. However, very old houses with balloon construction and accessible knee wall spaces permitted a reasonable visual inspection; in

these cases, the wall insulation was often torn and fallen down in the stud cavities, leaving the upper portions of the walls uninsulated. Ceiling insulation in these homes was often spotty as well unless new insulation had been installed over the original insulation.

3.1 Wall Insulation

Nearly two-thirds of owner occupied existing homes have 2x4 construction for conditioned/ambient walls and about one-quarter use a mixture of 2x4 and 2x6 construction (Table 3–1). Three-quarters of rental homes have 2x4 construction and 21% have 2x6 construction.

Table 3–1: Type of Construction for Conditioned/Ambient Walls
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
2 x 4	65%	76%	77%	78%	63%	76%
2 x 4 and 2 x 6	35%	24%	23%	19%	27%	0%
2 x 6	0%	0%	0%	4%	4%	21%
2 x 8	0%	0%	0%	0%	0%	3%
ICF & 8" CMU	0%	0%	0%	0%	4%	0%
Logs	0%	0%	0%	0%	2%	0%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Over three-fourths of owner occupied homes have fiberglass batts installed in at least some walls and 13% have blown-in cellulose installed in at least some walls. Nearly one-half of rental homes have cellulose insulation in the walls and 36% have batts (Table 3–2). A handful of homes have some type of rigid foam or a combination of fiberglass batts and other insulation.

Table 3–2: Type of Insulation in Conditioned/Ambient Walls
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Fiberglass Batts	80%	76%	50%	74%	69%	36%
Cellulose	5%	18%	23%	15%	11%	48%
None	10%	0%	0%	7%	1%	9%
Rigid Foam	0%	0%	9%	0%	2%	6%
Fiberglass Batts & Cellulose	0%	0%	9%	0%	0%	0%
Fiberglass Batts & None	0%	6%	0%	0%	2%	0%
Log	0%	0%	0%	0%	4%	0%
Panel Construction	5%	0%	0%	0%	3%	0%
2" styrofoam + 4" FB	0%	0%	5%	0%	0%	0%
6" FB + Thermax	0%	0%	5%	0%	0%	0%
Cellulose & None	0%	0%	0%	0%	2%	0%
Fiberglass Batts & Rigid Foam	0%	0%	0%	0%	2%	0%
Fiberglass Batts & Rock Wool	0%	0%	0%	4%	0%	0%
Unknown	0%	0%	0%	0%	2%	0%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

The current RBES minimum for wall insulation in new homes is R-19[6]; about 27% of owner occupied homes and 21% of rental homes meet or exceed this standard (Table 3–3). This figure is highest in the North Chittenden (35%) and Newport/Derby region (32%) and lowest in St. Albans (6%). Nine percent of rental homes and 7%-10% of owner occupied homes in North Chittenden and Burlington have no wall insulation in any walls.

Table 3–3: Ranges of R-value for Insulation in Conditioned/Ambient Walls

(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
No Insulation	10%	0%	0%	7%	1%	9%
Insulation R-Value less than 11.0	10%	24%	9%	19%	30%	24%
Insulation R-Value 11	25%	65%	45%	52%	31%	36%
Insulation R-Value > 11 and <19	20%	6%	14%	4%	11%	9%
Insulation R-Value 19	35%	6%	14%	19%	22%	18%
Insulation R-Value > 19	0%	0%	18%	0%	5%	3%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

For both owner occupied homes and rental homes in Vermont, the average R-value and median insulation R-value for conditioned/ambient walls is about R-12 and R-11, respectively (Table 3–4).

Table 3–4: R-value Statistics for Insulation in Conditioned/Ambient Walls

(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Minimum	0.0	2.8	7.0	0.0	0.0	0.0
Maximum	19.0	19.0	42.0	19.0	42.0	35.0
Average	12.7	10.4	16.4	10.9	11.9	11.7
Median	13.0	11.0	11.0	11.0	11.0	11.0
Number of Homes	20	17	22	27	123	33

* The average is weighted for the Owner Occupied Statewide column; all other results are unweighted.

[6] The current version of RBES applies to new homes built after January 2005. Thus, it does not apply to this sample of existing homes, all of which were built at least five years ago according to the homeowners. However, we believe that RBES provides a useful benchmark with which to compare the results of the onsite inspections, particularly for insulation levels.

Table 3–5 displays the R-value statistics for conditioned/attic walls and conditioned/garage walls. The average wall insulation is about R-9 for attic walls and R-12.5 for garage walls.

Table 3–5: R-value Statistics for Insulation in Conditioned/Attic and Conditioned/Garage Walls

(homes with conditioned/attic or conditioned/garage walls)

	Conditioned/Attic	Conditioned/Garage
	Statewide*	Statewide*
Minimum	0.0	3.0
Maximum	19.0	42.0
Average	9.1	12.5
Median	11.0	11.0
Number of Homes	15	30

* Averages not weighted due to low sample sizes.

3.2 Ceiling Insulation

About one-half of existing homes in Vermont have only flat ceilings with all joists covered with insulation. One in five homes have covered flat joists and cathedral ceilings (Table 3–6). The ceilings in the remaining homes are uncovered flat joists and/or cathedral ceilings.

Table 3–6: Type of Construction for Ceilings

(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Flat joists covered	60%	41%	68%	48%	48%	55%
Flat joists covered & Cathedral	5%	18%	9%	15%	21%	18%
Flat joists NOT covered	30%	29%	18%	26%	13%	9%
All Cathedral	5%	0%	0%	4%	9%	3%
Flat joists NOT covered & Cathedral	0%	6%	5%	4%	7%	9%
Flat joists NOT covered & Flat joists covered	0%	6%	0%	4%	3%	3%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Slightly over one-half of owner occupied homes and nearly three-quarters of rental homes have no vapor barriers in the ceilings (Table 3–7).

Table 3–7: Vapor Barriers in Ceilings
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
No Ceiling Areas	70%	47%	77%	56%	56%	73%
All Ceiling Areas	30%	35%	23%	37%	30%	18%
Some Ceiling Areas	0%	18%	0%	7%	12%	3%
Unable to Determine	0%	0%	0%	0%	2%	3%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

3.2.1 Flat Ceilings

Table 3–8 displays the type of construction for flat ceilings. Sixty percent of owner occupied homes with flat ceilings have 2x6 construction and 29% have 2x8 construction. Forty-five percent of rental homes are 2x6 construction and 39% are 2x8 construction.

Table 3–8: Type of Construction for Flat Ceilings
(homes with flat ceilings)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
2 x 4	5%	12%	0%	0%	1%	0%
2 x 6	42%	53%	68%	46%	60%	45%
2 x 8	42%	18%	23%	46%	29%	39%
2 x 10	0%	18%	9%	8%	6%	13%
Truss	11%	0%	0%	0%	3%	3%
Number of Homes	19	17	22	26	117	31

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Most owner occupied homes have only fiberglass insulation in the flat ceilings (59%), followed by only cellulose (30%) (Table 3–9). Rental homes also predominantly have only fiberglass insulation (45%) or only cellulose (39%).

Table 3–9: Type of Insulation in Flat Ceilings

(homes with flat ceilings)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Fiberglass Batts	42%	35%	41%	58%	59%	45%
Cellulose	53%	29%	45%	27%	30%	39%
Blown-in Fiberglass	0%	18%	5%	8%	2%	0%
Fiberglass Batts & Cellulose	5%	0%	5%	4%	3%	6%
Rock Wool	0%	0%	5%	0%	5%	3%
Fiberglass Batts & Rock Wool	0%	6%	0%	0%	0%	0%
Cellulose & Vermiculite	0%	0%	0%	4%	0%	0%
Rigid Foam	0%	0%	0%	0%	0%	3%
None	0%	6%	0%	0%	0%	0%
Unknown	0%	6%	0%	0%	0%	3%
Number of Homes	19	17	22	26	117	31

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

The current RBES minimum for flat ceilings in new homes is R-38[7]; only 9% of owner occupied homes and 16% of rental homes exceed this standard (Table 3–10). One home in St. Albans has no insulation in the flat ceiling.

Table 3–10: Ranges of R-value for Insulation in Flat Ceilings

(homes with flat ceilings)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
No Insulation	0%	6%	0%	0%	1%	0%
R-11 or Less	5%	6%	0%	0%	3%	0%
R-11 to R-19	32%	47%	32%	27%	32%	26%
R-19 to R-30	21%	18%	36%	42%	34%	45%
R-30 to R-38	26%	6%	27%	15%	21%	10%
Over R-38	16%	12%	5%	15%	9%	16%
Unknown	0%	6%	0%	0%	1%	3%
Number of Homes	19	17	22	26	117	31

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

[7] As noted earlier, the current RBES requirements do not apply to this sample of existing homes but do provide a useful benchmark.

Table 3–11 displays the R-value statistics for flat ceiling insulation. The average R-value for flat ceiling insulation in owner occupied homes is about R-27 and for rental homes is R-29.

Table 3–11: R-value Statistics for Insulation in Flat Ceilings
(homes with flat ceilings)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Minimum	10.6	0.0	15.0	15.0	0.0	11.5
Maximum	60.0	46.0	54.0	54.0	60.0	58.0
Average	30.4	22.8	28.6	29.2	26.9	29.2
Median	30.0	19.0	30.0	29.2	30.0	25.5
Number of Homes	19	16	22	26	116	31

* The average is weighted for the Owner Occupied Statewide column; all other results are unweighted.

3.2.2 Cathedral Ceilings

Forty percent of owner occupied homes and five of ten rental homes with cathedral ceilings utilize 2x8 construction (Table 3–12). Forty-three percent of owner occupied homes with cathedral ceilings utilize 2x6 construction.

Table 3–12: Type of Construction for Cathedral Ceilings*
(homes with cathedral ceilings)

	Owner Occupied	Rentals
	Statewide	Statewide
2 x 6	39%	2
2 x 8	45%	5
2 x 10	13%	2
2 x 12	0%	1
Truss	3%	0
Number of Homes	31	10

* Results not weighted.

Fiberglass batts is the predominant insulation in cathedral ceilings, installed in over three-quarters of owner occupied homes and nine of ten rental homes (Table 3–13).

Table 3–13: Type of Insulation in Cathedral Ceilings*

(homes with cathedral ceilings)

	Owner Occupied	Rentals
	Statewide	Statewide
Fiberglass Batts	68%	9
Cellulose	16%	0
Panel Construction	6%	0
Fiberglass Batts & Cellulose	3%	0
Fiberglass Batts & Rigid Foam	3%	0
Rock Wool	0%	1
Unknown	3%	0
Number of Homes	31	10

* Results not weighted.

All homes with cathedral ceilings have insulation installed (Table 3–14). However, only 9% of the owner occupied homes and two of ten rental homes with cathedral ceilings meet or exceed the current RBES standard of R-30 insulation in new homes.[8]

Table 3–14: Ranges of R-value for Insulation in Cathedral Ceilings*

(homes with cathedral ceilings)

	Owner Occupied	Rentals
	Statewide	Statewide
No Insulation	0%	0
R-11 or Less	13%	1
R-11 to R-19	45%	3
R-19 to R-30	26%	4
R-30	6%	1
Over R-30	3%	1
Unknown	6%	0
Number of Homes	31	10

* Results not weighted.

[8] As noted earlier, the current RBES requirements do not apply to this sample of existing homes but do provide a useful benchmark.

Table 3–15 displays the R-value statistics for cathedral ceiling insulation. The average R-value is almost R-21 for owner occupied homes and R-23 for rental homes.

Table 3–15: R-value Statistics for Insulation in Cathedral Ceilings*
(homes with cathedral ceilings)

	Owner Occupied	Rentals
	Statewide	**Statewide**
Minimum	5.0	11.0
Maximum	38.0	36.0
Average	20.8	23.0
Median	19.0	24.0
Number of Homes	29	10

* Results not weighted.

