MAINE

RESIDENTIAL NEW CONSTRUCTION

TECHNICAL BASELINE STUDY

FINAL REPORT

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I. EXECUTIVE SUMMARY

A. OVERVIEW

The new homes program that is developed out of this study is intended to encourage the construction of homes that meet the Maine Energy Code at a minimum, and hopefully, are built to higher tiers ranging up to zero net energy consumption. This program should provide cost-effective energy savings that will reduce the pressure on Maine's generation, transmission and distribution systems from new residential electricity demand and will also save participating Maine customers money on their annual bills. In addition, the program should promote participating builders and help them produce high-performing homes with superior comfort, safety and durability.

An additional task to supplement the technical in-field study of homes was to conduct a series of builder and architect surveys asking detailed questions about energy approaches and strategies in their businesses. These results are also included in this study.

B. APPROACH

Over the fall of 2007 and into early winter 2008, four accredited Maine Home Energy Rating System (HERS) providers sent five certified Energy Raters to visit 80 homes that had been built and occupied since January 1, 2005. Seventy-eight (78) energy ratings were finally used along with 76 homes from the supplemental Access database completed on each of these homes. A cluster sample approach was used to determine representative communities from which to recruit participating homeowners. Our team telephoned and enlisted participants with the aid of a $100 token of our appreciation for the three to five hour visit per home. Complete HERS energy ratings, including a blower door test and duct leakage testing (where appropriate), and an extensive additional list of questions and observations were gathered. Additionally, the Raters were encouraged to report their field observations on energy features, issues, deficiencies and opportunities. Using these professional, experienced eyes provided an additional level of insight that helped solidify a comprehensive picture of typical Maine new homes.

For the builder/architect surveys, willing participants were selected through a number of different means including personal referrals, suggestions from the home builders associations and by word of mouth.

REPRESENTATIVE MAINE HOME

Figure 1. Typical New Maine House

New Maine homes run the gamut from simple modestly-sized manufactured homes to large sprawling luxury homes, with some camps and seasonal homes in between. Although the houses in the survey were generally visually attractive from the outside, below the surface we found many cost-effective opportunities for improved energy and comfort performance. Figure 1 shows a typical Maine house that was included in the study. As with all homes, the inspectors conducted a thorough energy investigation and testing, including at least the following steps:

- Measured and recorded all exterior surfaces (walls, windows, doors, roof/ceilings, foundation) and determined the type and amount of insulation or other thermal properties;
- Tested the house air leakiness with a calibrated blower door and the duct tightness with a duct blaster;
- Recorded the make and model numbers of all mechanical equipment in order to look up their rated efficiencies from published directories;
- Collected an extensive survey of data of electricity-using lights, appliances and electronics; and
- Interviewed homeowners to gauge how the home performs from an energy and comfort perspective.

While we visited and performed energy ratings on 78 homes, data gathered for the supplemental Access database was only available for 76 buildings. Information collected at each home was compiled and run through analysis tools to determine the results. For this particular typical home, the characteristics include the following:

- Home Energy Rating Index: 86;
- No basement insulation;
- Poor quality ceiling insulation installation; and
- Estimated total energy consumption of 183 MMBtu/year at a cost of $5563.

C. KEY FINDINGS

Overall, we found that while Maine builders generally produce a reasonable home, in terms of energy consumption, there are numerous of opportunities for energy improvements. Most homes actually don't even meet Maine's Model Energy Code due, in large part, to uninsulated basements and low effective R-values of ceiling insulation due to many uninsulated areas and poor quality installation. There were also many opportunities for more efficient lighting. On the positive side, air leakage rates were in line with national standards, windows were predominantly energy-efficient low-E, most above-grade walls were framed with 2x6's to allow for more insulation, heating equipment efficiencies (AFUEs) were relatively high, there was a preponderance of efficient indirect-fired storage tanks to heat domestic hot water off the boiler and many of the major appliances are ENERGY STAR labeled.

Our research clearly indicates that there are significant, cost-effective, opportunities to improve the efficiency of residential new construction in Maine. This is not unusual, as virtually all residential new construction markets nationwide show substantial room for potential improvement through the promotion of cost-effective, market transformation oriented, energy efficiency programs. However, due to the lack of an existing residential new construction program, this study finds that the opportunities in Maine are greater than in other parts of the Northeast region. There are differences in energy efficiency features in these Maine homes as compared to homes in other states in the Northeast that have had ENERGY STAR Homes programs in place.

Table 1 shows a summary of the key findings from this study. While there are certainly some positive energy features, there are quite a few opportunities for improvement.

Table 1. Summary Average Characteristics of New Maine Home

Feature	Characteristic	Units	Notes
General Information			
Conditioned Area	2,057	Square Feet	
Bedrooms	3.1		
Building Shell Features			
Ceiling Flat	30.8	Nominal R-value	
Vaulted Ceiling	31.3	Nominal R-value	
Above Grade Walls	17.5	Nominal R-value	
2x4 Wall Framing	14%	Present	
2x6 Wall Framing	83%	Present	
Other	2%	Present	ICF; 2x8
Exposed Floor (ALL)	15.3	Nominal R-value	
Foundation Wall Insulation			
No Insulation Present	66%		For only walls exposed to ambient conditions
Foundation Walls	3.4	Nominal R-value	
Slab on Grade Insulation			
Combined	57%	Present	Insulation present under slab OR on perimeter
Windows			
Average U-value	0.37	U value	
Air Leakage (Infiltration)			
Blower-Door Tested	2,037	CFM50	
Air Changes per Hour at 50 Pascals	5.4	ACH-50	ENERGY STAR Homes Std. is <5
Air Changes per Hour Natural	0.3	ACH-Natural	
Mechanical Systems Features			
Heating Distribution System			
Ducted	14%	Present	
Hydronic	81%	Present	
Other (baseboard/unit heaters)	5%	Present	
Heating Fuel Type			
Natural Gas	4%	Present	
Propane	15%	Present	
Fuel Oil	75%	Present	
Electric	5%	Present	
Heating Efficiency			
Furnaces	87.7%	%AFUE	
Boilers	85.3%	%AFUE	
Cooling System Type			
Central Air Conditioning System	12%	Present	
Room Air Conditioner	34%	Present	
Cooling System Efficiency			
Central Air Conditioning System	12.85	SEER	
Room Air Conditioner	10.42	EER	
Duct Leakage			
Leakage to Outside	269	CFM-25 to outside	
Leakage per 100 sq. ft.	10.0	CFM-25 per 100 sq. ft.	ENERGY STAR Homes Std. is <6
Ventilation System			
None	82%		Don't meet Maine Ventilation Code
Domestic Hot Water Type			
Conventional	13%	Present	
Instantaneous	5%	Present	
Integrated (Indirect-Fired Storage Tank)	63%	Present	
Combination tank	3%	Present	
Tankless coil	17%	Present	
Lighting			
Total Fluorescent Fixtures	15%	Present	
Total Incandescent Fixtures	85%	Present	
Light Sockets Count	70	Per Home	
Appliances			
Refrigerator	65%	ENERGY STAR Qualified	13% Don't Know or NA
Dishwasher	68%	ENERGY STAR Qualified	15% Don't Know or NA
Clothes Washer	60%	ENERGY STAR Qualified	16% Don't Know or NA
Clothes Dryer Fuel Type	91%	Electric	

Some of the highlights from the study include the following:

- Eighty-three percent (83%) of homes would not pass the Maine Model Building Energy Code (IECC-2003 using consumption compliance path);
- Eighty-one percent (81%) of homes would not pass the Maine Ventilation Code;
- No homes were found to be already "ENERGY STAR labeled";
- Maine homes scored an average of 86 on the national Home Energy Rating System Index (with 100 as "national code" and 0 as a "zero energy home": lower is better);
- Oil is the predominant fuel for space heating (75%) and water heating (71%), with 63% utilizing a very efficient indirect-fired storage tank as a zone off the boiler;
- Boilers with efficient hydronic (baseboard) distribution systems are found in 86% of new homes;
- Twelve percent (12%) of new homes have a central air conditioning system;
- Most homes (83%) are framed with 2x6 walls;
- Ceiling insulation effectiveness was compromised and resulted in low effective R-values due to both poor quality of installation in combination with areas of missing insulation (such as attic hatches, among other locations);
- Sixty-six percent (66%) of foundation walls were uninsulated; this is one of the primary reasons homes don't pass code;
- Energy-efficient low-E windows (Uo<= 0.36) were the predominant type found;
- Air leakage (infiltration) rates (5.4 air-changes per hour at 50 Pascals) were in line with national ENERGY STAR Homes standards;
- Heating system efficiencies were relatively high (85%+ AFUE); and
- The overwhelming majority of light fixtures (85%) are still incandescent with opportunities for over 55 sockets (hard-wired and plug-in) per home to be fitted with efficient fluorescent CFLs.

Despite the fact that heating system efficiencies are generally pretty good, low-E windows are predominantly installed and air leakage rates are in line with ENERGY STAR standards, there are numerous opportunities to improve the energy efficiency of new Maine homes.

D. RECOMMENDATIONS

Maine's new home program should incorporate a number of strategies, including technical assistance, direct incentives, marketing and consumer education. The program should work closely with builders and other important stakeholders to encourage energy efficient homes that are also high performance buildings. Based on the research conducted for this study, including field testing and observations, discussions with homeowners and data analysis, we make the following recommendations to help improve program performance and maximize market impacts:

1. *Code Adoption and Enforcement* – Given the fact that 83% of new homes do not meet code in Maine, there are some real opportunities for raising the energy efficiency floor in an attempt to improve the performance of new homes. There are many political and implementation issues associated with an energy code that would need to be resolved in moving forward, but there is also a lot of energy that could be saved if all new homes were constructed to the code levels that Maine has already adopted. If a robust Home Energy Rating System (HERS)

infrastructure were developed through this residential new construction initiative, these raters could serve as a code support network. If builders were required to build to code and could demonstrate such through a Home Energy Rating, the costs of compliance could be rolled into the home costs so that buyers who benefit from lower energy costs would pay for these upgrades and services. Using HERS Raters for code support would relieve municipalities from any new mandates, would stimulate Maine "green collar" jobs and would introduce builders to energy professionals who could lead builders to higher tiers of the new homes program for greater energy savings.

2. *Builder Training* – Maine builders have a lot to learn about building performance and energy efficient construction. Comment and after comment from the Energy Raters pointed out building shortcomings and deficiencies. A comprehensive series of trainings targeted at builders with some inducements to get them to attend would go a long way towards improving the performance of the homes they build. Incorporating building science curricula at trade schools would start the process for the next generation of builders. Builder training is a long-term effort that needs to begin as a new homes program rolls out so that both work together to drive demand and supply of energy efficient homes, and need to continue into the future to ensure real market transformation of the new homes industry.

3. *Tiered Approach* – While many of the homes examined don't meet the energy code, there are some that are already doing pretty well in terms of energy performance. As the architect and builder surveys revealed, some of these people and businesses are building efficient homes without a program. What this demonstrates is that a program in Maine with "one size fits all" will likely not work because it won't meet the needs of all new homes customers. Adopting a program with multiple tiers that can allow entry into the program at multiple levels and which drives them to higher steps of performance would be the most effective approach.