3.3 Floor Insulation

RBES[9] requires insulation levels of R-30 for floors over unconditioned spaces[10] in new homes, and none of the owner occupied homes with floors over unconditioned spaces met this standard. Of the 59 owner occupied homes with floors over unconditioned basements, 21% of the floors were insulated (Table 3–16). Twenty-two percent of the 27 homes with floors over partially conditioned basements have insulation and 61% of the homes with floors over crawl spaces have insulation installed (average R-value of R-16). All ten homes with floors over garages contained insulation, with an average R-value of R-12.

A total of eight owner occupied homes have crawl spaces as the predominant type of foundation: three homes have insulation in the floors (two R-19 fiberglass, one R-14 rigid foam), one home has R-7 rigid foam insulation on the foundation walls, and four homes have no insulation on either the floor or the foundation walls.

[9] As noted earlier, the current RBES requirements do not apply to this sample of existing homes but do provide a useful benchmark.

[10] The RBES manual defines unconditioned space as 'Spaces enclosed within buildings that do not fall under the definition of "conditioned space." For example: garages separated from the house by insulated walls and/or ceilings; attics separated from the house by insulated floors; and basements and crawlspaces with insulated ceilings'. However, auditors defined conditioned space as intentionally heated space.

RBES requires insulation levels of R-38 for floors over outside space in new homes. All seven homes with conditioned/outside floors contained insulation, though none met the RBES requirement.

Table 3–16: Floor Insulation in Owner occupied Homes

(owner occupied homes with various floor configurations)

	Floor Over Conditioned Basement	Floor Over Unconditioned Basement*	Floor Over Partially Conditioned Basement	Floor Over Crawl Space	Floor Over Garage	Exposed Floor-Conditioned/ Outside
RBES Minimum	None	R-30	R-30	R-30	R-30	R-38
Percent Insulated	19%	21%	22%	61%	100%	7
Number of Homes with Known Insulation R-Value	5	6	6	19	10	7
Average R-Value of Insulated Floors	16.6	12.5	17.0	15.8	12.2	16.7
Percent Meeting Code	NA	0%	0%	0%	0%	0%
Number of Homes	27	59	27	33	10	7

* 'Percent Insulated' results for the 'Floor over Unconditioned Basement' column are weighted; all other results are unweighted.

Table 3–17 displays the floor insulation levels for rental homes. Of the 20 rental homes with floors over unconditioned basements, only 10% had insulation installed. None of the rental homes met the RBES requirement for floor insulation levels.

Table 3–17: Floor Insulation in Rental Homes
(rental homes with various floor configurations)

	Floor Over Conditioned Basement	Floor Over Unconditioned Basement	Floor Over Partially Conditioned Basement	Floor Over Crawl Space	Floor Over Garage	Exposed Floor-Conditioned/ Outside
RBES Minimum	None	R-30	R-30	R-30	R-30	R-38
Percent Insulated	0	10%	0	3	1	1
Number of Homes with Known Insulation R-Value	0	1	0	3	1	1
Average R-Value of Insulated Floors	NA	14.0	NA	19.0	19.0	19.0
Percent Meeting Code	NA	0%	0%	0%	0%	0%
Number of Homes	7	20	1	7	2	1

3.4 Foundation Walls and Slabs

Foundation walls in new homes which are 50% or more above grade are required by RBES to have insulation levels of R-19 or greater (Table 3–18). About one-half of owner occupied homes with these foundation walls have insulation, though only 7% meet the RBES requirement.

Table 3–18: Foundation Wall Insulation for Homes with Foundation Walls >50% Above Grade
(homes with foundation walls >50% above grade)

	Owner Occupied*	Rentals
	Statewide	**Statewide**
Percent of Homes with No Insulation	47%	2
Percent of Homes with R-19 or Higher	7%	1
Number of Homes	30	3

* Results not weighted.

Of those homes with insulated foundation walls, most have fiberglass batts (Table 3–19). Of the 16 owner occupied homes with insulated foundation walls, twelve had 2x4 stud framing installed on the inside of the foundation walls with fiberglass batts, usually without a vapor barrier. In owner occupied homes, the average and median R-value is about R-11.

Table 3–19: Foundation Wall Insulation Type and Level for Homes with Insulation for Foundation Walls >50% Above Grade*

(homes with insulated >50% above grade foundation walls)

	Owner Occupied*	Rentals
	Statewide	**Statewide**
Insulation Type		
Fiberglass Batts	12	1
Rigid Foam	3	0
Panel Construction	1	0
Insulation Level		
Minimum	4.9	19.0
Maximum	27.0	19.0
Average	11.1	19.0
Median	11.0	19.0
Number of Homes	16	1

* Results not weighted.

Thirty-six of the 103 owner occupied homes with foundation walls less than 50% above grade had insulated foundation walls; one-half of these 36 homes had fiberglass batts and 42% had rigid foam. The average R-value of insulation is about R-9 and the median is R-10.

Slab Insulation. Auditors were able to determine the type and R-value of slab insulation for only seven homes. In all cases the type of insulation was R-14 urethane foam board.

4 Windows and Doors

Double pane windows (27%) and a combination of single pane[11] and double windows (32%) are the most common type of windows installed in owner occupied homes (Table 4–1). Seven percent of owner occupied homes and 30% of rental homes only have single pane windows installed. An additional 45% of owner occupied homes and 27% of rental homes have at least some single pane windows installed.

[11] Single pane windows with storm windows are considered single pane.

Statewide, one-half of the owner occupied homes (50%) have at least some Low-e windows—either exclusively or in combination with clear windows. In contrast, significantly fewer rentals (21%) have any Low-e windows.

Table 4–1: Types of Windows
(all homes)

	Owner Occupied					Rentals
	North Chittenden	**St. Albans**	**Newport/ Derby**	**Burlington**	**Statewide***	**Statewide**
Single Pane & Double Pane (clear)	35%	53%	41%	22%	32%	24%
Double Pane (clear) Only	25%	6%	14%	19%	27%	24%
Single Pane & Double Pane low e	0%	18%	18%	19%	7%	3%
Double Pane low e Only	10%	12%	0%	7%	17%	18%
Double Pane (clear) & Double Pane low e	15%	6%	5%	11%	5%	0%
Single Pane & Double Pane (clear) & Double Pane low e	5%	6%	18%	4%	6%	0%
Single Pane Only	5%	0%	5%	15%	7%	30%
Double Pane (clear) & Double Pane low e Argon	5%	0%	0%	0%	1%	0%
Double Pane (clear) & Triple Pane (clear)	0%	0%	0%	4%	0%	0%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Double pane clear windows account for 44% of total glass area in owner occupied homes, double pane low-e windows account for 28%, and single pane windows account for 26% (Table 4–2).

In these owner occupied homes, nearly four-fifths (77%) of the total square footage of all types of window glass does not have storm windows, because they are mostly double pane windows. However, about four-fifths (78%) of the total square footage of single pane windows has storm windows.

Wood frames are associated with close to three-fourths (72%) of the total square feet of window glass in owner occupied homes, and most of the remaining total glass area is associated with vinyl frames in double pane windows (25%). Practically all (97%) of the total area of single pane windows is associated with wood frames; whereas about two-thirds of the total area of double pane clear windows (65%) and double pane Low-e windows (65%) is associated with wood frames.

Table 4–2: Characteristics by Window Types – Owner Occupied Homes*

(owner occupied homes)

	Double Pane (clear)	Double Pane Low-e	Double Pane Low-e Argon	Single Pane	Three Pane (clear)	Total
Percent of Homes With Window Type	72%	37%	1%	60%	1%	
Percent of total glass area	44%	28%	1%	26%	0%	100%
Storm Windows: Percent of total glass area…						
With storm windows	3%	4%	0	78%	0	23%
Without storm windows	97%	96%	1	22%	1	77%
Window Frames: Percent of total glass area …						
Metal Frame	0%	5%	0	1%	0	2%
Vinyl Frame	34%	30%	1	0%	1	25%
Wood Frame	65%	65%	0	97%	0	72%
Unknown Frame	1%	0%	0	2%	0	1%
Number of Homes	103	52	1	93	1	123

* Results not weighted.

In rentals, double pane clear windows account for 28% of total glass area and single pane windows account for 45% of total glass area (Table 4–3). Overall, the total square footage of window glass in rentals is about evenly split between the area with (48%) and without (52%) storm windows, due to the predominance of single pane windows with storm windows.

Wood frames are associated with close to three-fourths (71%) of the total square footage of window glass in rentals, and most of the remaining total glass area is associated with vinyl frames (28%). Practically all (99%) of the total area of single pane windows is associated with wood frames; whereas 41% of the total area of double pane clear windows and 56% of the total area of double pane Low-e windows is associated with wood frames. Most of the remaining total glass area of double pane clear (59%) and double pane Low-e (44%) windows is associated with vinyl frames.

Table 4–3: Characteristics by Window Types -- Rentals
(rental homes)

	Double Pane (clear)	Double Pane Low-e	Single Pane	Total
Percent of Homes With Window Type	45%	21%	58%	
Percent of total glass area	28%	27%	45%	100%
Storm Windows: Percent of total glass area…				
With storm windows	19%	3%	93%	48%
Without storm windows	81%	97%	7%	52%
Window Frames: Percent of total glass area …				
Metal Frame	0%	0%	1%	1%
Vinyl Frame	59%	44%	0%	28%
Wood Frame	41%	56%	99%	71%
Unknown Frame	0%	0%	0%	0%
Number of Homes	15	7	19	33

On average, slightly over one-tenth of the exterior wall area in homes is glazed—in both owner occupied homes (13%) and rentals (11%) (Table 4–4). The RBES requirement for glazing percentage in new homes varies from 12% to 18%, depending upon the other features incorporated into the home and the compliance path followed.[12]

Table 4–4: Glazing Percentage of Exterior Wall Area*
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide**	Statewide
Minimum	9%	5%	8%	7%	3%	4%
Maximum	24%	18%	21%	20%	24%	16%
Average	14%	11%	11%	11%	13%	11%
Median	14%	11%	11%	10%	12%	12%
Number of Homes	20	17	22	27	123	33

* All non-unconditioned-basement window area as a percentage of wall area.
** The average is weighted for the Owner Occupied Statewide column; all other results are unweighted.

Owner occupied homes tend to have a higher glazing percentage than rentals, as 26% of owner occupied homes statewide have windows constituting a 16% or higher ratio of window-to-wall area (Table 4–5). In contrast, a miniscule fraction (3%) of the rentals have windows constituting a 16% or higher ratio of window-to-wall area. Conversely, windows constitute a 15% or lower ratio of window-to-wall area in about four out of five of owner occupied homes (74%) as compared with nearly all of the rentals (97%).

Table 4–5: Statewide Glazing Area Window-to-Wall Area Ratio*
(all homes)

	Owner Occupied	Rentals
	Statewide	Statewide
Less than 10%	23%	42%
10 to 12%	30%	12%
13 to 15%	21%	42%
16 to 20%	23%	3%
More than 20%	3%	0%
Minimum	3%	4%
Maximum	24%	16%
Average	13%	11%
Median	12%	12%
Number of Homes	123	33

*All non-unconditioned-basement windows area as a percentage of wall area.
* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

[12] As noted earlier, the current RBES requirements do not apply to this sample of existing homes but do provide a useful benchmark.

4.1 Doors

About one-half of exterior doors in owner occupied homes are of wooden panel construction and one-quarter of doors are either hollow core or solid core doors (Table 4–6). Most of the doors in rental homes are panel doors (82%). One-half of doors are insulated and roughly one-half have storm doors. About three-quarters of doors contain glass, with just over one-half of these doors having double pane glass.

Table 4–6: Door Type & Features
(all homes)

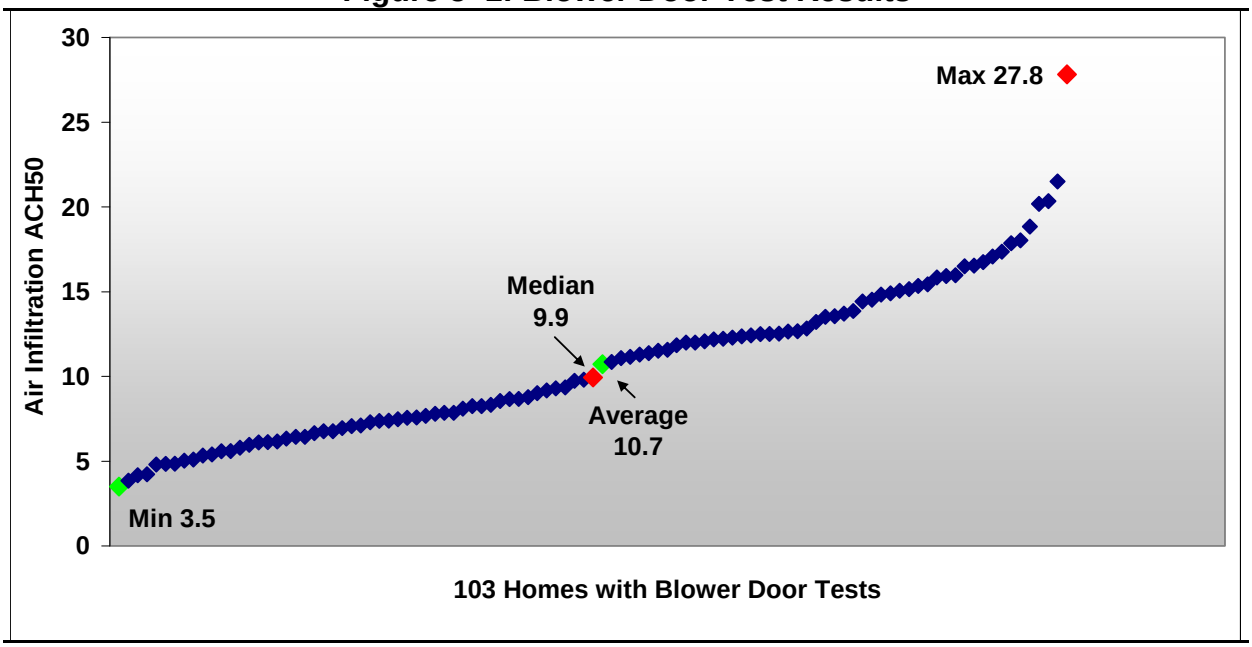
	Owner occupied Homes*	Rentals
	Statewide	**Statewide**
Door Type		
Hollow Core Doors	23%	8%
Panel Doors	53%	82%
Solid Core Doors	24%	10%
Door Features		
Insulated	53%	52%
Storm	43%	57%
With Glass	72%	80%
Number of Doors	**251**	**61**

* Results not weighted.

5 Building Shell Leakage

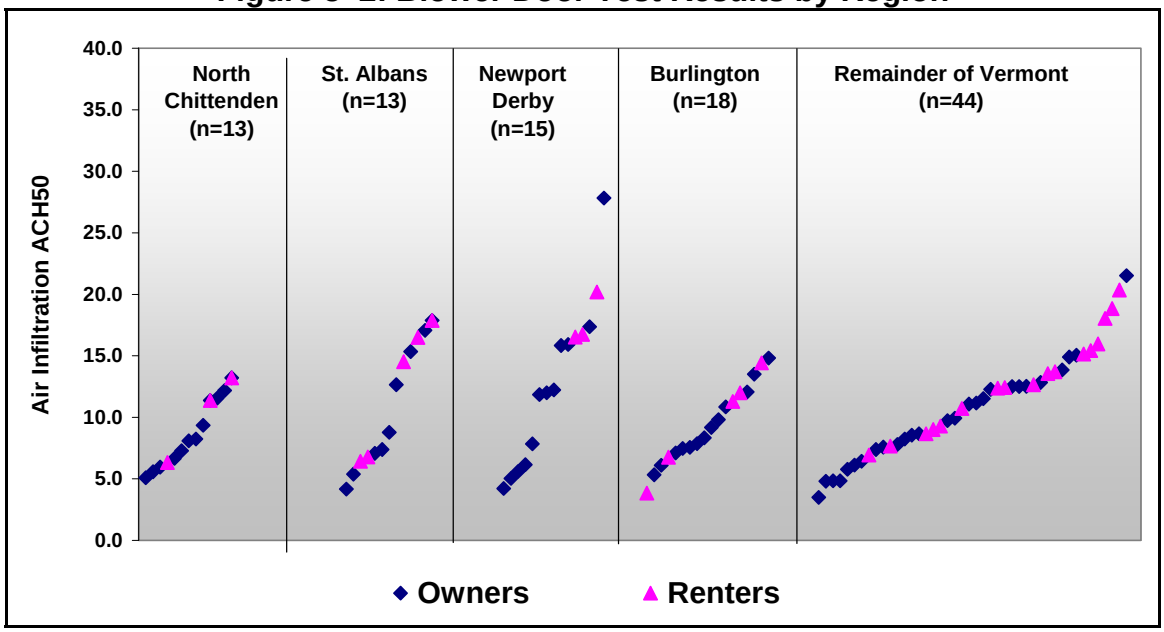
A sample of 103 homes were subjected to blower door tests of air infiltration at 50 Pascals. The test results yielded an average of 10.7 air changes per hour (ACH50) statewide, with a median of 9.9 ACH50 (Figure 5–1). As a point of comparison, the ENERGY STAR homes program requires newly constructed homes in Vermont to have less than 5.0 ACH50.

Figure 5–1: Blower Door Test Results



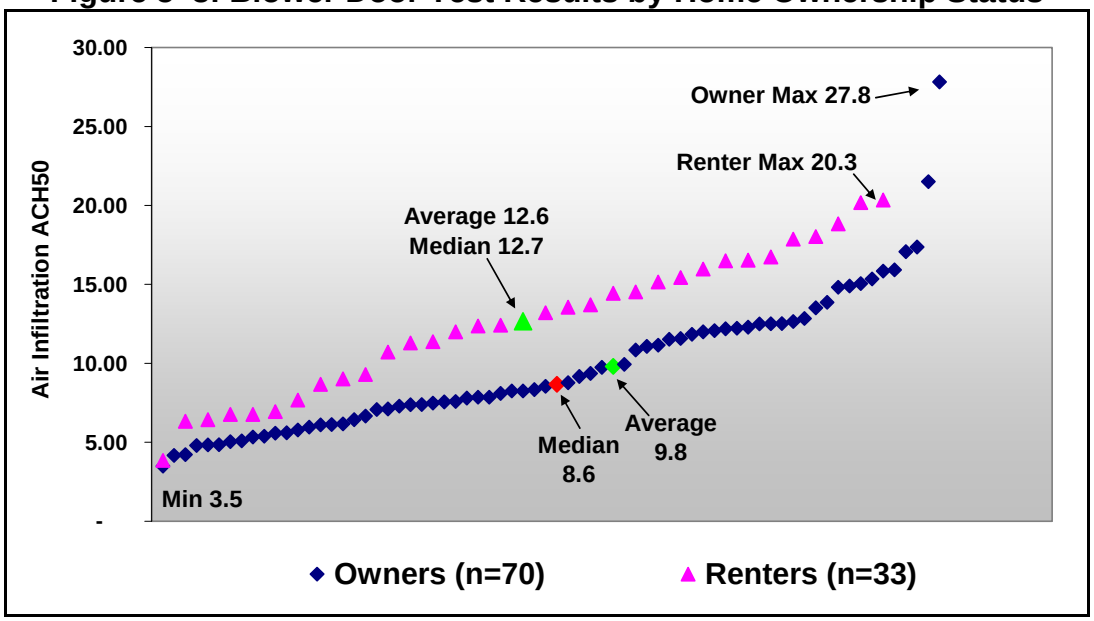
The sample of homes in North Chittenden were the most air tight on average (average 8.5 ACH50, median 8.1 ACH50); and those in Newport/Derby were the least air tight (average 13.0 ACH50, median 12.2 ACH50) (Figure 5–2). In the St. Albans sample, the test results yielded an average of 10.8 and a median of 8.8 air changes per hour. In the Burlington sample, the test results yielded an average of 9.4 and a median of 8.8 air changes per hour.

Figure 5–2: Blower Door Test Results by Region



Owner occupied homes are, on average, more air tight than the rental homes. In the sample of owner occupied homes, the test results yielded an average of 9.8 and a median of 8.6 air changes per hour (Figure 5–3). In the sample rentals, the test results yielded an average of 12.6 and a median of 12.7 air changes per hour.

Figure 5–3: Blower Door Test Results by Home Ownership Status



6 Heating and Air Conditioning

Statewide, about three out of five homes—both owner occupied and rentals—depend on oil as the primary heating fuel; about one in five owner occupied homes and one in four rentals use natural gas as the primary heating fuel (Table 6–1). North Chittenden (60%) and Burlington (89%) are significantly more likely than the state as a whole to have gas as the primary heating fuel, due to the greater availability of utility gas.

Table 6–1: Primary Heating Fuel
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Oil	30%	65%	77%	11%	59%	58%
Natural Gas	60%	29%	0%	89%	19%	24%
Propane	5%	0%	9%	0%	7%	12%
Wood	0%	6%	9%	0%	13%	6%
Pellets	0%	0%	5%	0%	0.1%	0%
Coal	0%	0%	0%	0%	2%	0%
Kerosene	5%	0%	0%	0%	0.5%	0%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

The distribution of heating fuels from the onsite homes is similar to the distribution from the 2006 ACS for Vermont, with 59% of homes from each source being heated by fuel oil. However, the on-site audits yielded more homes with natural gas (19% vs. 12%) and fewer homes with bottled gas (7% vs. 15%).

Table 6–2 displays the type of heating systems installed in the homes. Forty-three percent of owner occupied homes have a sole boiler, while about 20% have a boiler plus another system or a furnace. In rental homes, 42%-45% have a single boiler or furnace installed.

Table 6–2: Type of Heating Systems
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Boiler	35%	47%	27%	48%	43%	42%
Boiler plus Non-Boiler System	15%	18%	14%	11%	20%	3%
Furnace	25%	24%	36%	30%	19%	45%
Furnace plus Non-Furnace System	15%	6%	14%	7%	11%	6%
Boiler and Furnace	0%	0%	5%	4%	2%	0%
Stove or Stove & Elect Resistance	10%	6%	5%	0%	6%	3%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Table 6–3 displays the type of heating system for those homes with only one heating system. Two-thirds of these owner occupied homes have hot water boilers, and about one-third have furnaces. Slightly over one-half of these rental homes have furnaces, and 44% have hot water boilers.

Table 6–3: Type of Single Major Heating System
(homes with a single major heating system)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Hot Water Boiler	7	5	5	10	64%	44%
Hydro-Air Boiler	1	0	0	0	1%	0%
Steam Boiler	0	0	0	0	4%	4%
Furnace	4	4	7	6	31%	52%
Stove	1	0	0	0	1%	0%
Number of Homes	13	9	12	16	71	27

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Statewide, about two-thirds of boilers and furnaces are located in unconditioned spaces (Table 6–4).

Table 6–4: Location of Heating System
(homes with boilers or furnaces)

	Owner Occupied*		Rentals	
	Boiler	**Furnace**	**Boiler**	**Furnace**
Conditioned Space	31%	30%	27%	41%
Unconditioned Space	69%	70%	73%	59%
Number of Heating Systems	74	46	15	17

* Results not weighted.

The average age of boilers and furnaces is 13 years and 14 years, respectively; the median age is eight or ten years for boilers and ten years for furnaces (Table 6–5).

Table 6–5: Age of Heating System
(homes with boilers or furnaces)

	Owner Occupied*		Rentals	
	Boiler	**Furnace**	**Boiler**	**Furnace**
Minimum	1	1	2	2
Maximum	40	58	50	30
Average	13	14	13	14
Median	10	10	8	10
Number of Heating Systems	73	41	14	17

* Results not weighted.