4. *Manufactured Homes* – About a quarter of the new homes constructed each year in Maine are built in a factory. Quite a few of these homes are constructed in Maine, as well. A concerted focus on improving the energy efficiency of manufactured homes could yield lasting results since once certain approaches are changed in the factory situation, there is a high likelihood that those changes will stick and be applied to all future homes. There are also some opportunities to work with the national ENERGY STAR Homes program to build in energy improvements into the process for manufacturers. This market would benefit from participation in a new homes program.

5. *Electricity Focus* – There were a number of opportunities for electrical savings identified in the homes in the survey. These areas should be a focus of the new homes program in order to reduce electrical use.

    a. Electric Heat
    b. Cooling Systems
    c. Lighting
    d. Appliances
    e. Clothes Dryers

6. *Coordinate Efforts with Oil and Natural Gas Companies* – Oil is the heating and hot water fuel in three-quarters of the homes surveyed. Any efforts to coordinate with oil companies and

the gas utilities to bring some of their resources and customer contacts into a new homes program would help make Efficiency Maine funds go further and would leverage additional customers.

7. *Technical Features* – Homes in the survey had quite a few energy and building science-related shortcomings. These resulted in a wide range of HERS scores and a high percentage of code underachievement outcome. Some of these areas include:

    a. Building Science
    b. Insulation
    c. Seal Ducts
    d. Reduce Infiltration
    e. HVAC Over-sizing
    f. Mechanical Ventilation

II. INTRODUCTION

In 2008 Efficiency Maine plans to launch a Maine ENERGY STAR Homes (MESH) program statewide. The goal of MESH is to increase the energy efficiency and environmental performance of residential new construction throughout Maine The program will provide services to, and work closely with the building community and a range of partners. Program activities and strategies include marketing, technical assistance, direct incentives, and quality control.

New construction markets often provide classic examples of important market barriers to energy efficiency including split incentives between the builder and consumer, lack of technical understanding of key efficiency features by builders and subcontractors (e.g., air leakage, duct leakage, etc.) and a lack of consumer inability to differentiate information and labeling to allow for rational comparison of the costs and performance of apparently similar buildings. Also, importantly for Efficiency Maine from the long-term resource perspective, cost-effective efficiency upgrades in new construction, if not captured during construction are often "lost opportunities" that negatively impact building performance and durability for decades. For these and other reasons, the MESH program is an important addition to Efficiency Maine's program portfolio.

A. GOALS

In order to better understand the residential new construction market in Maine and to build up a base of knowledge to help in strategically approaching builders, Efficiency Maine embarked on a comprehensive study of local residential new construction. This study was commissioned by Efficiency Maine in the summer of 2007 to provide a baseline analysis of the building and equipment characteristics that impact residential new construction. In carrying out this effort, Efficiency Maine hired the ERS Team to help develop and implement a suite of residential programs. A residential new construction program was part of that suite, including conducting this technical baseline study. Vermont Energy Investment Corporation (VEIC), as part of the ERS team, led this effort and received assistance and input from GDS Associates and ERS. This effort targets efficiency opportunities in residential new construction with the following goals:

- **Baseline measurement:** The primary objective of the study is to establish a technical baseline that documents the current market for ENERGY STAR Homes to aid in future program evaluation.

- **Program Design and Implementation:** A secondary objective of the study is to enhance Efficiency Maine's understanding of the new residential construction market to inform program design. This information will be used as MESH is modified and enhanced over time.

- **Builder Outreach & Training Strategies**: With a better understanding of the homes they are building and the market in which the homes are being built, MESH will be more effective in targeting and training builders and focusing on the problem areas in their homes in order to achieve the greatest program participation and energy savings per participant at the least cost.

- **Program Savings**: As MESH commences, this study provides a technical baseline against which to compare future participating homes and to assess program savings.

B. PROJECT TEAM

With these goals in mind, VEIC led the effort to design and administer the baseline study. GDS Associates played a key role in designing the statistical approach to sampling, gathering the names of potential customers, recruiting customers and managing the Energy Raters in their collection of the field data. GDS also performed all of the builder surveys.

Four accredited Home Energy Rating System (HERS) providers were engaged to collect all of the field data, generate the energy models of each house (using REM/Rate software) and populate the Access database. The providers who participated in this effort include:

- GDS Associates, Inc
- WYDEVUE Residential Energy Services, LLC
- Conservation Services Group
- Horizon Residential Energy Service Maine, LLC

C. ORGANIZATION OF REPORT

This study provides comprehensive information from the in-field home inspections in the main body of the report, with more detailed data and background information in the appendices. The results from the REM/Rate home energy ratings are combined with the data from the additional information that the Energy Raters collected and stored in the Access database. We have also included sections in both the main body of the report and the appendices from the GDS builder/architect interviews.

In addition, there is significantly more data stored in electronic form that was collected as part of the on-site rating process. If there is some technical aspect of a house, or the collection of homes, that is not presented here but is still of interest, chances are that it was collected, but just not reported. That additional information may be made available upon request.

III. METHODOLOGY

A. STUDY SAMPLE

Owners of 80 new homes were recruited from geographically-targeted locations throughout Maine based on random calling from lists of new homes gathered from town clerks, city halls, building suppliers and utilities. A cluster-sampling technique was used to develop the representative sample based on building activity in different regions in the state. Recruited homeowners were rewarded for opening up their homes to our team of four certified Home Energy Rating System (HERS) Energy Raters for a half-day with a cash payment of $100 each.

Table 2. Sample Geographic Distribution

Region	City/Town	New Housing 2000	Sample
South	York/Wells/Ogunquit	413	16
	Kennebunk/Scarborough	312	12
	Portland	95	4
	Brunswick	85	3
Central	Auburn/Lewiston	37	10
	Augusta	40	11
	Skowhegan	42	11
	Bangor	17	5
Eastern Shore	Bar Harbor	54	3
	Bucksport	35	2
North	Caribou/Presque Isle	45	2
	Madawaska	16	1
Total Target			80

B. DATA COLLECTION

The project team contracted with four certified Maine HERS energy rating providers to perform energy ratings to the standards of the Northeast HERS Alliance (www.energyratings.org) and RESNET (www.resnet.us). In addition, a comprehensive survey of supplemental energy, customer and building performance information was collected on each house and entered in an Access database (see appendices). Due to some attrition and data quality issues, 76 homes from the Access database and 78 from REM/Rate HERS energy ratings were used to prepare this report.

C. ANALYSES

The project team conducted the following analyses on the collected data in order to better understand the implications of our findings while using it to inform energy policy and program design:

- Home Energy Rating System (HERS) results;
- HERS results in comparison to other Northeastern states that have ENERGY STAR Homes programs;
- Proper heating and cooling system sizing;
- Least-cost analysis to determine the upgrade cost of the optimal package of energy efficiency improvements to bring the average baseline home to code (performance and prescriptive approaches), ENERGY STAR, Federal Tax Credit levels ("EPACT") and micro-load homes (both without and with a renewable energy system);
- Cash-flow analysis (energy savings less increased mortgage costs) for bringing the average baseline home to code (performance and prescriptive approaches), ENERGY STAR, Federal Tax Credit levels ("EPACT") and micro-load homes (both without and with a renewable energy system); and
- Maine Energy Code compliance (for energy and ventilation).

Conclusions and recommendations for program design and implementation conclude the technical portion of the baseline study.

IV. BASELINE TECHNICAL RESULTS

This section contains the results of the in-field investigations of 78 housing units. Of these 78, two were duplexes (one of these was characterized as a single building), and one was a mobile home. The remaining homes were single-family detached. Summarized data for all homes has been reported here.

A. SUMMARY TECHNICAL RESULTS

The following tables highlight some of the major findings and characteristics of the average single-family detached houses found in Maine. More detail on all of the summary results can be found in the sections that follow.

Table 3 shows that the most common type of construction found in the baseline survey was traditional on-site stick built. Manufactured homes comprise 24% of the sample homes surveyed. The percentage of manufactured homes in the sample resembles the average percentage of manufactured housing in Maine for the recent past. Between 25-30% of all new homes in Maine are considered “manufactured housing”. This percentage includes both modular and mobile homes[1].

Table 3. Summary of Construction Type for New Maine Homes

Construction Type	Incidence
Stick	74%
Modular	23%
Mobile	1%
Log	1%
Total	**100%**

Table 4.provides single-family detached house characteristics. Fuel percentages are reported for all heating systems, not percent of homes. A small number of homes had more than one heating system.

[1] Percentage estimated based on manufactured housing data obtained from conversations with Robert LeClair, Executive Director of the Manufactured Housing Board in Maine, and US Census data. Data for years 2002-2006.

Table 4. Summary Average House Characteristics

Feature	Units	Value
House Size	Sq Ft	2,057
Central Air Conditioning	%	12%
Space Heating Fuel		
Natural Gas	%	4%
Propane	%	15%
Fuel Oil	%	75%
Electric	%	5%
Wood	%	1%
Domestic Hot Water Fuel		
Natural Gas	%	1%
Propane	%	15%
Fuel Oil	%	71%
Electric	%	12%
Wood	%	1%
Light Sockets		
Incandescent	Count/home	50
Incandescent	%	71%
Fluorescent	Count/home	14
Fluorescent	%	20%
Total Light Sockts (all types)	Count/home	70

Table 5 shows the average HERS score across all homes in the study. Also listed are costs to achieve the different energy efficiency tiers that have been recommended for Maine's residential new construction program. Detail on these costs can be found in the section of this study on the "least cost analysis".

Table 5. Summary Average Energy Results

Feature	Value
Energy Rating (using HVAC name plate performance)	86
Cost to Achieve IECC 2003 Code Compliance	$ 3,692
Cost to Achieve IECC 2003 Code, Prescriptive	$ 3,366
Cost to Achieve ENERGY STAR	$ 4,144
Cost to Achieve EPACT	$ 4,661
Cost to Achieve Micro Load	$ 18,723
Cost to Achieve Micro Load with RE	$ 47,763

Table 6 displays the summary HVAC features of homes in the study. The data represents the average of all systems. Some homes have more than one system.

Table 6. Summary Average HVAC Characteristics

Feature	Units	Value
Heating System Distribution		
Ducted	% Present	14%
Hydronic	% Present	81%
Other (Unit/baseboard)	% Present	5%
Heating Efficiency		
Furnaces	AFUE	87.7%
Boilers	AFUE	85.3%
Cooling Efficiency		
Unadjusted SEER	Rated SEER	12.8
Duct Leakage		
Total Leakage to Outside	CFM-25	240
Domestic Hot Water		
Indirect-Fired Tank	% Present	63%
Tankless Coil	% Present	17%
Storage Tank	% Present	13%
Instantaneous	% Present	5%
Combined Appliance	% Present	3%
N. Gas/Propane-fired Indirect Tank	Energy Factor	0.82
Oil-fired Indirect Tank	Energy Factor	0.78

Table 7 examines appliance efficiency for refrigerators, clothes washers, dishwashers and room air conditioners. Incidence of ENERGY STAR appliances in the study is compared to the entire state of Maine, New England, and the US. This data was obtained from field surveys. In some cases it was not possible to determine the ENERGY STAR rating. “Don’t Know” responses were reported for the ME Baseline homes as follows: refrigerator (13%); clothes washer (16%); dishwasher (15%) and Room AC (34%).