Table 6–6 displays the efficiency of heating systems; note that these efficiencies include AFUE, manufacturer rated efficiency, and capacity calculations.[13] The average efficiency rating for heating systems in owner occupied homes was 82%-85% for boilers and 83%-86% for furnaces.

Table 6–6: Steady-State Efficiency of Heating System for Owner Occupied Homes*

(homes with boilers or furnaces with efficiency data)

	Boiler		Furnace	
	Oil	Gas	Oil	Gas
Minimum	68%	78%	78%	67%
Maximum	88%	95%	85%	94%
Average	82%	85%	83%	86%
Median	83%	84%	83%	89%
Number of Heating Systems	39	28	22	19

* Averages not weighted.

The average steady-state efficiency rating for heating systems in rental homes was 80%-84% for boilers and 82%-87% for furnaces (Table 6–7).

Table 6–7: Steady-state Efficiency of Heating System for Rental Homes

(homes with boiler or furnaces with efficiency data)

	Boiler		Furnace	
	Oil	Gas	Oil	Gas
Minimum	56%	80%	79%	82%
Maximum	87%	87%	84%	92%
Average	80%	84%	82%	87%
Median	83%	83%	82%	88%
Number of Heating Systems	8	6	10	6

6.1 Temperatures and Controls

Statewide, close to three out of four owner occupied homes (71%) and about four out of five rentals (79%) have manual thermostats (

[13] Auditors generally collected the data according to a hierarchy with AFUE first, manufacturer rated efficiency next and input over output last. About one-quarter of units had AFUE ratings posted, another one-quarter had manufacturers efficiency on the nameplate, and about one-third had only input and output capacity ratings available. The remainder did not have enough information to determine the unit efficiency. It is important to distinguish the rated efficiencies reported in this study from operating efficiencies. Units that are not periodically checked and tuned may operate at reduced efficiencies; RLW found that a little over one-half of the heating systems had been checked by a service technician within the last five years or so. Most of those with service tags on them indicated post tune-up operating efficiencies close to the rated efficiencies, as determined by the flue gas temperature and CO2 tests performed.

Table 6–8). Programmable thermostats are installed in about one in four owner occupied homes (24%) and nearly one in five rentals (18%) statewide. Among owner occupied homes, those in Burlington (52%) are significantly more likely than the state as a whole to have programmable thermostats; and those in Newport/Derby (9%) are significantly less likely to do so.

Table 6–8: Type of Thermostat
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Programmable	35%	24%	9%	52%	24%	18%
Electronic Non-programmable	5%	0%	0%	0%	1%	3%
Manual	55%	76%	86%	48%	71%	79%
Don't know / Other	0%	0%	0%	0%	2%	0%
None	5%	0%	5%	0%	3%	0%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Statewide, nearly three out of five owner occupied homes (57%) and about two out of five rentals (42%) use their thermostats to setback the temperature at night (Table 6–9). Among owner occupied homes, significantly fewer residents (28%) setback the thermostat temperature in the daytime.

Table 6–9: Temperature Setback Use
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Nighttime	55%	65%	45%	56%	57%	42%
Daytime	35%	35%	14%	33%	28%	36%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Statewide, the preferred temperature for homeowners, across regions and home ownership status, is 68° Fahrenheit (Table 6–10).

Table 6–10: Preferred Indoor Temperature (° Fahrenheit)
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Preferred Temperature						
Average	68	68	68	67	68	68
Median	68	68.5	68	68	68	68

Number of Homes	20	17	22	27	123	33

* The average is weighted for the Owner Occupied Statewide column; all other results are unweighted.

Statewide, about one-third of owner occupied homes have one thermostat (30%) and one zone (32%) (Table 6–11). Thirty-six percent of owner occupied homes have two thermostats and 29% have two zones. In contrast, 82% of rentals have a single thermostat and 67% have a single zone.

Table 6–11: Number of Thermostats & Control Zones
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Number of Thermostats						
None	0%	0%	5%	0%	4%	0%
One	50%	47%	45%	48%	30%	82%
Two	20%	18%	27%	26%	36%	12%
Three	30%	29%	23%	22%	17%	6%
Four or more	0%	6%	0%	4%	13%	0%
Number of Control Zones						
None	0%	0%	5%	0%	0%	0%
One	50%	47%	45%	48%	32%	67%
Two	20%	12%	23%	22%	29%	24%
Three	30%	35%	27%	26%	24%	6%
Four or more	0%	6%	0%	4%	15%	3%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

6.2 Supplemental Heating Systems

Statewide, two out of three owner occupied homes (67%) and about four out of five rentals (82%) have no fireplace (Table 6–12). Significantly fewer owner occupied homes in Newport/Derby are likely to have fireplaces (14%) than the state as a whole (33%).

Table 6–12: Number of Fireplaces
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
None	55%	76%	86%	56%	67%	82%
One	45%	24%	9%	41%	29%	12%
Two or more	0%	0%	5%	4%	4%	6%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Statewide, substantially more owner occupied homes (57%) than rentals (24%) have a single fireplace or stove (Table 6–13). Wood is the fuel for most fireplaces or stoves.

Table 6–13: Fireplaces or Stoves & Fuel Used

(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Number of Fireplaces/Stoves						
None	35%	65%	41%	48%	34%	70%
One	60%	35%	50%	48%	57%	24%
Two or more	5%	0%	9%	4%	9%	6%
Number of Homes	20	17	22	27	123	33
Fireplace/ Stove Fuel**						
Natural gas	5	1	0	8	11%	2
Oil	0	0	1	0	0%	0
Propane	2	0	1	0	5%	0
Wood	6	6	11	6	85%	8
Number of Fireplaces/Stoves	13	7	13	14	73	10

* Results for the Owner Occupied Statewide data are weighted; all other results are unweighted.
** Because of small sample sizes, unweighted counts are shown for these results

Statewide, around four out of five owner occupied homes (78%) and rentals (85%) do not have any portable space heaters (Table 6–14). Among those that do, the majority are electric space heaters.

Table 6–14: Portable Space Heaters & Fuel Used

(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Number of Portable Space Heaters						
None	80%	88%	86%	85%	78%	85%
One	20%	12%	14%	7%	22%	12%
Two	0%	0%	0%	7%	0%	3%
Number of Homes	20	17	22	27	123	33
Space Heater Fuel**						
Electric	3	2	3	4	91%	5
Propane	1	0	0	0	9%	0
Number of Space Heaters	4	2	3	4	22	5

* Results for 'Number of Portable Space Heaters' for the Owner Occupied Statewide data are weighted; all other results are unweighted.
** Because of small sample sizes, unweighted counts are shown for these results

6.3 Air Conditioning

Statewide, about one in three owner occupied homes (34%) and two out of five rentals (42%) have a window air conditioning unit (Table 6–15). Most of these owner occupied homes (23%) and rentals (27%) have a single window air conditioner.

Table 6–15: Number of Window Air Conditioning Units*
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide**	Statewide
None	45%	71%	82%	67%	66%	58%
Have at least one unit	55%	29%	18%	33%	34%	42%
One	30%	12%	18%	15%	23%	27%
Two	15%	12%	0%	7%	7%	12%
Three or more	10%	6%	0%	11%	4%	3%
Number of Homes	20	17	22	27	123	33

* Includes one portable AC unit
* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

In the homes that do have window air conditioning units, there are an average of about 1.5 units per home with an average age of four to five years old (Table 6–16). The average size of the units is 0.7 to 1.0 tons and they have an average efficiency level of 9.7 EER.

Table 6–16: Characteristics of Window Air Conditioning Units*
(all homes with window air conditioning unit information)

	Owners	Renters
Average number of units	1.6 (n=41)	1.5 (n=14)
Average age of units (years)	5.5 (n=34)	4.3 (n=13)
Average size (tons)	1.0 (n=38)	0.7 (n=14)
Average efficiency (EER)	9.7 (n=31)	9.7 (n=12)

* Includes one portable AC unit
** Unweighted data

Only two homes have central air conditioning—one has a three ton, 11.9 SEER unit that is thirteen years old and the other has a 2.5 ton, 10.0 SEER unit that is three years old.

6.4 Ducts

Of the 156 homes audited, 57 (37%) have ducts installed in the home. Of these 57 homes with ductwork, about 70% have duct runs in unconditioned space. (Table 6–17)

Table 6–17: Location of Ducts
(all homes with ducts)

	Owner occupied Homes*	Rentals
	Statewide	Statewide
Attic	2%	0%
Conditioned Space	27%	31%
Unconditioned Space	70%	69%
Number of Homes	44	13

* Results not weighted.

Duct seams were sealed in only seven of the forty homes with ducts in unconditioned space.[14] Five of these seven homes had duct runs in unconditioned space: three with sealed supply and return ducts (two with mastic, one with duct tape), one with sealed supply ducts using PS tape, and one with only some supply ducts sealed with PS tape.

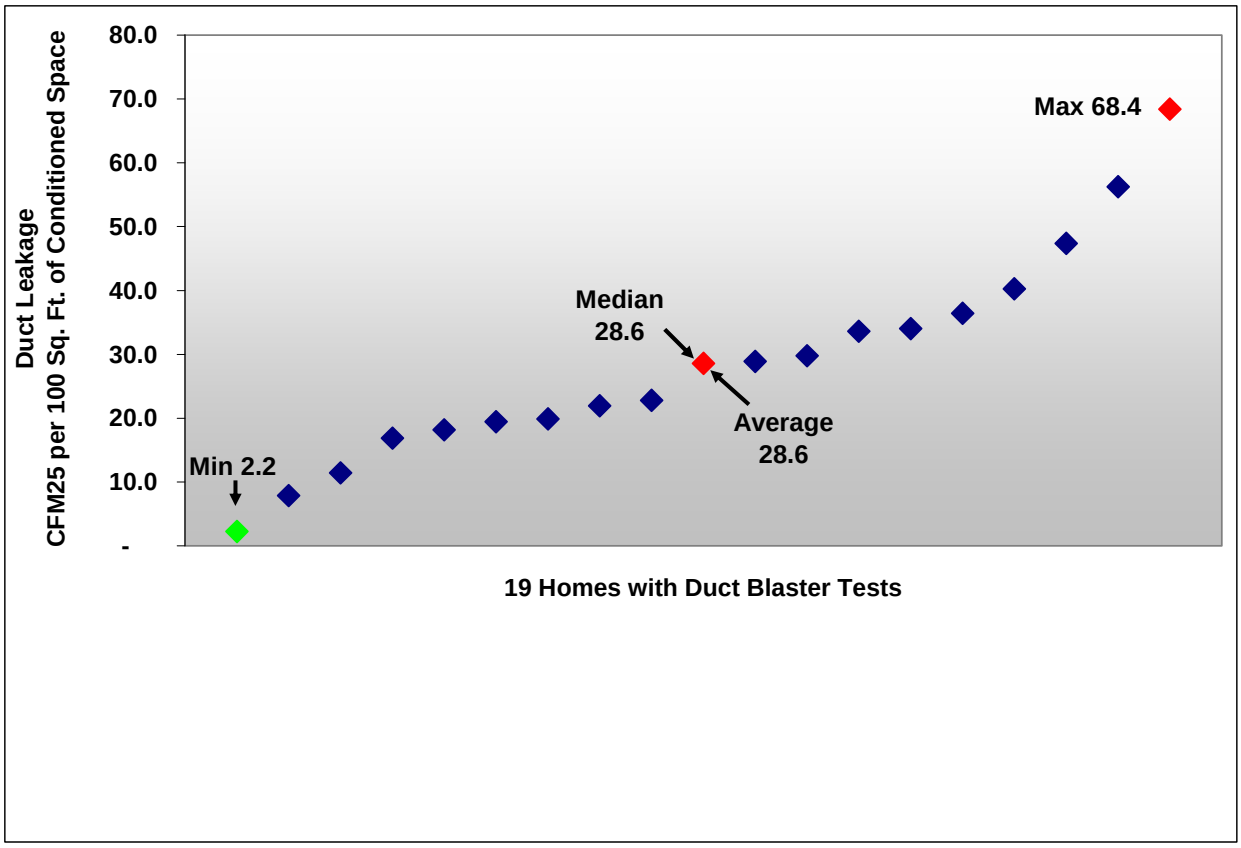
Ducts were insulated in only four of the forty homes with ducts in unconditioned space.[15] In the home with ducts located in the attic, both supply and return ducts had two-inch (R-5) insulation. In one of the homes with ducts in unconditioned space, some of the supply and return ducts had R-7 internal insulation.

[14] RBES requires that ducts installed in unconditioned spaces in new homes be sealed using mastic with a fibrous backing tape.

[15] RBES requires that ducts installed in unconditioned spaces in new homes be insulated to R-5, except for return ducts in unconditioned basements which require R-3.3.

Figure 6–18 displays the result of duct blast testing at 19 owner occupied homes. The average and median duct leakage was 28.6 CFM25 per 100 square feet of conditioned space. To put this in perspective, the requirement for ENERGY STAR new homes in Vermont is less than 4.0 CFM25 per 100 square feet of conditioned space.

Figure 6–18: Duct Blaster Test Results



7 Water Heating

About one-half of owner occupied homes (53%) have stand alone tank water heaters, while the other half have a water heater integrated with their space heating system, either with a storage tank or a tankless coil system (Table 7–1). Nearly three-quarters of rental homes (73%) have stand-alone water heaters.

Table 7–1: Type of Water Heating Systems
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Storage, stand alone	60%	59%	52%	56%	53%	73%
Integrated, w/tank	30%	29%	24%	37%	26%	18%
Integrated, tankless	10%	12%	19%	4%	21%	9%
Instantaneous	0%	0%	5%	4%	0.3%	0%
Number of Homes	20	17	21	27	122	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Statewide, 37% of owner occupied homes have water heaters that use oil, 31% use electric, and 19% use natural gas (Table 7–2). There is a strong regional difference due to the availability of natural gas, with 85% of Burlington homes and 65% of North Chittenden homes using natural gas, compared to none of the Newport/Derby homes, which are primarily oil (62%). Roughly one-quarter to one-third of rental homes have natural gas or electric water heaters.

Table 7–2: Water Heating System Fuel
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Nat. Gas	65%	35%	0%	85%	19%	27%
Oil	15%	47%	62%	0%	37%	21%
Electric	20%	18%	19%	15%	31%	33%
Propane	0%	0%	19%	0%	13%	18%
Number of Homes	20	17	21	27	122	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

The average age of water heating systems is between seven and eight year old, the median age is five to six years (Table 7–3).

Table 7–3: Age of Water Heating System

(homes with water heater age data available)

	Owner occupied Homes*	Rentals
	Statewide	**Statewide**
Minimum	1	1
Maximum	30	20
Average	8	7
Median	6	5
Number of Water Heaters	114	32

* Results not weighted.

About two-thirds of water heaters are located in unconditioned spaces (Table 7–4).

Table 7–4: Location of Water Heating System

(homes with water heaters)

	Owner occupied Homes*	Rentals
	Statewide	**Statewide**
Conditioned Space	34%	39%
Unconditioned Space	66%	61%
Unknown	1%	0%
Number of Water Heaters	122	33

* Results not weighted.

The average energy factor for integrated tank water heaters in owner occupied homes is about 0.8; it is calculated by multiplying the boiler efficiency by 0.92 (Table 7–5). The average energy factor for tankless coil systems is 0.4; the energy factors were calculated using a formula provided in the RBES manual, except based on the number of occupants rather than bedrooms. A similar pattern occurs for rental homes, though note the small sample sizes as efficiency ratings were not available for many units (Table 7–6). Note that efficiency ratings were not visible on the majority of stand-alone water heaters, thus the low sample sizes

Table 7–5: Efficiency of Water Heating System for Owner Occupied Homes*

(owner occupied homes with efficiency data on water heater)

	Integrated Tank (Energy Factor)	Electric	Fossil Fuel Stand Alone	Tankless Coil
Minimum	0.74	0.83	0.84	0.4
Maximum	0.87	0.88	0.89	0.5
Average	0.79	0.86	0.87	0.4
Median	0.79	0.87	0.87	0
Number of Water Heaters	35	3	3	18

* Results not weighted due to low sample sizes.

Table 7–6: Efficiency of Water Heating System for Rental Homes

(rental homes with efficiency data on water heater)

	Integrated Tank (Energy Factor)	Electric	Fossil Fuel Stand Alone	Tankless Coil
Minimum	0.76	0.88	0.61	0.4
Maximum	0.80	0.90	0.82	0.5
Average	0.78	0.89	0.72	0.4
Median	0.78	0.89	0.72	0
Number of Water Heaters	5	3	2	3

Statewide, slightly over one in ten homes have water heaters wrapped with insulation (Table 7–7). RBES requires R-14 insulation for water heater tank wraps in new homes, except where the warranty is voided by installing a tank wrap[16]; none of the homes had R-14 insulation tank wraps. Ten of the 28 owner occupied homes with electric stand alone water heaters have wrapped tanks; three of the eleven rental homes with electric stand alone water heaters have wrapped tanks.

Table 7–7: Water Heater Wrap Insulation & R-Values*

(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide	Statewide
Percent with insulation	15%	12%	18%	4%	13%	12%
Number of Homes	20	17	22	27	123	33
Number with R-values**						
2	0	0	0	1	1	0
3	0	1	1	0	5	1
5	0	0	1	0	2	2
6	2	0	2	0	5	1
11	1	0	0	0	1	0
12	0	1	0	0	1	0
Number of water heaters with insulation	3	2	4	1	15	4

* Results for "Percent with Insulation" in the Owner Occupied Statewide column are weighted; all other results are unweighted.

** Unweighted counts

[16] As noted earlier, the current RBES requirements do not apply to this sample of existing homes but do provide a useful benchmark.

Statewide, one out of five owner occupied homes (20%) and about one in seven (15%) rentals have insulation on their water heater piping (Table 7–8). None of the homes in North Chittenden have insulation on their water heater piping. Among the owner occupied homes that do have water heater piping insulation, 86% have insulation with an R-value of 2.0.

Table 7–8: Water Heater Piping Insulation & R-Values

(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide	Statewide
Percent with insulation	0%	12%	55%	30%	20%	15%
Number of Homes	20	17	22	27	123	33
Number with R-values**						
1	0	0	1	0	11%	0
2	0	2	10	5	86%	2
3	0	0	0	1	1%	3
5	0	0	1	1	1%	0
6	0	0	0	1	1%	0
Number of water heaters with insulation	0	2	12	8	30	5

* Results for "Percent with Insulation" in the Owner Occupied Statewide column are weighted; all other results are unweighted.

** Unweighted counts

7.1 Low Flow Shower Heads and Faucet Aerators

Statewide, more than one-half of owner occupied homes (56%) and over two out of three rentals (70%) do not have any low flow shower heads (Table 7–9).[17] Statewide, owner occupied homes (84%) are significantly more likely than rentals (61%) to have faucet aerators.

Table 7–9: Low Flow Shower Heads & Faucet Aerators
(all homes)

	Owner Occupied					Rentals
	North Chittenden	**St. Albans**	**Newport/ Derby**	**Burlington**	**Statewide***	**Statewide**
Number of low flow shower heads						
None	70%	59%	64%	48%	56%	70%
One	25%	24%	27%	22%	30%	24%
Two or more	5%	18%	9%	30%	14%	3%
Don't know	0%	0%	0%	0%	0%	3%
Number of Faucet Aerators						
None	15%	18%	18%	7%	16%	39%
One	0%	6%	9%	7%	9%	15%
Two	40%	35%	27%	30%	31%	36%
Three	15%	29%	32%	41%	29%	6%
Four or more	30%	12%	14%	15%	15%	0%
Don't know	0%	0%	0%	0%	0%	3%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

[17] Low flow shower heads were identified as such if the showerhead appeared to be a low flow design or if a low water rate flowed when the showerhead was turned on.

8 Appliances

All of the homes visited have at least one refrigerator and a range with an oven. Nearly all owner occupied homes have a clothes washer, compared to 85% of rental homes (Table 8–1). Over nine in ten owners but less than three quarters of renters have a clothes dryer while eight in ten owners but only a bit over a quarter of renters have a dishwasher. Separate freezers are found in one-third of owner occupied homes and almost one-fifth of renter-occupied homes. Second working refrigerators are found in one-quarter of owner occupied homes, but few rental homes. Separate freezers and second refrigerators are less common in Burlington than in other regions.

Table 8–1: Appliance Saturations
(all homes)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Refrigerator	100%	100%	100%	100%	100%	100%
Oven / Range	100%	100%	100%	100%	100%	100%
Clothes washer	100%	94%	100%	100%	99%	85%
Clothes dryer	95%	94%	86%	96%	95%	72%
Dishwasher	75%	77%	82%	74%	82%	27%
Separate freezer	55%	53%	64%	18%	34%	18%
Second refrigerator	20%	29%	23%	7%	25%	6%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

ENERGY STAR Appliances. In owner occupied homes, refrigerators are most likely to be ENERGY STAR-labeled (23%), followed by dishwashers (18%) and clothes washers (17%) (Table 8–2). Appliances in homes occupied by renters are, in all cases, less likely to be ENERGY STAR-labeled. Model numbers were recorded for most appliances during the on-sites; the ENERGY STAR status of these models was checked at http://www.energystar.gov/index.cfm?c=appliances.pr_appliances, the ENERGY STAR website.

Table 8–2: ENERGY STAR Appliances
(all appliances)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Refrigerators	25%	6%	14%	11%	23%	15%
No. of refrigerators	24	22	27	28	147	34
Dishwashers	13%	15%	6%	15%	18%	3%
No. of dishwashers	15	13	18	20	97	10
Clothes washers	25%	31%	14%	4%	17%	7%
No. of clothes washers	20	16	22	26	122	28
Separate freezers	18%	0%	7%	0%	3%	0%
No. of freezers	11	9	14	5	50	6

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

The remaining sections focus on individual appliance characteristics. The number of appliances listed in each table refers to the number with available data.

Refrigerators. Most refrigerators, both in owner occupied and renter-occupied homes, are in good condition, according to auditors; very few are considered to be in poor condition (Table 8–3).

Table 8–3: Refrigerator Condition

(all refrigerators)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Good	86%	91%	85%	94%	87%	82%
Fair	9%	9%	15%	3%	10%	18%
Poor	5%	0%	0%	3%	3%	0%
Number of Refrigerators	22	22	27	29	148	34

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

Close to six in ten refrigerators are less than 10 years old; three out of ten are less than five years old (Table 8–4). Seventeen percent of refrigerators in owner occupied homes are estimated to be 20 years or older.

Table 8–4: Age of Refrigerators

(all refrigerators)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
4 years or less	17%	19%	30%	27%	31%	28%
5 to 9 years	31%	29%	22%	46%	28%	41%
10 to 14 years	13%	29%	15%	8%	11%	13%
15 to 19 years	13%	14%	11%	8%	13%	9%
20 years or more	26%	9%	22%	11%	17%	9%
Number of Refrigerators	23	21	27	26	141	32

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

The majority of refrigerators are between 16 and 19 cubic feet in size (Table 8–5).

Table 8–5: Refrigerator Size

(all refrigerators)

	Owner Occupied					Rentals
Cubic Feet	**Chittenden**	**St. Albans**	**Newport/ Derby**	**Burlington**	**Statewide***	**Statewide**
10 to 15	5%	5%	8%	0%	6%	0%
16 to 19	68%	50%	54%	46%	55%	79%
20 to 24	18%	30%	31%	43%	28%	21%
over 24	9%	15%	7%	11%	11%	0%
Number of Refrigerators	22	20	26	28	142	34

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

Over one-half of refrigerators in owner occupied homes and almost all in rentals are top-freezer models (Table 8–6).