Table 7. Energy Star Appliance Penetration – ME Baseline, ME State, New England and US

Appliance	ME Baseline	ME State	New England	US
Refrigerator	65%	40.31%	38.58%	31.16%
Clothes Washer	60%	46.08%	48.28%	37.93%
Dishwasher	68%	95.27%	93.57%	92.26%
Room AC	36%	55.97%	54.07%	36.14%

Note: Maine State and All States averages obtained from D&R International (2006)

B. HOUSE CHARACTERISTICS

1. Size

Table 8 provides the size range for new single-family detached houses in square feet.

Table 8. Size in Square Feet

Mean	2057
Minimum	576
Maximum	5,498

Figure 2 shows the distribution of single-family detached house size by conditioned square feet. The greatest percentage of units, nearly 50%, are between 1,000 to 2,000 square feet..

Figure 2. Distribution of Single-Family Detached Housing Sizes

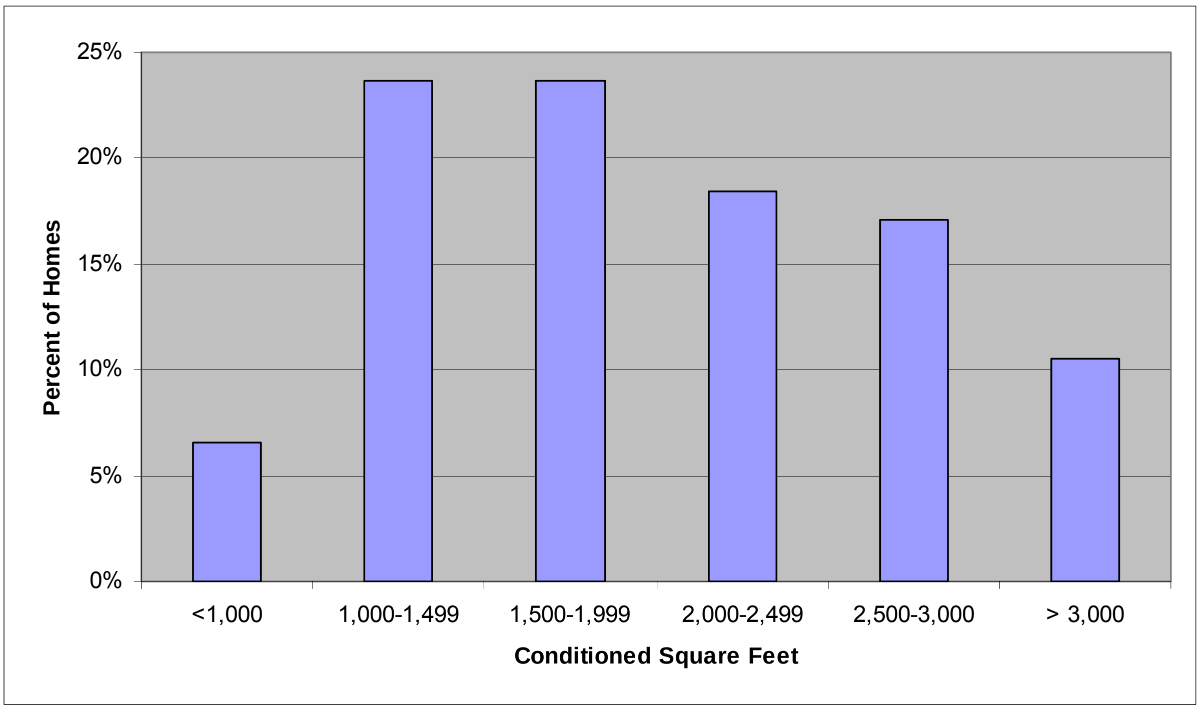


Table 9 lists the average square footage for each floor of homes in the study that contain these floor types.

Table 9. Average Area in Square Feet by Floor

Floor	Average Area (sq ft)
Basement	1330
First Floor	1453
Second Floor	1196
Third Floor	796

C. BUILDING ENVELOPE

Table 10 summarizes average house thermal characteristics for air leakage, windows, walls and insulation. For the most part, Maine homes are reasonably air tight, have efficient low-E windows and decent wall R-values. However, basement walls are mostly uninsulated and ceilings are generally lacking both the quantity and quality of insulation.

Table 10. Summary Average Thermal Envelope Characteristics

Feature	Units	Value
Air Leakage		
Blower Door Tested	CFM-50	2037
Windows		
Thermal Properties	U-Value	0.37
Shading Properties	Solar Heat Gain Coefficient	0.45
Glazing Percentage	% Window to Wall Ratio	15%
Walls	R-Value	17.5
Frame Floors	R-Value	15.3
Foundation Walls	R-Value	3.4
Ceiling	R-Value	31

1. Foundations

Table 11shows the prevailing foundation types for the single-family detached homes. For all homes nearly half are over a conditioned basement.

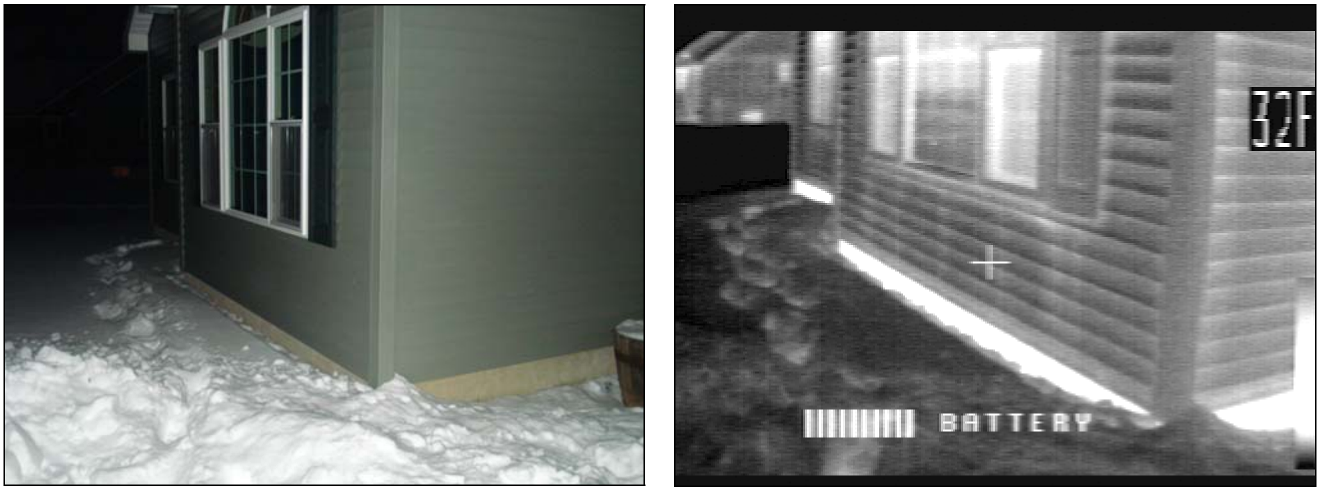
Table 11. Summary of Foundation Type

Foundation Type	Frequency	Percent
Conditioned Basement	36	46%
Unconditioned Basement	20	26%
Multiple Types	8	10%
Slab	7	9%
Enclosed Crawl	4	5%
Open Crawl	2	3%
Conditioned Crawl	1	1%
Total	**78**	**100%**

Looking at only foundation walls exposed to ambient conditions, the findings indicated that 66% were uninsulated, regardless of whether the basement or crawl space was conditioned. When foundation wall insulation is present, the most commonly used type is extruded polystyrene.

Figure 3 below shows a side by side view of a photograph and infrared image taken on an uninsulated radiant slab foundation.

Figure 3. Lack of Slab Insulation on Radiant Floor



Stephen Carr, WydeVue Residential Energy Services, 2008

Figure 4 shows a photo assembly of a typical finding in this study: unintentionally heated basement with partially insulated foundation walls. The raters comments regarding this basement were as follows: "basement is unintentionally heated, no basement ceiling or pipe insulation; some wall, rim/band joist insulation, band joist insulation is missing at radiator supply/returns."

Figure 4. Typical Foundation Walls

Adam Gifford, Conservation Services Group, 2008

This image, Figure 5, shows an example of completely uninsulated foundation walls with an uninsulated steel bulkhead access door.

Figure 5. Uninsulated Foundation Walls.

Bruce Bennett, GDS Associates, 2007

2. Band Joists

The majority of band joists occur between conditioned or unconditioned space and ambient. Band joist insulation is similar to wall insulation with an average value of R-16. The most common insulation type in band joists is fiberglass batts.

3. Exposed Floors

Exposed floors occur primarily over unconditioned basements (67%) followed by floors over enclosed crawls spaces (16%). About half of the frame floors over unconditioned basements had some insulation, the average being R-10. Frame floors over enclosed crawls spaces were primarily uninsulated. When insulation is present, the most common type used is fiberglass batts.

4. Above Grade Walls

The vast majority of above grade walls are located between conditioned spaces and ambient. The average insulation level of walls between conditioned and ambient is R-18, just slightly higher than the average R-value of all walls. Fiberglass batts are the most prevalent insulation type in above grade walls.

Most above grade walls (83%) were found to be 2x6 framing. Of the 14% that were 2x4, only about 33% are exposed to ambient conditions. The remaining 2x4 walls are between conditioned and buffered space such as a garage. The remaining percentage of walls comprises a small number of 2x8 and Insulated Concrete Form (ICF) walls.

5. Windows

The window average U-value, a measure of the rate of heat flow through a material or assembly) is expressed in units of Btu/hr-ft^2-°F or W/m^2-°C. Window manufacturers and engineers commonly use the U-value to describe the rate of non-solar heat loss or gain through a window or skylight. Lower window U-values have greater resistance to heat flow and better insulating value.

The solar heat gain coefficient ("SHGC") is the standard indicator of a window's shading ability. (SHGC is the fraction of solar radiation admitted through a window or skylight, both directly transmitted and absorbed, and subsequently released inward.) SHGC is expressed as a number without units between 0 and 1. Low SHGC will increase heating energy consumption and decrease cooling.

The predominant window type in Maine new homes is double pane, Low-E (emissivity) with a U-value of 0.37 and a SHGC of 0.45. Fifteen percent of exterior walls are window area.

Table 12. Summary of Window Characteristics

Window Glazing	Value
Average Percent Glazing	15%
Average SHCG	0.45
Average U-Value	0.37
Percent LoE (U<=.36)	77%

6. Skylights

The average SHGC for skylights is comparable to that of windows (SHGC = .47). The average U-value is higher (U-value = .46). This is largely due to a single instance of a vinyl single pane skylight. Without this single record the average is more consistent with windows (U-value = .39). Of all homes, 14% had skylights. The average skylight area per home is just under 3 square feet.