Table 8–6: Refrigerator Type

(all refrigerators)

	Owner Occupied					Rentals
Cubic Feet	**Chittenden**	**St. Albans**	**Newport/ Derby**	**Burlington**	**Statewide***	**Statewide**
Top freezer	64%	52%	45%	50%	55%	94%
Bottom freezer	0%	19%	11%	14%	23%	0%
Side by side	32%	29%	33%	36%	18%	3%
Single door	4%	0%	11%	0%	4%	3%
Number of Refrigerators	22	21	27	28	142	34

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

Separate Freezers. Close to three quarters of separate freezers in owner occupied homes are in good condition; the small number found in rentals are also in good condition (Table 8–7).

Table 8–7: Separate Freezer Condition

(all separate freezers)

	Owner Occupied					Rentals
	Chittenden	**St. Albans**	**Newport/ Derby**	**Burlington**	**Statewide***	**Statewide**
Good	67%	78%	72%	4	73%	5
Fair	33%	22%	14%	0	26%	0
Poor	0%	0%	14%	0	1%	0
Number of Separate Freezers	9	9	14	4	46	5

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.. Counts are displayed if sample sizes are low.

Separate freezers are older than other appliances; close to one-third of separate freezers in owner occupied homes are at least 20 years old (Table 8–8).

Table 8–8: Age of Separate Freezers

(all separate freezers)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
4 years or less	9%	0%	8%	1	27%	2
5 to 9 years	9%	22%	17%	0	17%	0
10 to 14 years	18%	11%	17%	1	5%	1
15 to 19 years	18%	22%	33%	0	19%	1
20 years or more	46%	45%	25%	1	32%	0
Number of Separate Freezers	11	9	12	3	46	4

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted. Counts are displayed if sample sizes are low.

Most separate freezers (56%) are under 10 cubic feet in size (Table 8–9).

Table 8–9: Separate Freezer Size

(all separate freezers)

	Owner Occupied					Rentals
Cubic Feet	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
4 to 6	20%	0%	8%	1	31%	0
7 to 9	10%	22%	23%	0	25%	1
10 to 14	20%	44%	39%	0	24%	0
15 or more	50%	34%	30%	1	20%	3
Number of Separate Freezers	10	9	13	2	44	4

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted. Counts are displayed if sample sizes are low.

Two-thirds of separate freezers are single-door models (Table 8–10).

Table 8–10: Separate Freezer Type

(all separate freezers)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Single door	88%	57%	67%	2	67%	3
Upright	12%	43%	22%	0	20%	0
Chest	0%	0%	11%	0	13%	1
Number of Separate Freezers	8	7	9	2	37	4

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted. Counts are displayed if sample sizes are low.

Dishwashers. More than nine in ten dishwashers are in good condition (Table 8–11).

Table 8–11: Dishwasher Condition

(all dishwashers)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Good	93%	100%	82%	90%	91%	6
Fair	7%	0%	18%	10%	9%	3
Number of Dishwashers	14	13	17	20	95	9

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted. Counts are displayed if sample sizes are low.

More than two-thirds of dishwashers in owner occupied homes are under 10 years old; one-third are under five years old (Table 8–12). Twelve percent of dishwashers in owner occupied homes are 20 years or older.

Table 8–12: Age of Dishwashers

(all dishwashers)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
4 years or less	23%	25%	33%	44%	33%	1
5 to 9 years	38%	50%	22%	33%	36%	2
10 to 14 years	31%	8%	17%	6%	9%	0
15 to 19 years	0%	17%	22%	11%	10%	0
20 years or more	8%	0%	6%	6%	12%	4
Number of Dishwashers	13	18	12	18	91	7

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted. Counts are displayed if sample sizes are low.

Clothes Washers. More than nine in ten clothes washers are in good condition (Table 8–13).

Table 8–13: Clothes Washer Condition

(all clothes washers)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Good	89%	100%	73%	77%	93%	86%
Fair	6%	0%	23%	23%	6%	14%
Poor	5%	0%	4%	0%	1%	0%
Number of Clothes Washers	18	16	22	26	119	28

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Close to two-thirds of clothes washers are under 10 years old; few are twenty years or older (Table 8–14).

Table 8–14: Age of Clothes Washers

(all clothes washers)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
4 years or less	58%	53%	35%	33%	27%	28%
5 to 9 years	21%	33%	25%	21%	37%	32%
10 to 14 years	0%	7%	5%	17%	25%	20%
15 to 19 years	10%	7%	20%	8%	9%	8%
20 years or more	11%	0%	15%	21%	2%	12%
Number of Clothes Washers	19	15%	20	24	113	25

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

About two-thirds of clothes washers in owner occupied homes and over 90% of models in rental homes are top-loading (Table 8–15).

Table 8–15: Clothes Washer Type

(all clothes washers)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Top load	60%	67%	82%	81%	67%	93%
Front load	40%	33%	18%	19%	33%	7%
Number of Clothes Washers	20	15	22	26	119	28

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

Clothes Dryers. Close to nine in ten clothes dryers in owner occupied homes and eight in ten clothes dryers in rentals are in good condition (Table 8–16).

Table 8–16: Clothes Dryer Condition

(all clothes dryers)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Good	83%	100%	79%	92%	91%	75%
Fair	17%	0%	21%	8%	9%	25%
Number of Clothes Dryers	18	16	19	24	111	24

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

About one-half of clothes dryers are under ten years old, and 10%-14% are over twenty years old (Table 8–17).

Table 8–17: Age of Clothes Dryers

(all clothes dryers)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
4 years or less	21%	38%	28%	36%	16%	19%
5 to 9 years	26%	31%	33%	27%	30%	33%
10 to 14 years	26%	25%	11%	14%	38%	29%
15 to 19 years	0%	6%	6%	14%	6%	5%
20 years or more	27%	0%	22%	9%	10%	14%
Number of Clothes Dryers	19	16	18	22	108	21

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

More than four in five clothes dryers in owner occupied homes and almost all clothes dryers in rentals use electricity (Table 8–18).

Table 8–18: Clothes Dryer Fuel

(all clothes dryers)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Electricity	83%	80%	78%	71%	81%	95%
Propane	0%	0%	11%	0%	12%	0%
Natural Gas	17%	20%	11%	29%	7%	5%
Number of Clothes Dryers	18	15	18	24	108	21

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

Ranges and Ovens. Most all ranges (93% in owner occupied homes) are rated as being in good condition (Table 8–19).

Table 8–19: Range Condition

(all ranges)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Good	94%	94%	74%	84%	93%	75%
Fair	6%	6%	26%	16%	7%	25%
Number of Ranges	18	17	19	25	111	32

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

Nearly two-thirds of ranges in owner occupied homes but only one-third in rentals are under ten years old; 13% and 32% are twenty years or older in owner occupied homes and rental homes, respectively (Table 8–20).

Table 8–20: Age of Ranges

(all ranges)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
4 years or less	6%	19%	11%	39%	29%	13%
5 to 9 years	39%	50%	32%	17%	34%	20%
10 to 14 years	28%	12%	11%	4%	13%	19%
15 to 19 years	0%	13%	26%	17%	11%	16%
20 years or more	27%	6%	20%	23%	13%	32%
Number of Ranges	18	16	19	23	106	31

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

Over one-half of ranges in owner occupied homes and over three-quarters in rentals use electricity (Table 8–21).

Table 8–21: Range Fuel

(all ranges)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Electricity	58%	77%	75%	52%	51%	78%
Propane	0%	0%	15%	11%	26%	9%
Natural Gas	42%	23%	10%	37%	23%	13%
Number of Ranges	19	17	20	27	119	32

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

As would be expected, oven data is similar to ranges; most ovens are in good condition (Table 8–22).

Table 8–22: Oven Condition

(all ovens)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Good	89%	94%	74%	84%	92%	77%
Fair	11%	6%	26%	16%	8%	23%
Number of Ovens	18	17	19	25	110	30

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

Nearly six in ten ovens in owner occupied homes but only three in ten in rentals are under ten years old (Table 8–23).

Table 8–23: Age of Ovens

(all ovens)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
4 years or less	6%	19%	11%	39%	29%	13%
5 to 9 years	39%	50%	32%	17%	32%	17%
10 to 14 years	28%	12%	11%	4%	13%	20%
15 to 19 years	0%	13%	26%	17%	13%	17%
20 years or more	27%	6%	20%	23%	13%	33%
Number of Ovens	18	16	19	23	105	30

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

Nearly one-half of ovens in owner occupied homes and over three-quarters in rentals use electricity (Table 8–24).

Table 8–24: Oven Fuel

(all ovens)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Electricity	58%	77%	75%	48%	48%	77%
Propane	0%	0%	15%	11%	27%	10%
Natural Gas	42%	23%	10%	41%	25%	13%
Number of Ovens	19	17	20	27	118	30

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

Televisions and Peripherals. About nine in ten homes have at least one TV set; six in ten have at least two (Table 8–25).

Table 8–25: TV Set Saturation

(all homes)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
None	0%	6%	0%	7%	9%	3%
One	35%	18%	23%	33%	31%	30%
Two	55%	23%	41%	30%	30%	30%
Three or more	10%	53%	36%	30%	30%	37%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

Most TVs are cathode ray tube models; about 12% of homes have LCD, projection, or plasma models (Table 8–26).

Table 8–26: TV Set Type

(all TV Sets)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
CRT	86%	91%	94%	91%	89%	87%
LCD	8%	7%	4%	7%	9%	10%
Projection	6%	0%	2%	0%	2%	2%
Plasma	0%	2%	0%	2%	0%	1%
Number of TV Sets	36	43	48	57	257	69

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

Most TV monitors are under 30 inches in size; about 10% of homes have a TV over 40” in size (Table 8–27).

Table 8–27: TV Monitor Size

(all TV Sets)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
15 inches or less	8%	14%	13%	16%	13%	10%
16 to 20 inches	22%	19%	8%	23%	19%	21%
21 to 30 inches	36%	42%	54%	47%	39%	50%
31 to 40 inches	25%	16%	21%	9%	20%	9%
Over 40 inches	9%	9%	4%	5%	9%	10%
Number of TV Sets	36	43	48	57	257	69

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

The most common TV peripherals are both VCRs and DVD players, which are installed in nearly two-thirds of TVs (Table 8–28). Two out of five TVs have no peripherals attached.

Table 8–28: TV Peripherals

(all TV Sets)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
VCR and DVD player	27%	26%	34%	29%	30%	28%
DVD player only	3%	15%	7%	15%	17%	24%
VCR only	24%	14%	18%	11%	13%	13%
None	46%	45%	41%	45%	40%	35%
Number of TV Sets	33	42	44	53	240	68

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

Computers. About eight in ten homes have at least one computer and about two-thirds also have at least one printer (Table 8–29).

Table 8–29: Computer and Printer Saturation

(all homes)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Computers						
None	5%	35%	23%	8%	22%	12%
One	70%	53%	64%	59%	52%	79%
Two or more	25%	12%	13%	33%	26%	9%
Printers						
None	10%	35%	23%	15%	23%	36%
One	80%	59%	73%	74%	67%	64%
Two or more	10%	6%	4%	11%	10%	0%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

About two-thirds of computers have LCD monitors, the remaining one-third are CRT (Table 8–30).

Table 8–30: Computer Monitor Type

(all computers)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
LCD	54%	38%	30%	66%	62%	69%
CRT	46%	62%	70%	34%	38%	31%
Number of Computers	28	13	20	35	137	32

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

Most computer monitors are between 16 and 20 inches in size; 60% of monitors in owner occupied homes are in this size range (Table 8–31).

Table 8–31: Computer Monitor Size

(all computers)

	Owner Occupied					Rentals
	Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
15 inches or less	32%	38%	25%	29%	32%	50%
16 to 20 inches	64%	62%	75%	63%	60%	44%
Over 20 inches	4%	0%	0%	8%	8%	6%
Number of Computers	28	13	20	35	137	32

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted

9 Lighting

CFL bulbs, including both screw-in and pin-based, were installed at almost 90% of owner occupied homes, with the lowest saturation in Burlington (78%). Seventy percent of rental homes also have CFLs installed (Table 9–1). Overall, about one-quarter of owner occupied homes and 15% of rental homes have CFLs in storage. Dimmable incandescent bulbs are installed in one-third of owner occupied homes and 3% of rental homes.

Table 9–1: Proportion of Homes with CFLs
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
CFLs Installed	85%	82%	86%	78%	90%	70%
CFLs in Storage	6%	9%	14%	27%	24%	15%
Dimmable Bulbs Installed	45%	18%	5%	19%	33%	3%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Table 9–2 displays the proportion of CFL bulbs installed in homes. About one-quarter of owner occupied homes each have between 1% and 10% CFLs, between 11% and 25% CFLs, and between 26% and 50% CFLs. Ten percent of owner occupied homes have more than one-half CFLs installed. Rental homes have a lower penetration of CFL bulbs.

Table 9–2: Proportion of CFLs Installed
(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
None	15%	18%	14%	22%	10%	30%
1% to 10%	40%	18%	14%	15%	27%	15%
11% to 25%	25%	18%	46%	22%	24%	33%
26% to 50%	20%	35%	18%	33%	29%	15%
51% to 100%	0%	12%	9%	7%	10%	6%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Table 9–3 displays various statistics for CFLs installed in all homes. In owner occupied homes, an average of 9.5 and median of 6 CFL bulbs are installed, representing 19% of all incandescent and CFL bulbs installed.[18] In rental homes, an average of 4.0 and median of 3 CFL bulbs are installed, representing 15% of all incandescent and CFL bulbs installed.

Table 9–3: Mean, Median, and Proportion of CFLs Installed

(all homes)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Mean number of CFLs	6.2	8.6	7.6	8.4	9.5	4.0
Median number of CFLs	3.5	5	7	7	6	3
Proportion of bulbs that are CFLs	15%	21%	19%	20%	19%	15%
Number of all bulbs	41.3	41.0	40.0	42.0	50.0	26.7
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

About two-thirds of owner occupied homes have T12 fluorescent tube fixtures installed and one-quarter have T8 tube or circline fluorescent fixtures installed (Table 9–4). Fewer rental homes have fluorescent fixtures installed; one-third have T12 fixtures and 12% have T8 fixtures.

Table 9–4: Proportion of Homes with Fluorescent Fixtures

(all homes)

	Owner Occupied					Rentals
Fixture Type	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
T12	60%	71%	73%	59%	63%	36%
T8	25%	24%	18%	15%	28%	12%
T5	0%	0%	9%	0%	0%	0%
Circline	15%	41%	23%	7%	24%	3%
Number of Homes	20	17	22	27	123	33

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

[18] Sockets were not categorized as eligible or not eligible for screw-in CFLs. However, given the expanding array of screw-in CFL bulbs available on the market (such as dimmable, three-way, candelabra bulbs, etc), it is reasonable to assume that nearly all sockets could accommodate a screw-in CFL, though some of the specialty designs are less prevalent in retail stores than are standard CFLs..

10 Owner Survey

The on-site audit included brief interviews with the owners of 123 owner occupied homes and the tenants or owners of 31 renter occupied homes in order to gather information on energy efficiency in the homes. The objective of these interviews is to understand the energy issues facing Vermont residents in order to provide additional information to support the analysis of the onsite audits.

Energy Use. About one-half of respondents consider fixing their windows or installing energy efficient windows in order to save energy in their homes (Table 10-1). Adding insulation to various parts of the home including the attic, basement, floors and walls is also considered by one-third or more of respondents. About one-fourth of respondents believe that replacing their doors with energy efficient models or repairing them will improve the energy efficiency of their homes. Another one-quarter of respondents consider replacing various appliances, such as their clothes washers and dryers. Another popular energy saving option includes switching to better lighting (more CFL bulbs).

Table 10-1: Respondent's Opinion of Additional Changes at Home that Could Save Energy

(All respondents, multiple response)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Add energy efficient windows	20%	65%	52%	41%	51%	45%
Add insulation	75%	53%	43%	26%	32%	58%
Replace appliance with a more energy efficient one; buy more energy efficient appliances	5%	0%	5%	15%	28%	7%
Add energy efficient doors	25%	12%	10%	15%	27%	26%
Use better lighting; more CFL bulbs	30%	6%	33%	26%	20%	13%
Replace furnace and heating system with energy efficient one	25%	18%	0%	4%	14%	7%
Air sealing; fix infiltration problem	10%	12%	10%	4%	6%	10%
Make an effort to conserve energy	5%	6%	0%	19%	6%	0%
Use more solar energy	0%	6%	0%	7%	3%	0%
Nothing	5%	6%	19%	15%	4%	10%
Other	25%	12%	19%	15%	21%	7%
Total Respondents	**20**	**17**	**21**	**27**	**122**	**31**

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Respondents were asked why they had not made the energy-saving changes to their home that they mentioned. The high cost of making such changes is an obstacle for a majority of respondents (67% from owner occupied households and 50% from renter occupied households) (Table 10-2). A little over one-third of respondents also consider a lack of time as an obstacle.

Table 10-2: Factors that have Caused Respondents to Avoid Making Changes for Greater Energy Efficiency in their Home

(All respondents, multiple response)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Cost too much / can't afford it / don't have the money / etc	53%	69%	82%	61%	67%	50%
Lack of time	37%	38%	41%	48%	33%	35%
Just bought new appliance; Don't use the appliance very much; appliances still work, waiting for them to break	26%	6%	6%	17%	22%	0%
Don't' like CFLs; CFLs don't fit properly	16%	0%	0%	13%	13%	0%
Don't have the skill or knowledge / not sure how to do it / etc	11%	13%	0%	4%	7%	4%
Aesthetic reasons	5%	0%	0%	0%	3%	0%
Need someone to help me	0%	6%	0%	0%	3%	0%
Need someone to show me	0%	0%	0%	0%	2%	0%
Physically unable to do it	5%	0%	6%	0%	1%	0%
Other	11%	0%	6%	9%	8%	23%
Total Respondents	**19**	**16**	**17**	**23**	**110**	**27**

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Thermal Comfort. Respondents were asked if they are satisfied with the thermal comfort of their homes. Eighty-two percent of respondents from owner occupied households and 84% from renter occupied households report being satisfied with the thermal comfort in their homes (Table 10-3). Respondents from owner occupied households who were not satisfied with the thermal performance of their homes cite the poor distribution of heat in their homes (28%), the lack of enough heat (33%) and the cold drafts due to inefficient windows (28%) (Table 10-4).

Table 10-3: Respondents Satisfaction with the Thermal Comfort of their Homes

(All respondents)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport / Derby	Burlington	Statewide*	Statewide
Satisfied	90%	65%	91%	89%	82%	84%
Not Satisfied	10%	35%	9%	11%	18%	16%
Total Respondents	**20**	**17**	**21**	**28**	**123**	**31**

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Table 10-4: Homeowner's Reasons for Dissatisfaction with the Thermal Comfort of their Homes*

(respondents not satisfied with the thermal comfort of their homes, multiple response)

	Owner Occupied	Rentals
	Statewide	Statewide
Some rooms or floors are cold / Not enough heat	33%	2
It is drafty	33%	1
Poor distribution of heat; Poor heat circulation; cold and hot spots in the house	28%	1
Drafty and cold because of inefficient windows	28%	1
The radiant heat is not sufficient	6%	0
Trying to save energy	6%	0
The temperature is not steady	6%	0
Rooms don't have gas heat and don't like to use electric heat	6%	0
Total Respondents	**18**	**5**

* All results are unweighted.

Respondents were asked about the one thing they would most like to change to order to improve the thermal performance of their homes. Most often, respondents would like to improve the heat distribution in their homes (Table 10-5). Adding more insulation to reduce energy usage was considered by about one-fifth of the respondents, while others state that they would either replace or fix their windows. There were however quite a few respondents (16% from owner occupied households and 23% from renter occupied households) who wouldn't do anything to improve the thermal performance of their homes.

Table 10-5: What Respondents Would Consider Changing in their Homes for Improving their Thermal Performance

(all respondents)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Better zoning / better heat distribution / additional heating / backup heating	25%	18%	10%	22%	25%	32%
Add or improve insulation	20%	35%	5%	11%	24%	16%
Improve the windows/ switch windows	5%	18%	10%	22%	18%	7%
Work on the overall efficiency of the house/ use less energy overall	25%	0%	10%	7%	9%	13%
Improve or replace doors/ add a better storm door to the front	0%	0%	5%	0%	2%	7%
Nothing	20%	18%	40%	26%	16%	23%
Other	5%	12%	20%	11%	7%	3%
Total Respondents	**20**	**17**	**20**	**27**	**121**	**31**

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Energy Conservation Programs. Respondents were asked to rate on a scale of zero to ten where zero is 'not important at all' and ten is 'very important', how important they considered each of the factors provided in Table 10-6 for participating in energy conservation programs. The factors considered to be very important (rated an 8 or higher) by a large majority of respondents include 'It saves money on your fuel bill' (97%-100%), 'It is good for the environment' (94% owners, 87% renters), 'It makes my home more comfortable' (89% owners, 97% renters) and 'It saves money on your electric bill' (85% owners, 90% renters).

Table 10-6: Respondents Rating of Reasons to Participate in Energy Conservation Programs as 'Very Important'

(all respondents)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
It saves money on your fuel bill	95%	100%	95%	96%	97%	100%
It is good for the environment	85%	94%	86%	86%	94%	87%
It makes your home more comfortable	70%	77%	81%	82%	89%	97%
It saves money on your electric bill	95%	94%	95%	96%	85%	90%
It prolongs the life of my HVAC equipment	80%	77%	71%	89%	76%	90%
It will reduce the need for new power plants	65%	88%	81%	89%	72%	81%
It prolongs the life of my home	75%	88%	71%	86%	69%	87%
It helps to keep everyone's electric rates down	50%	71%	71%	79%	62%	74%
Your neighbors/friends recommended it	10%	24%	19%	14%	19%	29%
Total Respondents	**20**	**17**	**21**	**28**	**122**	**31**

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Respondents were asked if they would consider searching on the internet for information on energy conservation programs, and if they had visited EVTs website. Over ninety percent of respondents say that they would consider the internet as an option. One-quarter report that they had visited EVTs website when searching for energy conservation information (Table 10-7).

Table 10-7: Whether Respondents Looked at the EVT's Website for Information on Available Conversation Programs*

(all respondents)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Would look on the Internet but have not been to EVT's website	62%	53%	67%	43%	66%	61%
Have been to EVT's website	19%	28%	19%	39%	25%	29%
Would not consider looking on the internet	19%	18%	14%	18%	9%	10%
Total Respondents	**21**	**17**	**21**	**28**	**123**	**31**

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.
*20 missing values excluded from the analysis

Respondents were asked about where else they would search for information regarding conservation programs. Over one-third of these respondents claim that they would search for such information in the phone book, newspapers, magazines, electric bill flyers, on television, or in the library (Table 10-8).

Table 10-8: Other Sources Respondents Considered as Options for Information on Available Conservation Programs

(respondents who did not visit EVTs website)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
Public information; Phone Book/Yellow pages; Newspapers, Magazines, Electric bill flyers, TV, Seminars, Library	18%	20%	33%	29%	35%	37%
Friends, family or neighbors	9%	10%	7%	10%	17%	0%
Federal Government; US Department of Energy	18%	30%	7%	5%	16%	37%
Electric and Gas Company / Utility company; Advertisements from utility companies	27%	10%	13%	29%	14%	16%
Vermont Department of Public Service/Welfare; EVT, DPS, VEIC, Energy efficiency Vermont	18%	20%	0%	14%	9%	21%
Local building supply dealers; gas and oil distributors; contractors; Agway	0%	0%	7%	0%	6%	11%
None/Don't Know	27%	10%	33%	14%	13%	5%
Other	9%	0%	20%	10%	2%	0%
Total Respondents	**11**	**10**	**15**	**21**	**83**	**19**

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

Willingness to Pay for Audit. When respondents were asked if they would be willing to pay $250 for an assessment of their homes by a certified contractor, about two-thirds of respondents say they would not be willing to pay that amount (Table 10-9). Note that 23% of respondents from renter occupied households are uncertain about their decisions.