7. Doors

Homes have an average door area of 77 square feet with an average insulation value of R-3.2.

8. Ceilings

Approximately 83% of all ceilings are flat. Both flat and sloped ceilings have about the same average R-31 insulation. Fiberglass batts are the most commonly used insulation type (65%). Blown fiberglass is used in about 11% of homes, followed by cellulose (6%). There were very few instances of other types of insulation such as rigid foam boards, or spray foam.

While nominal insulation R-values were acceptable, we found several instances of very poor insulation installation across the homes in this study. The quality of insulation installation is defined by the insulation Grade[2]. A value of I (highest) to III (lowest) is applied in the modeling software used for this study to de-rate the nominal R-value. While the average value across all ceilings was Grade II, 40% of all ceiling insulation was defined as Grade III. Some examples poor quality insulation installation are shown below.

Figure 6 displays a series of photos matched up with the corresponding infrared image detailing cold spots due to poor quality installation.

Figure 6. Typical Gaps in Ceiling Insulation

Stephen Carr, WydeVue Residential Energy Services, 2008

The photos shown in Figure 7 are examples of all too common haphazard ceiling insulation installation.

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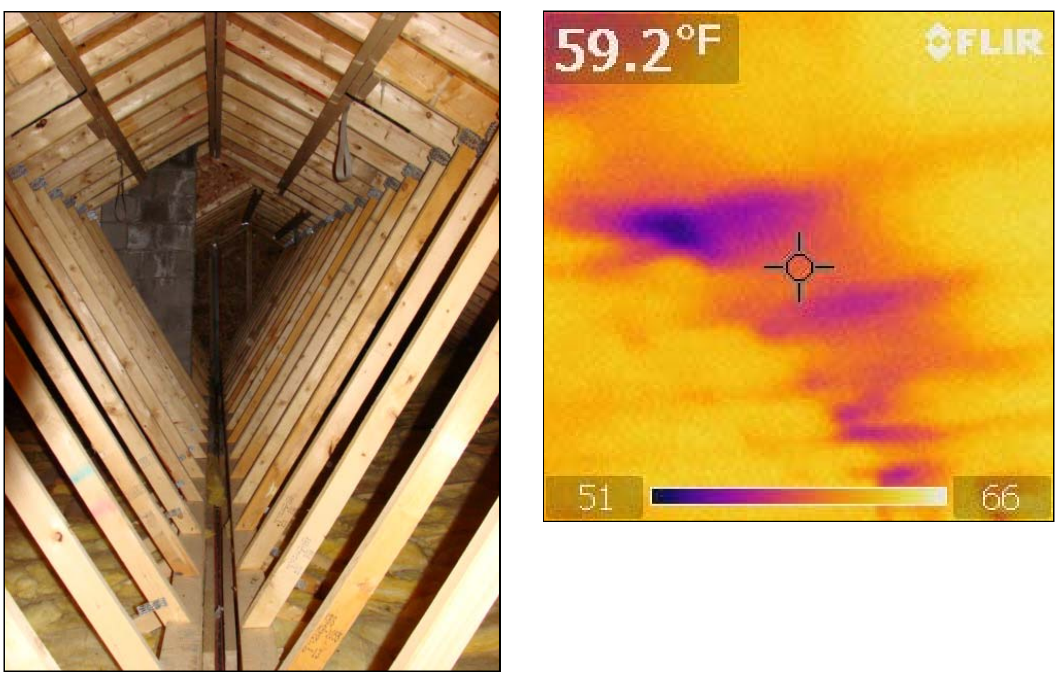
[2] RESNET standards specify insulation grade values from I to III. Grade 1: Highest quality, full loft, no gaps or voids around obstructions, split around pipes or wires, and complete contact with all required surfaces in the cavity. Grade III: Lowest quality, with substantial gaps and voids amounting to 2-5% of the area, open on one side to a vented cavity or not in contact with one surface.

Figure 7. Typical Haphazard Ceiling Insulation Installation

Bruce Bennett, GDS Associates, 2007 Stephen Carr, WydeVue Residential Energy Services, 2008

We also found a common lack of properly insulated marriage walls in manufactured homes, where the two halves are joined. In some cases insulation was of poor quality, in others there was no insulation at all. Figure 8 shows a photo on the left of a modular home with no insulation above the marriage wall. The infrared image on the right shows cold spots along the marriage wall of another modular home.

Figure 8. Lack of Insulation at Marriage Wall



Adam Gifford, Conservation Services Group, 2008 Bruce Bennett, GDS Associates, 2007

D. INFILTRATION (AIR LEAKAGE)

The average leakage rate of homes in this study is 2037 CFM at 50 Pascals pressure as measured with a blower door. In general, larger homes leaked more. The one exception, homes in the 4,500-4,999 square foot category, was slightly lower. However, there is only one representative home in this area category. Figure 9 shows the increase in leakage rate by home size.

Figure 9. Air Leakage Rates by House Size

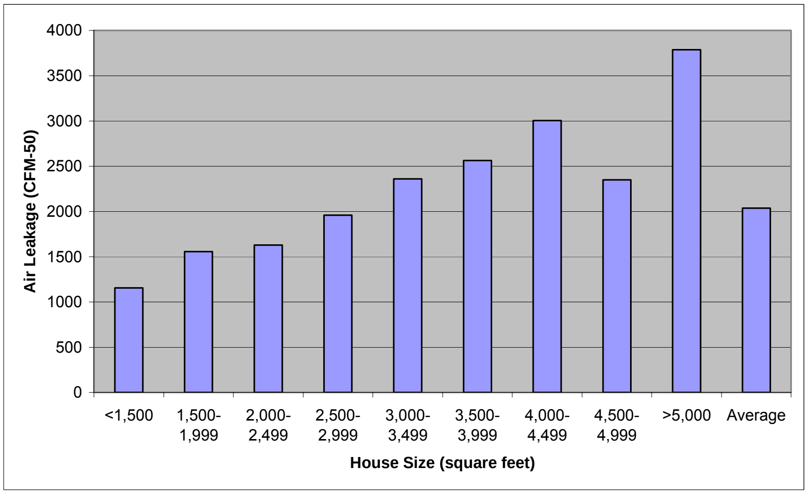


Figure 10 shows the effects of poor air sealing. Rater comments on this home were as follows: "The frost is on the attic side of door frame to walk-up attic. Represents humidity transport through air leakage to the attic (around door frame)." This is the same home shown on the left in Figure 7 above.

Figure 10. Effects of Poor Air Sealing

Bruce Bennett, GDS Associates, 2007

Figure 11 is a good example of air leakage displayed during a blower door test. This home had an infiltration rate of 3885 CFM-50. This value is 90% greater than the average infiltration rate of 2037 CFM-50.

Figure 11. Construction Dust Displaying Air Infiltration

Bruce Bennett, GDS Associates, 2007

E. SPACE HEATING

1. Heating Fuel Type and Use

Table 13 shows data for primary heating fuel usage. Fuel oil is used in 75% of new homes. The next significant fuel used is Propane at 15%. Natural Gas, electricity and wood account for the remaining 10%.

Looking at homes by heating fuel type, the table below also shows, on average, the amount of fuel consumed and cost per year to heat the home. These numbers are averages for only the homes using the given fuel type.

Weighted by fuel type, the average annual cost of heating is about $2,666[3]. The average annual cost of electricity to power fans and pumps used for heating is just over $40.

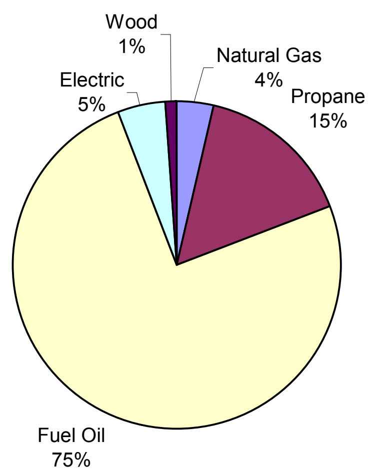
[3] Heating costs are estimated using REM/Rate software to provide consumption data and average current utility rates for Maine: Electric ($0.16/kWh); Natural Gas ($1.34/therm); Propane ($3.05/gal); Fuel Oil ($3.45/gal); Wood ($170/cord)

Table 13. Heating System Fuel Use by Fuel Type

Primary Heating Fuel	Percent Fuel Type	If Only Fuel, Avg Use/Yr	Avg Annual Cost
Oil (gallons)	75%	771	$2,660
Propane (gallons)	15%	1,002	$3,057
Natural Gas (therms)	4%	473	$632
Electricity (kWh)	5%	20,248	$3,236
Wood (cords)	1%	11	$1,799
Total Weighted Average	**-**	-	**$2,666**

Figure 12 is a graphical representation of fuel use for heating.

Figure 12. Distribution of Heating Fuel Use



2. Heating System Types

Table 14 shows data on the number of heating units installed per house for single-family detached units. Most homes have only one heating system installed. Less than 10% have a secondary system. Of the homes with a secondary system, 33% were space heating units accounting for less than 10% of the homes total heating load.

Table 14. Number of Heating Systems per Home

Number of Heating Units	Incidence
1	92%
2	8%
None	0%
Total	**100%**

Table 15 presents information on the type of distribution system installed along with primary fuel type. We found that for hydronic systems, fuel oil was by far the primary fuel type, but for ducted systems fuel oil was only used in half of the systems. Propane was the next most commonly used fuel for both system types. We did find one home with an electric furnace but the majority of electric heating was baseboard.

Table 15. Primary Fuel and Distribution System

Primary Heating Fuel	Ducted	Hydronic	Space/Baseboard	Overall (fuel)
Oil	50%	84%	0%	75%
Propane	33%	12%	25%	15%
Natural Gas	8%	3%	0%	4%
Electric	8%	0%	75%	5%
Wood	0%	0%	0%	1%
Overall (distribution)	14%	81%	5%	100%

3. Heating System Sizing

Table 16 shows the average rated heating output for all heating systems. Also shown here is the average heating design load as calculated by the REM/Rate modeling software. This calculation enables us to see that, on average, heating systems in Maine homes are oversized by 139%.

Table 16. –Heating System Average Rated Output

Avg Rated Output (kBtuh)	Avg Design Load (kBtuh)	% Oversized
113	47	139%

4. Heating System Efficiency

The average Annual Fuel Utilization Efficiency (AFUE) for single-family detached housing is 88.7% for furnaces. Boilers have a lower average AFUE of 85.3%. This is higher than expected.

Table 17 shows that propane and natural gas heating systems have higher efficiencies for both distribution types. This is due to the nature of oil versus gas technologies; gas equipment is inherently more efficient.

Table 17. Heating Efficiency by Fuel and Distribution

	Oil	Propane	N. Gas
Ducted	84.3%	92.7%	88.0%
Hydronic	84.6%	90.9%	90.0%

The average AFUE across all systems and fuel types is 86.3

5. Location of Heating Systems

All heating systems were located in either a conditioned space or an unconditioned basement. Over 80% were located in a conditioned space.

6. Heating System Venting

The majority of heating systems that produced combustion exhaust used either sealed combustion (42%) or natural draft (49%). Power vents were used for 7% of heating systems. The remaining 2% were vented by induced draft. Of the homes where combustion exhaust data was reported, roof venting was the primary location (65%). The remaining systems (35%) were vented through the wall.

7. Woodstoves & Fireplaces

The study indicates that 18% of homes have at least one woodstove and nearly half of all homes utilize a fireplace or insert. Of all fireplaces and inserts, 73% were fossil fuel (primarily propane), 19% were traditional wood and 5% were fueled by pellets or biobricks. There was also one home with an electric fireplace. The homes utilizing wood as the fuel source burned an average of 6 cords during the 2005/2006 heating season. Over half of the fireplaces had a designated air supply. The majority (70%) were reported to have tightly fitting doors.

F. COOLING

1. Central Cooling System Incidence

Of all homes in the study, about 12% have at least one central air conditioning (CAC) unit. Table 18 shows the incidence of CAC systems. Of the homes that do have CAC, about half have two units. No homes have more than two units.

Table 18. Number of Central AC Systems per Home

Number of CAC Units	Incidence
1	6.4%
2	5.1%
None	88.5%
Total	**100%**

2. Room Air Conditioner Incidence

About 35% of homes in the study were reported to have at least one room air conditioning unit.

Table 19 shows the incidence of units per home. Most homes have either one or two units. The average size room AC unit is approximately 7600 Btu/hr. The average EER (Energy Efficiency Ratio) is 10.3.

Table 19. Number of Room AC Systems per Home

Number of RAC Units	Incidence
1	12%
2	17%
3	1%
4	4%
None	66%
Total	**100%**

Note: These averages are based only on reported data. Information was not available for all equipment.

3. Cooling System Sizing

Table 20 shows that the average central cooling capacity, for homes where CAC is present, is 5 tons. The high capacity is primarily due to the number of homes with multiple CAC units. Compared to the average design load, as calculated by REM/Rate, cooling systems tend to be oversized by 77%.

Table 20. Cooling System Average Rated Output

	Avg Rated Output	Avg Design Load	% Oversized
kBtuh	59	33	77%
Tons	5	3	

4. Cooling System Efficiency

Central Air Conditioning efficiency ranged from a minimum of 10 SEER (Seasonal Energy Efficiency Ratio) to a maximum of 14.0 SEER. Table 21 shows the minimum, maximum and mean nameplate SEER ratings for Maine homes.

Table 21. Central AC System Efficiency

	SEER
Mean	12.8
Min	10.0
Max	14.0

The federal standard minimum, implemented in January 2006, is SEER 13.0.

Due to the time of year this study was conducted, no detailed testing of cooling system charge and airflow was conducted to determine the actual in-field SEER performance of these units. This additional analysis could be conducted at a later time when temperatures are warm enough to conduct the testing.

5. Location of Central Cooling Systems

All CAC systems were located in either a conditioned space or an attic. Over 80% were located in a conditioned space.

G. HVAC DISTRIBUTION

1. Distribution Types

Across all homes, ductwork was present in 19%. Table 22 shows that the percentage of homes with central air conditioning (CAC) does not equal the percentage of homes with ducted heating. This is because many homes with hydronic heating also have central air conditioning. We found that the incidence of a hydronic or ducted heating system did not seem to affect the presence of central air conditioning. Homes with hydronic heating actually had a slightly higher incidence of CAC (56%).

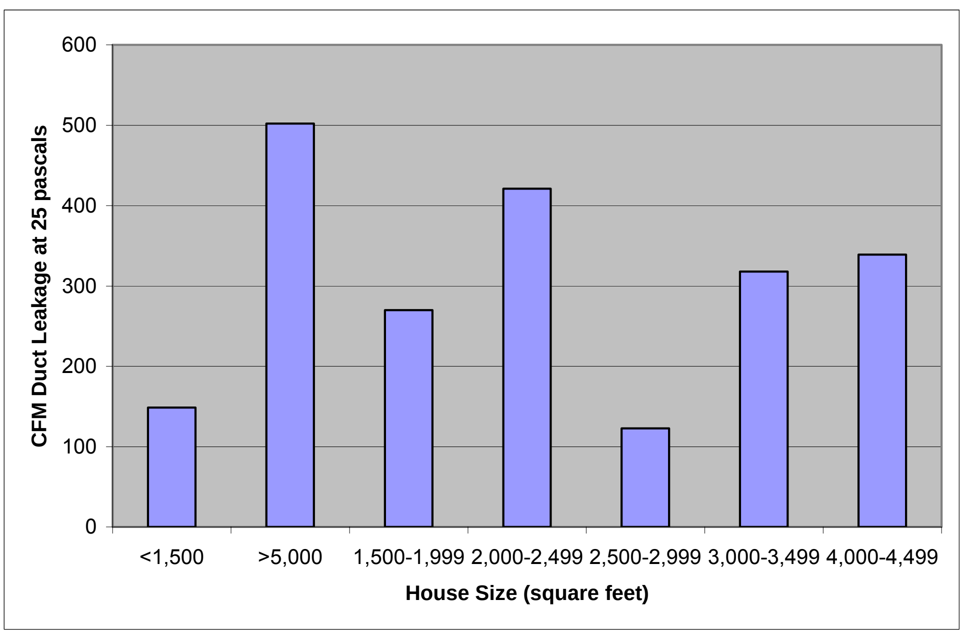
Table 22. Presence of Ductwork in New Maine Homes

	Incidence
Ducted Heating	14%
Ducted Cooling	12%
Homes with Ducts	19%

2. Duct Leakage

Figure 13 presents average duct leakage to outside, by house size, based on the industry standard test condition of 25 Pascals duct pressure. The average duct leakage rate, per home, is 269 cubic feet per minute (CFM) at 25 Pascals. This is sometimes expressed in terms of duct leakage per 100 square feet of house area. For Maine, the average rate is approximately 10 CFM-25 per 100 sq. ft. This is about 67% leakier than the ENERGY STAR Homes standard of less than 6 CFM-25 per 100 sq. ft. It is important to note the small sample size. Only 15 homes in the study have ducts; 14 were tested for leakage. With the exception of the <1500 sq ft bin which represents 4 homes, all other house size bins are only represented by 1-2 homes.

Figure 13. Duct Leakage by House Size



H. THERMOSTATS

Only 17% of homes in the study utilized a programmable thermostat to control the heating system. Of the 9 homes with central air conditioning, 33% were run on a programmable thermostat.

I. MECHANICAL VENTILATION

Most homes, 82%, had no mechanical ventilation system beyond standard bath fans and kitchen range hoods. Of the homes that did have ventilation systems installed, 14% were balanced systems and 4% were exhaust-only systems.

J. DOMESTIC HOT WATER

1. Domestic Hot Water Fuel Use

Table 23 shows that oil is the predominant fuel for domestic water heating, followed by propane and natural gas. Weighted by fuel type, the average annual cost to heat domestic hot water is $472[4].

Table 23. Domestic Hot Water Fuel Use by Fuel Type

Fuel Type	Percent Fuel Type	Avg Unit Annual Consumption	Avg Annual Cost
Oil (gallons)	71%	132	$455
Propane (gallons)	15%	158	$482
Natural Gas (therms)	1%	143	$191
Electricity (kWh)	12%	3,873	$619
Wood (cords)	1%	1.76	$299
Total Weighted Average	**-**	-	**$472**

2. Domestic Hot Water System Type

Table 24 shows the distribution of domestic hot water heating system types. The majority of systems installed in new homes are an indirect fired storage tank.

Table 24. Distribution of DHW System Type

System Type	Incidence
Indirect Fired	63%
Tankless Coil	17%
Stand-Alone Tank	13%
Instananeous	5%
Combined Appliance	3%

[4] Domestic hot water costs are estimated using REM/Rate software to provide consumption data and average current utility rates for Maine: Electric ($0.16/kWh); Natural Gas ($1.34/therm); Propane ($3.05/gal); Fuel Oil ($3.45/gal); Wood ($170/cord)

Figure 14 is a graphical representation of hot water system types present in Maine homes.

Figure 14. DHW System Type

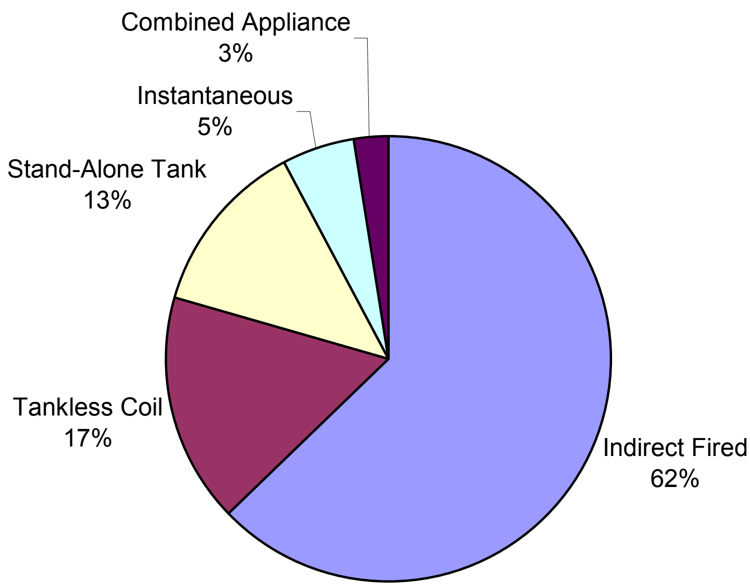


Table 25 shows the percent domestic hot water fuel type compared to the system type. The most common system type, indirect fired tank, also uses the most common fuel type, oil. Nearly all stand-alone tanks use electricity and nearly all tankless coils are oil.

Table 25. DHW Types by Fuel

	Oil	Propane	Natural Gas	Electricity	Wood
Indirect Fired	56%	5%	1%	-	-
Tankless Coil	14%	1%	-	-	1%
Stand-Alone Tank	-	1%	-	12%	-
Instananeous	-	5%	-	-	-
Combined Appliance	-	3%	-	-	-

3. Domestic Hot Water Energy Factor

Table 26 shows the average domestic hot water heating system Energy Factor (efficiency) by system and fuel type.

Table 26. Average DHW Energy Factor

	Oil	Propane	Natural Gas	Electricity	Wood
Indirect Fired	0.78	0.82	0.86	-	-
Tankless Coil	0.51	0.60	-	-	0.70
Stand-Alone Tank	-	0.63	-	0.90	-
Instananeous	-	0.86	-	-	-
Combined Appliance	-	0.83	-	-	-

The average EF across all systems and fuel types is .76.

4. Number of Domestic Hot Water Units

Two homes, or 3%, had more than one domestic hot water system. In both homes, the secondary unit provided about 30% or more of the total hot water load.