Table 10-9: Would you be Willing to Pay $250 for an Assessment by a Certified Contractor?

(all respondents)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington	Statewide*	Statewide
No	62%	82%	71%	71%	69%	61%
Yes	24%	18%	14%	25%	25%	16%
Maybe / Don't Know	0%	0%	5%	4%	2%	23%
Missing	14%	0%	10%	0%	4%	0%
Total Respondents	**21**	**17**	**21**	**28**	**123**	**31**

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

CFLs. Of the 154 respondents, 27 did not have any CFLs installed in their homes, although they were all familiar with CFLs when the interviewer showed them an actual CFL bulb (Table 10-10). Of these 27 respondents, 25 have thought about using CFLs while the remaining two had not considered it. Over one-quarter of these respondents from owner occupied households say the high cost of CFLs is the primary obstacle; another 24% report that they have 'not gotten around to it'. Twelve percent of respondents from owner occupied homes have not needed new bulbs because the bulbs currently installed are still working.

Table 10-10: Why Respondents Decide Against Using CFL Bulbs*

(Respondents with no CFL bulbs in their homes)

	Owner Occupied	Rentals
	Statewide	Statewide
Too expensive, not worth the cost	29%	0
Have not gotten around it	24%	0
Have not needed new bulbs yet, bulbs in use still work	12%	1
Did not work on dimmers, need dimmable lights	12%	0
They burnt out and now I can't dispose them in the garbage	6%	0
Quality of light is poor	6%	0
Do not like the light	6%	0
Delay in light coming on	0%	1
It is up to the tenants	0%	2
They don't fit in fixtures	0%	1
I don't use a lot of light bulbs	0%	1
Other	12%	2
Total Respondents	**17**	**8**

*All results are unweighted

When the respondents with no CFLs installed in their homes were asked what would encourage them to try CFLs, a few respondents suggest the provision of free bulbs or coupons as possible options (Table 10-11).

Table 10-11: What May Encourage Respondents to use CFL Bulbs

(Respondents with no CFL bulbs in their homes)

	Total Responses*
Coupons for bulbs	1
Free bulbs	1
If there was no issue with the mercury	1
If they had 3-way bulbs	1
Additional incentives	1
Able to put into dimmable sockets	1
Don't know	1
Total Respondents	**7**

*Total unweighted counts due to the low number of observations

Freezer and Refrigerators. Respondents who own a second refrigerator or stand alone freezer were asked how often they plugged in the additional appliance. ~~A majority~~ Most of these respondents report that the appliances are plugged in at all times (Table 10-12).

Table 10-12: How Often Respondents Plug in Second Freezer or Refrigerator

(Respondents who own a second freezer or refrigerator)

	Owner Occupied					Rentals
	North Chittenden	St. Albans	Newport/ Derby	Burlington*	Statewide*	Statewide
All the time	77%	91%	82%	7	83%	6
Occasionally	0%	0%	0%	0	5%	0
Never	23%	9%	18%	1	12%	0
Total Respondents	**13**	**11**	**11**	**8**	**62**	**6**

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.
*Total unweighted counts due to the low number of observations

Of the 68 respondents who have secondary refrigerators or freezers, 25% claim to have considered removing them at some point while 75% say it had not occurred to them. Respondents who considered removing their second freezer or refrigerator were asked why they had not already done so. Almost one-half of those respondents say they need their freezers or refrigerators for additional storage or extra capacity (Table 10-13).

Table 10-13: What has Kept Respondents from Removing their Second Refrigerator or Freezer

(Respondents who own a second freezer or refrigerator and have considered removing them)

	Total Responses*
I still need it for storage / for the extra capacity	6
Haven't gotten around to it yet	3
Cost savings on groceries	1
I don't use it	1
Will remove once I get a new one	1
It doesn't get in my way	1
I still need it and am planning to get an energy efficient one	1
Other	1
Total Respondents	**15**

*Total unweighted counts due to the low number of observations

Respondents who had not considered removing their secondary freezers or refrigerators were asked what would encourage them to dispose of the units; almost one-third of the respondents from owner occupied households say that there is nothing that would convince them to do so (Table 10-14). Another fourteen percent claim they will get rid of the appliances only after they stop working. Some other respondents state that they will stop using the additional appliances once they find an alternative or if they don't need the extra storage space anymore.

Table 10-14: What Would Encourage Respondents to get Rid of their Second Freezer or Refrigerator

(Respondents who own a second freezer or refrigerator but have not considered removing them)

	Owner Occupied	Rentals
	Statewide*	Statewide
If it broke	14%	0
After children move out / once we get older	9%	0
If I didn't need it for storage	9%	2
If I find a cheap alternative	9%	0
If I hadn't just bought it	7%	1
If the big garden wasn't there anymore	5%	0
If gas prices were lower	5%	0
If I had a bigger indoor freezer	2%	2
If I get a replacement for free	2%	0
If I get its money's worth	2%	0
If I noticed a big change in the electric bill due to it or if I'm convinced that it uses a lot of energy	2%	0
If someone offered a good price for it or provided good a compensation	2%	0
Nothing	31%	1
Don't Know	0%	0
Other	3%	0
Total Respondents	**45**	**6**

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.
*Total unweighted counts due to the low number of observations

Respondents with a secondary freezer or refrigerator were asked what they would do with the appliances once they were removed. Almost one-half say they will give them away to someone (Table 10-15). Twenty-eight percent of respondents from owner occupied households claim that they will likely dispose of the unused appliances while another 17% say they may try selling them.

Table 10-15: What Respondents Would Do With their Removed Refrigerator or Freezer

(Respondents who own a second freezer or refrigerator)

	Owner Occupied (percent weighted)	Rentals (unweighted counts)*
Give it to someone else	43%	1
Trash it	28%	1
Sell it	17%	2
Recycle it	7%	0
Give it to charity/ Donate it	5%	0
Haven't thought about it	<1%	0
Nothing	1%	0
Other	10%	1
Total Respondents	**57**	**5**

* Results for the Owner Occupied Statewide column are weighted; all other results are unweighted.

*Total unweighted counts due to the low number of observations

Heating and Air Conditioning Systems. Eight respondents with oil or natural gas heating systems that were old (over 25 years) and/or inefficient (less than 74% steady state) were asked if they had considered replacing them with a more energy efficient model. Six respondents report having considered a replacement. while two state that they have not thought of it yet. Four of the six respondents that considered such a replacement claim that the high cost of a replacement was the reason for not making the switch to an energy efficient system (Table 10-16).

Table 10-16: What is Keeping Respondents from Replacing Old/Inefficient Fossil Fuel Heating Furnaces

(Respondents with old/inefficient fossil fuel heating systems who have considered a replacement)

	Number of Responses*
The cost is too high	4
Calculated return wouldn't be worth it	1
Vermont Gas won't help replace a floor furnace	1
Lack of time	1
Scheduling an appointment with the contractor	1
Tenants pay for heat	1
Total Respondents	**6**

*Total unweighted counts due to the low number of observations

Respondents with old and/or inefficient (electric strip or heat pump with COP less than 2.0)

electric heating systems were asked a similar question regarding whether they had considered replacing their systems with a newer model. Two respondents report having considered such a replacement while another two have not thought of it. One of the respondents considering replacing their system cites the high cost of such replacements as an obstacle. Another respondent suggests that a financial incentive would probably allow him/her to consider replacing the system.

Two respondents with old and/or inefficient (10 SEER or less) window air conditioning systems report having considered replacing their AC units with energy efficient ones while another three claim not to have thought about it. Similar to heating systems, the lack of time and money were cited by these respondents as reasons for not updating to a more energy efficient model. A particularly hot summer or the provision of financial incentives might encourage a few respondents to consider replacing their old systems.

Attic Insulation. Twelve respondents with less than R-19 attic insulation were asked if they had considered adding attic insulation; eight respondents claim to have considered such additions while four state that they have not considered it yet. High costs and the lack of time are the two most common reasons why they have not considered adding attic insulation (Table 10-17). If provided with a financial incentive along with more information on the energy savings, some respondents may be encouraged to add more insulation to their attics (Table 10-18).

Table 10-17: What is Keeping Respondents from Adding Attic Insulation

(Respondents with attic insulation less than R-19 who have considered adding attic insulation)

	Number of Responses*
The cost is too high	4
Just haven't gotten around to it/ no time	2
Cannot add more due to 2 by 6 construction	1
Would need to install soffit vents	1
would have to rip up decking	1
Total Respondents	**8**

*Total unweighted counts due to the low number of observations

Table 10-18: What Would Encourage Respondents to Add More Attic Insulation

(Respondents with attic insulation less than R-19 who have not considered adding attic insulation)

	Number of Responses*
Did not know it would do any good	1
If it would save money	1
Money Assistance Program	1
Need to re-wire attic first	1
Total Respondents	**4**

*Total unweighted counts due to the low number of observations

Wall Insulation. Seven of the respondents from households with no exterior wall insulation have considered adding wall insulation while three have not considered it. The high cost of insulation and the lack of time are the two most common reasons why respondents without exterior wall insulation have not considered adding them. The provision of financial incentives was stated by one respondent as motivation for considering the addition of more wall insulation.

Table 10-19: What is Keeping Respondents from Adding Exterior Wall Insulation

(Respondents with no exterior wall insulation who have considered adding it)

	Number of Responses*
Have not had time	3
The cost is too high	2
Filling out application to EVT	1
Nothing	1
Total Respondents	**6**

*Total unweighted counts due to the low number of observations

Air Sealing. Thirteen respondents with infiltration levels exceeding 0.7 ACHnat report having considered doing air sealing while two report not having thought of conducting any air sealing. A number of respondents (four out of ten) report that the high cost of replacing windows had kept them from taking any action (Table 10-20).

Table 10-20: What has Kept Respondents from Doing Air Sealing

(Respondents with infiltration ACH levels exceeding 0.7 who have considered doing air sealing)

	Number of Responses*
Cost of replacing windows	4
Filling out application to EVT	1
Landlord only provided one tube of caulk	1
Have not had the time	1
Don't know/ Don't know how	3
Total Respondents	**10**

*Total unweighted counts due to the low number of observations

Floor Insulation. Twenty three respondents with uninsulated floor areas over their porch, garage, or crawl space were asked if they had considered adding floor insulation. Nine of the respondents report having considered adding floor insulation while fourteen claim not to have considered any such additions. Three of these nine respondents report that the high cost of adding the insulation has kept them from doing so while three cite a lack of time (Table 10-21). A number of respondents (four of fourteen) say that they would consider adding the insulation if someone convinced them of the energy savings (Table 10-22).

Table 10-21: What has Kept Respondents from Adding Floor Insulation

(Respondents with uninsulated floor areas over a porch, garage or crawl space who have considered adding insulation)

	Number of Responses*
High cost	3
Haven't gotten to it yet; lack of time	3
Level of difficulty, difficult to access	2
Didn't think it would be worth it	1
Didn't know how	1
Filling out application to EVT	1
Total Respondents	**9**

*Total unweighted counts due to the low number of observations

Table 10-22: What Would Encourage Respondents to Add Floor Insulation

(Respondents with uninsulated floor areas over a porch, garage or crawl space who have not considered adding any insulation)

	Number of Responses*
If someone convinced him about the savings, if it was worth the cost	4
Haven't thought of it, not sure	2
If I saw the need for it	2
If I wasn't moving	2
If monetary help was provided	1
Nothing	1
Other	2
Total Respondents	**14**

*Total unweighted counts due to the low number of observations