5. Location of Domestic Hot Water Units

All hot water heating systems were located in either a conditioned space or an unconditioned basement. Nearly 80% were located in a conditioned space.

6. Domestic Hot Water Venting

Of the hot water heating systems that had combustion exhaust, the majority used sealed combustion (59%) or natural draft (35%). One unit had a power vent. Venting was pretty evenly split between the wall and the roof (59% and 41% respectively).

K. LIGHTING AND APPLIANCES CHARACTERISTICS

1. Light Fixtures, Sockets and Bulbs

For this study we obtained the total percentage of fluorescent fixtures in homes. We also conducted a more detailed socket survey. Homes in the study have, on average 15% fluorescent fixtures. Of these, about 9% are screw-based CFL's, with the remaining being pin-based. When looking at socket data, on average, homes have 20% fluorescent light sockets and 71% incandescent sockets. The remaining percentage is primarily halogens. A surprising total of 70 light sockets were counted per home. Table 27 lists some of the socket characteristics found.

Table 27. Lighting Socket Characteristics

Characteristic	Incidence
Hard-Wired	90%
Dimmer	13%
Recessed Can	17%

The majority of all lighting sockets were hard-wired. Lights that were not hard-wired were, for the most part, either incandescent or CFL.   There were almost no fluorescent lights on dimmers. The sockets on dimmers were nearly evenly split between incandescent and halogen. The majority of lights that were recessed were halogen, followed by incandescent. A small percentage of CFL's were also recessed.

2. Appliances

Listed below are the average ages of each major appliance in the home as well as the percentage that are ENERGY STAR rated. It should be noted that there was an approximate 15% incidence of "Don't Know" answers for ENERGY STAR rating, 30% for freezers. So the actual percentage of units rated as ENERGY STAR could be slightly higher or lower.   More detailed appliance information can be found in the appendix.

Table 28. Major Appliances – ENERGY STAR Rating and Age

Appliance	Avg Age (yr)	ENERGY STAR
Dishwasher	2	68%
Refrigerator	3	65%
Freezer	7	10%
Clothes Washer	3	60%

L. ENERGY CONSUMPTION

REM/Rate modeling software was used to calculate the energy consumption of each home. Figure 15 shows the breakout of energy use (in MMBtu per year) for heating, domestic hot water, cooling and lights and appliances. Heating comprises over two-thirds of total energy usage in Maine homes. Cooling accounts for less than half of one percent of the total energy usage for Maine homes.

Figure 15. Average Energy Consumption by Major End Use Category

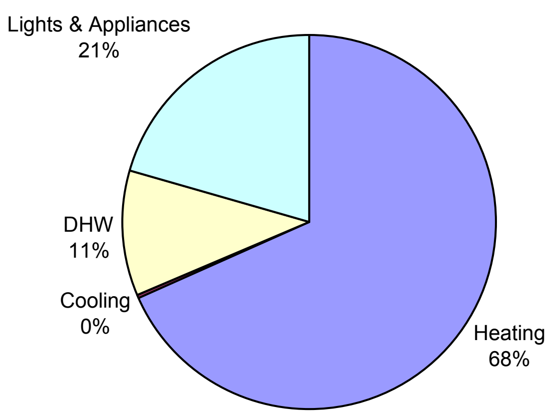
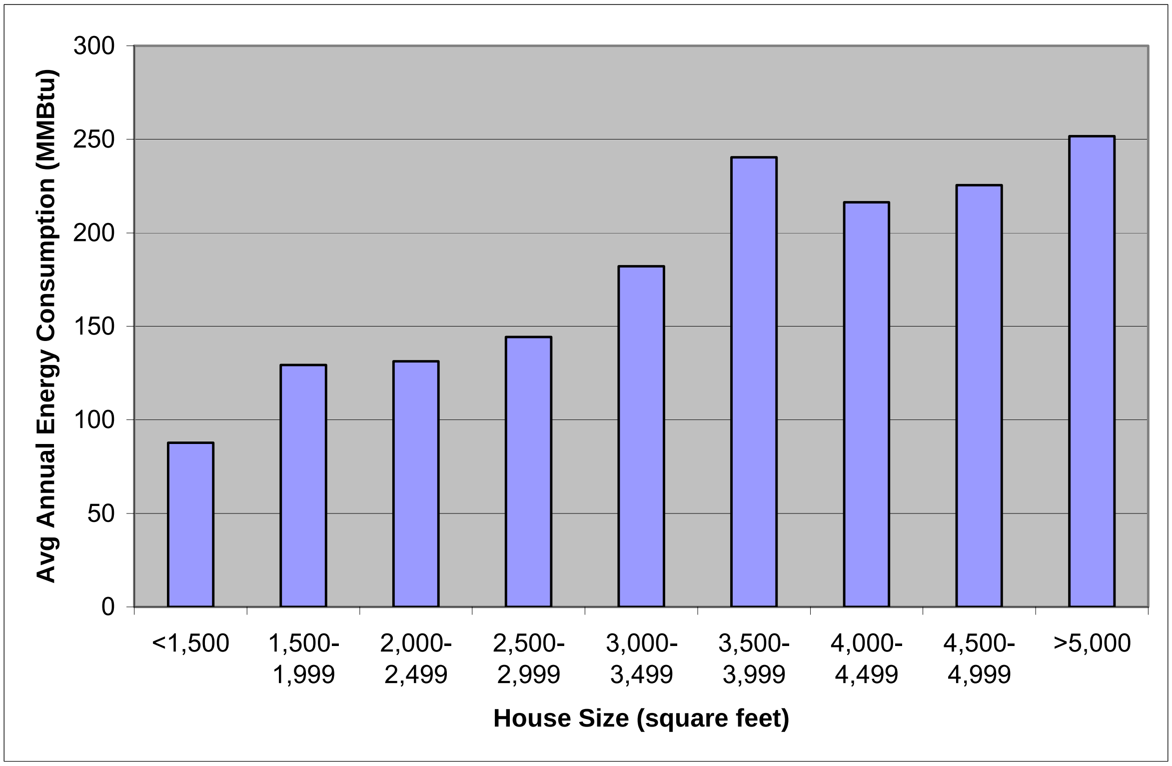


Figure 16 shows the proportional increase in average annual energy consumption by house size, with one exception in the 3,500 – 3,999 square foot range.

Figure 16. Average Annual Energy Consumption (in MMBtu) by House Size



From the HERS energy ratings conducted on each home, we averaged projected energy consumption (in terms of millions of Btu's) and costs based on current electricity and fuel costs. The average home will expend approximately $5,000 at today's rates for energy costs. Costs for each end use are listed in Table 29 below. The costs in this table represent average costs across all homes and are not weighted by fuel type.

Table 29. Estimated Annual Energy Use and Cost of Average New Maine Homes

End Use	MMBtu	Cost
Heating	108.0	$ 2,741.51
Cooling	3.8	$ 257.35
Hot Water	17.5	$ 466.29
Lights & Appliances	32.4	$ 1,501.36
Service Charge		$ 92.17
Total	**161.8**	**$ 5,058.68**

Note: The cooling costs represent the average annual cost for only homes that have central air conditioning. The average annual cost for cooling across all homes is about $30.

M. HOME ENERGY RATING SYSTEM (HERS) SCORES

The HERS Index is shown graphically in Figure 17 It was created by the Residential Energy Services Network ("RESNET", see www.resnet.us) and is recognized and used by the U.S. EPA, U.S. Department of Energy, as well as many states and utilities nationwide. This scale sets "the American Standard New Home" (a new home built to national energy code) at 100 points, establishes 80 points as the "ENERGY STAR Homes" level for northern-tier states like Maine, and sets 0 points for the home that requires no purchased energy, or a "Zero Energy Home". The lower the score, the more efficient the home.

Figure 17. RESENT HERS Index Example

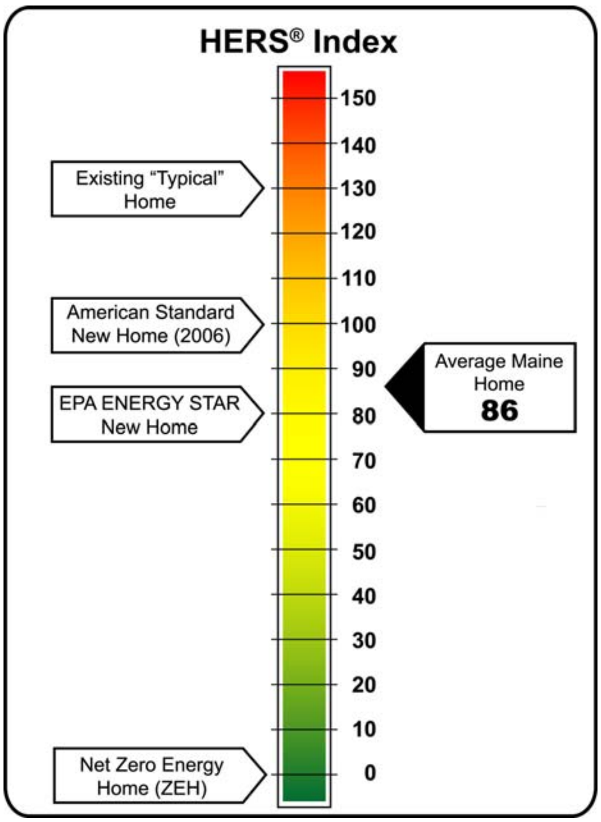


Table 30 shows the average, minimum and maximum HERS scores for new Maine homes. The home with the maximum score represents a home that uses almost twice the energy as if it were built to the average Maine characteristics. The minimum score is below the level that would make it eligible for the federal tax credits.

Table 30. HERS Index - Average and Range

	HERS Index
Mean	86
Minimum	58
Maximum	183

Table 31 shows the rating score for the single-family user defined reference home (UDRH) relative to the actual buildings evaluated. The UDRH home is a theoretical average composite home built up from all of the average characteristics of all the homes from this study. It results in a HERS score of 86, the same score as the numeric average of all 78 homes in the study.

Table 31. HERS Score – Actual Building Average vs. Composite Building

	HERS Index
Actual Buildings (avg)	86
Composite Building	86

Figure 18 is a graphical view of the home energy rating index distribution. The graph shows that the majority of homes score in the 81-85 range.

Figure 18. HERS Index Distribution

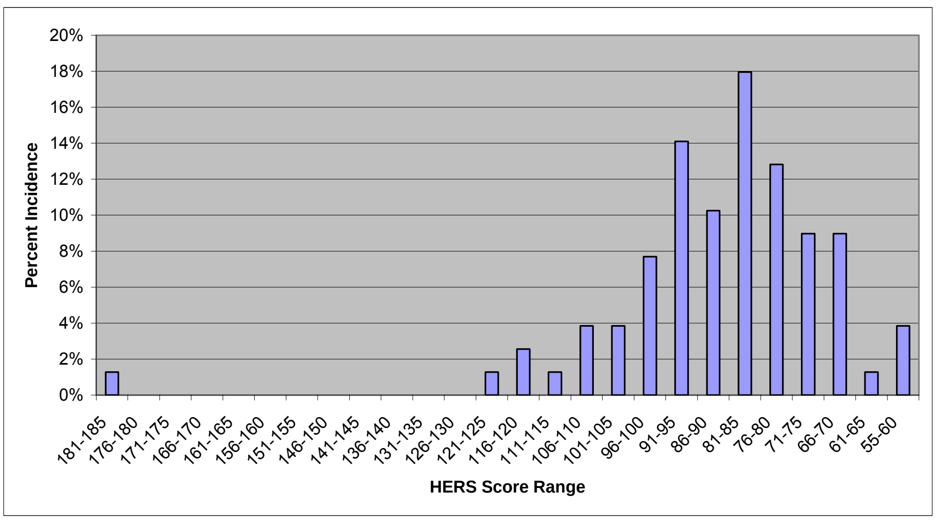
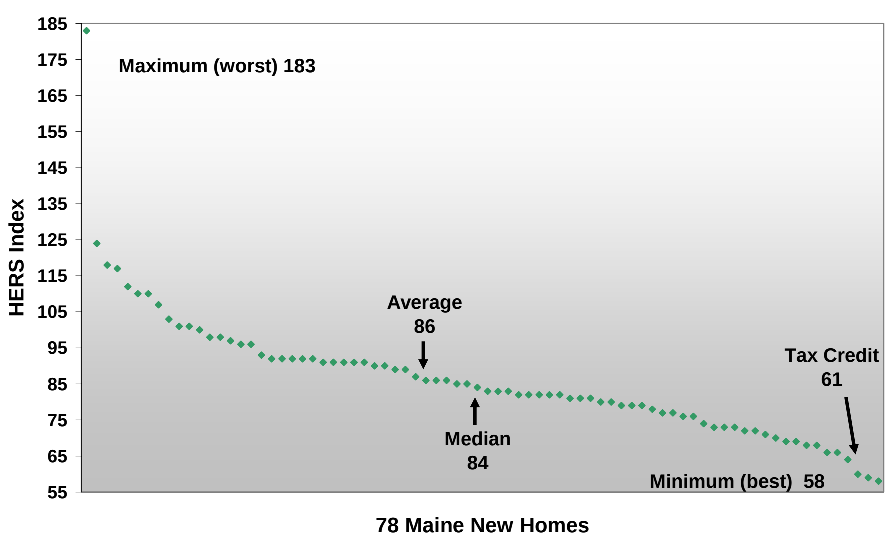


Figure 19 is another graphical representation of HERS Index distribution that really conveys the range of scores found in the study.

Figure 19. HERS Index Distribution Range



One of the most interesting findings of this study was the wide range of homes that make up the Maine new construction market. Table 32 provides a glimpse inside this range of homes. The images show that from the outside it isn't necessarily easy to tell the difference between a "good" home and a "bad" home. Even on the inside, there is room for improvement in an EPACT qualifying home. On the other end, having a decent percentage of fluorescent fixtures and all ENERGY STAR appliances doesn't end up counting for much when attention isn't paid to building quality.

Table 32. Range of Homes Surveyed


David Milliken, Horizon Residential Energy Service, 2008


Adam Gifford, Conservation Services Group, 2008


David Milliken, Horizon Residential Energy Service, 2008

HERS Index: 64	HERS Index: 86	HERS Index: 183
Passes Code (IECC 2003)	Fails Code (IECC 2003)	Fails Code (IECC 2003)
Building Shell Features		
R-22 ICF Foundation Walls	Uninsulated foundation walls	Uninsulated foundation walls
Walls R-19, Grade III	Walls R-19, Grade III	Walls R-11, Grade III
Ceiling R-41, Grade I	Ceiling R-33, Grade II	Ceiling R-11, Grade III
Window U-Value .33	Window U-Value .36	Window U-Value .39
Mechanical Systems & Infiltration		
Natural Gas Boiler 93 (AFUE)	Oil Boiler (83 AFUE)	Electric Furnace
Indirect-fired Tank	Indirect-fired Tank	Dedicated Boiler (integrated) for DHW and Propane Instantaneous
No Central Air Conditioner	No Central Air Conditioner	Central Air Conditioner (14 SEER)
Heat Recovery Ventilator	Heat Recovery Ventilator	Energy Recovery Ventilator
Blower Door 700 CFM-50	Blower Door 1175 CFM-50	Blower Door 2130 CFM-50
Lights & Appliances		
Natural Gas Oven/Electric Dryer	Electric Oven & Dryer	Electric Oven & Dryer
Some ENERGY STAR Large Appliances	Some ENERGY STAR Large Appliances	All ENERGY STAR Large Appliances
14% Fluorescent Fixtures	6% Fluorescent Fixtures	20% Fluorescent Fixtures
Energy Consumption & Costs		
93 MMBtu/yr	183 MMBtu/yr	181 MMBtu/yr
7997 kWh/yr	12,090 kWh/yr	48,421 kWh/yr
$2,372/yr	$5,563/yr	$8,369/yr

N. COMPARISON TO OTHER BASELINE STUDIES

We compared the average HERS Energy Rating of the sample of Maine homes (HERS Index of 86) to other northern New England states, all of which have had ENERGY STAR Homes programs and the associated builder training and support for years. Maine was actually not too far out of line from some of them, and did better than many.

While there is no single consistent and reliable source to obtain comparable HERS Energy Ratings across states, we were able to compile recent baseline studies in an attempt to derive composite average ratings. These comparisons are by no means definitive and must be taken "with a grain of salt". The Maine HERS Index of 86 appears to compare favorably with other New England scores. However, compared to Vermont which has had a new homes program for more than a decade, it appears that Maine has a little ways to go to move the energy efficiency of new homes up to the Vermont level, which is approximately comparable to the ENERGY STAR Homes standard.

Table 33. Northeast States Baseline New Homes HERS

State	HERS Rating Index
VT Baseline	80
ME Baseline	86
NH Baseline	90
MA Baseline	92
NY Baseline	99

O. RATERS' GENERAL OBSERVATIONS

Having professional eyes in 78 new homes has provided unique insights into the status of the new Maine housing stock and the opportunities for energy and building performance improvements. The most prevalent general observations by these raters include the following:

	Characteristic	Ranking	Scale
1.	Construction Quality	4	1 (low) to 5 (high)
2.	Missed Energy Opportunities by Builder	3	1 (many) to 5 (none)
3.	Recommendations for Energy Improvements	3.5	1 (many) to 5 (none)

It appears that construction quality is generally pretty high, but there are missed energy opportunities.

P. OPPORTUNITIES FOR IMPROVEMENT

Raters also rated the "worst energy features" in the homes they visited. There was pretty clear consensus on those features of Maine housing that should be addressed in any energy program and included in builder training efforts. These opportunities for energy improvement include the following:

1. Lack of basement insulation;
2. Low and missing ceiling insulation R-values and poor installation that degrades insulation effectiveness;
3. House air leakage rates, including a focus on attic/ceiling air leakage;
4. Bathroom fan quality and effectiveness; and
5. Lighting.

Q. ANALYSIS RESULTS

1. Maine Energy Code Compliance

The residential energy components of Maine's "Model Building Energy Code" are based on the International Energy Conservation Code (IECC) 2003 version (including Chapter 11 of the International Residential Code (IRC), 2003). The residential ventilation components of the Maine Code are based on standard ASHRAE 62.2-2003. We were able to use the HERS Energy Rating software (REM/Rate, v. 12.43) to generate a code compliance report for each home in the sample in order to determine typical code compliance rates for new Maine Homes.

A full 83% of homes in the study do not pass the "IECC 2003 Consumption Compliance" analysis and 95% do not pass the alternative compliance route, the "IECC 2003 Overall Uo Compliance" analysis. As noted throughout this report, a mix of both efficient and inefficient energy features were found in homes. The average Maine home included mechanical equipment (heating, cooling, and hot water) that exceeded minimum federal code requirements, while insulation levels generally fell short of code requirements.

There are interactive effects that determine whether or not a home meets the code, but these trade-offs are limited to shell features. For example; better than average ceiling insulation might partially offset lower than average wall insulation, but (depending upon compliance methodology), better insulation may not offset a low efficiency heating system. In addition to overall heat loss of the building envelope, there are certain "must-meet" criteria such as mechanical efficiency, duct insulation, and (in the case of Maine's Rx code) ventilation.

When mechanical equipment found in the Maine baseline home was changed (efficiency reduced) in the rating model so that each piece of equipment represented the minimum efficiency requirements of the code, the index rose from 86 to 103, a level that represents 3% greater energy consumption than what might be found in a code compliant home.

Maine has a long way to go in order to move new homes to compliance with the energy components of the Energy Code. Much of this progress could be made through insulating basements.

We also examined the mechanical ventilation requirements of the Energy Code (ASHRAE 62.2-2003) and found that only 14 of the 76 homes (19%) had systems that may pass code. Some of these homes with central ventilation systems did not meet all of the seven specific ventilation code requirements (e.g. fan sone ratings, garage isolation, etc.) and so may not have passed code even though they had a controlled ventilation system. Eleven (11) of these systems were heat-recovery or energy-recovery ventilators.

2. Least-Cost Improvement Analysis

a) Least-Cost Overview

The purpose of the least-cost improvement analysis is to determine those combinations of measure upgrades that would most cost-effectively improve the homes in the study so that they meet the energy efficiency requirements of each program tier. The results of this study will assist planners to design programs and set incentive levels that will truly move the market toward higher levels of ENERGY STAR residential new construction, while supporting and recognizing efforts that are substantially beyond ENERGY STAR certification requirements. In addition, the analysis demonstrates which measures are generally more cost-effective and yield greater energy savings.

The methodology used to conduct this least-cost analysis consists of several key parts. First, a baseline reference home was created in REM/Rate to serve as a proxy for the typical single-family detached home in Maine. Energy consumption and costs from the 78 modeled homes in the baseline study were averaged and compared with the reference home results, and found to have greater than 98% correlation in terms of energy consumption. Next, potential efficiency measures such as improved building shell, better mechanical equipment, etc. were added to the baseline model. Through an iterative process, the most cost-effective combination of efficiency measures needed to reach each improvement tier was determined. The incremental costs for the efficiency measures were based on existing information collected from an extensive survey of builders and product distributors in New York, New Jersey, and Vermont.

The levels examined in this analysis include the following:

1. "IECC Code": Maine Model Building Energy Code (IECC 2003);
2. "Maine Rx Code": Maine Model Building Energy Code Appendix A;
3. "ENERGY STAR": EPA ENERGY STAR Homes program standards applicable to Maine;
4. "EPACT": Federal Energy Policy Act of 2005 levels (50% savings for heating and cooling);
5. "Micro": Highly energy efficient home with HERS Index of 54; and
6. "Micro RE": Highly energy efficient home with 3.5 kW photovoltaic system and solar hot water system, HERS index of 39.

b) Least-Cost Modeling Requirements

All modeled improvement tiers meet or exceed the requirements of the IECC 2003 Energy code, with the exception of the Maine Rx (prescriptive) code model. Where baseline home criteria were found to exceed code requirements, they were left unchanged. Improvement tiers higher than code also include a requirement for electrical energy reduction measures such as efficient lighting and appliances. All equipment included as part of an upgrade was assumed to be properly installed and verified (per program requirements) and to operate at rated efficiency levels (e.g. 85 AFUE heating equipment was modeled at 85 AFUE). Cost credit was given for right-sizing equipment.

c) *Least-Cost Modeling Results*

In general, the most cost-effective measures, not including the required components (i.e. code requirements and kWh savings assumed to be required for each program tier) were the following:

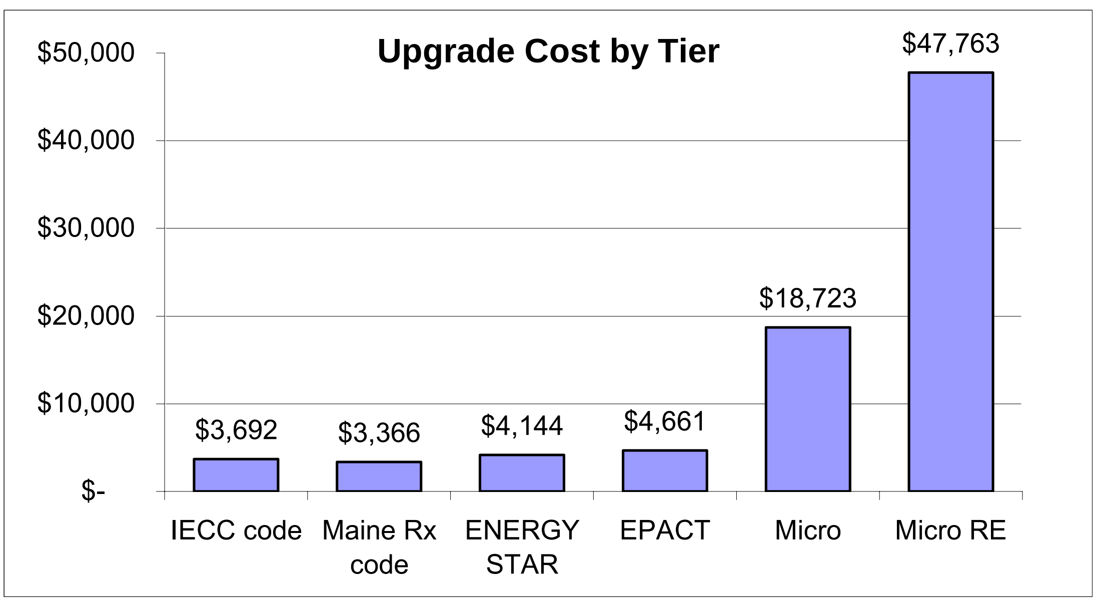
- Air sealing to <.5 CFM50 per square foot of floor area (with mechanical ventilation);
- Sealing ductwork (where it exists);
- Adding foundation wall insulation; and
- Improving insulation installation quality.

Table 34. Typical Upgrade Requirements by Tier

	IECC 2003 code	Maine Rx code	ENERGY STAR	EPACT	Micro
Air Sealing (CFM50/sq ft)	NA	NA	0.5	0.32	0.25
Seal Ductwork ($CFM25_{out}$)	NA	NA	168	0	0
Foundation insulation (code level)	R-10	R-10	R-10	R-10	R-10
Improve Insulation Quality (grade 1)	Grade 1	NA	Grade 1	Grade 1	Grade 1

With limited incentive dollars, focusing on air-sealing (both shell and ducts) and quality installation of thermal and mechanical components appears to be the most cost-effective route toward ENERGY STAR levels after all code requirements are met. As Figure 20 below indicates, the incremental costs to reach the various improvement tiers increase with the desired score level.

Figure 20. Least-Cost Analysis Results for all Improvement Tiers



d) Recommendations

This least-cost analysis provides useful guidance for program planning. Because the Maine new home baseline is relatively high already (a HERS index of 86 points for the average composite house is about 5% away from ENERGY STAR), the cost to implement ENERGY STAR requirements are relatively modest. It is important to note that bringing the baseline home to code compliance (either IECC 2003 or Maine prescriptive approach) will be far more costly than improving that code compliant home to ENERGY STAR.

If Maine wishes to incentivize builders to achieve better HERS scores in the future, this analysis provides some useful guidance about the approximate costs to achieve several efficiency tiers, taking a least-cost path.

e) Cash-Flow Analysis

With the projected costs to upgrade homes to these tiers of energy efficiency from the least-cost analysis, we examined the costs and savings assuming a home buyer were to finance each of these packages of improvements as part of their 30 year mortgage. The cash flow (energy savings less incremental mortgage costs) results indicate that while all packages (except the micro-load home with renewables) generate greater energy savings (in the first year) than the incremental mortgage cost, driving to higher levels of efficiency at the ENERGY STAR and EPACT levels are more cost-effective than building to code. In fact, achieving the EPACT level of efficiency will generate more than $700 per year cash-flow. Adding renewable energy on a highly-efficient home will cost the homeowners about $1,000 more per year than the savings it will generate. Note that this analysis assumes energy savings at today's costs. As energy costs increase in the future, mortgage costs stay fixed and the cash flow to the homeowners will increase even more, making all of these packages look more favorable.

Table 35. Cash Flow Analysis Results for Improvement Packages

Maine RNC Improvement Financing Scenarios							
	Baseline	IECC code	Maine Rx code	ENERGY STAR	EPACT	Micro	Micro RE
Improvement Costs	$ -	$ 3,692	$ 3,366	$ 4,144	$ 4,661	$ 18,723	$ 47,763
Mortgage Interest Rate	6%	6%	6%	6%	6%	6%	6%
Loan Term (Years)	30	30	30	30	30	30	30
Annual Incremental Mortgage Payment	$ -	$ 268	$ 245	$ 301	$ 339	$ 1,360	$ 3,470
Annual Energy Costs, 2008	$ 4,917	$ 4,605	$ 4,676	$ 4,184	$ 3,602	$ 3,030	$ 2,108
Annnual Energy Savings from Baseline	$ -	$ 312	$ 241	$ 733	$ 1,315	$ 1,887	$ 2,809
Annual Cash Flow	**$ -**	**$ 44**	**$ (4)**	**$ 432**	**$ 976**	**$ 526**	**$ (661)**

V. MAINE BUILDERS AND ARCHITECTS INTERVIEWS

The market actor interviews were conducted by telephone with the initial survey done in person. Comprehensive guides were prepared for use with each type of market actor interviewed, in consultation with members of the Efficiency Maine Residential New Construction (RNC) Team. The guides were intended to extract both descriptions of the residential new construction market as perceived by important participants and baseline assessments of such indicators of market function as awareness of energy-efficiency options, promotional activities, and current demand for energy-efficient practices, services, and products.

The interviews were conducted by experienced, professional members of the RNC Team. The length of time devoted to the interviews varied considerably among respondents, as a function of the individual's availability and their areas of knowledge. Broadly speaking, each interview required between 45 and 120 minutes.

Each of the discussion guides included major sections assessing the market actors' awareness of energy efficient home programs. Each guide also sought to discover the market actors' sources of information regarding energy efficiency and their perceptions of current barriers to energy efficiency in the residential new construction market. The guides differed in various sections intended to identify the particular market niche for each of the interviewees as well as issues peculiar to their trade or profession.

Copies of each of the relevant discussion guides are provided in Appendix F.

In outline summary, the discussion guide for interviewing general contractors, builders, and developers included the following major topics and subtopics:

Respondent niche
General contractor? Developer?
Years in business
Where active—locations, market segments, advertising

Perceived interests of buyers re energy efficiency features
What's demanded, what's offered
Drivers of activity
Recent changes in any of these areas

Energy Star® homes
Awareness
Attitudes toward program
Likelihood of joining program/continuing in program

Perceived barriers to building energy-efficient homes
Subcontractor knowledge and practices
Availability of equipment

Information and communication
Sources—sufficiency, currency, trustworthiness
Training needs and availability
Awareness of energy-efficiency mortgages

In outline summary, the discussion guide for interviewing architects included the following major topics and subtopics:

Respondent niche
General practice/specialty
Proportion of business devoted to single-family detached homes
Number of homes built recently
Years in business
Characterization of client population

Perceived interests of buyers re energy efficiency features
What's demanded
Drivers of activity
Recent changes in any of these areas

Proactive efforts regarding energy efficiency
Perceived expertise and level of interest
Sources of information—sufficiency, currency, trustworthiness
Training needs and availability

Energy Star® homes
Awareness
Attitudes toward program

Perceived barriers to designing/building energy-efficient homes
Contractor and subcontractor knowledge and practices
Training
Availability of equipment
Customer awareness, interest, willingness to fund

A. MARKET DESCRIPTION

This section describes characteristics of the residential new construction market based on the results of interviews with selected market actors.

BUILDERS

Most of the builders (8) interviewed for this study identified themselves as general contractors, with the remaining two being manufacturers of manufactured homes. The builders in this study have been in the trade from five to forty-eight years.

The majority of those interviewed build an upgraded standard, retirement or second home, targeted for the top 20% of the home buyers. One builder, which is the largest builder in the survey, indicates he builds exclusively for the first 80% of the market. A majority of the respondents build only custom homes. As would be expected, the latter group builds considerably fewer homes in a given year whereas the builder who caterers to 80% of the market builds over 25 homes a year.

The majority of respondents say they either build one home at a time or a few homes with multiple crews. One of the respondents reported building sub-divisions of 20 homes or more but indicated he owned the land so that he can control the quality of the construction.

Of those interviewed a majority sell their homes directly to homebuyers because of the custom nature of their business. One builder indicated that he worked with a real estate professional on a few of his homes.

The homes range in size from 1,500 square feet to as large as 4,500 square feet, with a median of between 1,500 square feet and 2,000 square feet. Selling prices range from $150,000 to $750,000, with a median between $250,000 and $350,000. One of the two manufactured housing representatives in the survey indicated the average selling price for their homes was below $150,000. The other participant would not provide us with that information.

As might be expected, given the home sizes and selling prices involved, several of the builders explicitly target the high-end of the market. Most assume that the homes will attract move-up, second home and retirement buyers. To meet the needs of these buyers, the homes tend to be larger and tend to include numerous amenities.

ARCHITECTS

The architects who participated in this study primarily work with homeowners in the design and development of custom homes.

Of the eight architects interviewed for this study, five provide both designs and specs for use by others. Many of them qualified this by indicating they worked closely with the mechanical contractors and homeowners on the specifications for the heating and ventilation equipment. The history of their firms ranges widely, from ten years to thirty-nine years. (Three have over thirty years of experience.)

These architects deal with both new construction (including additions) and renovations specializing in the residential sector. Most of their work is on either high-end homes or those in the mid-range. Ten to fifty percent of the assignments completed during the past year were on additions or renovations with an average of 30%.

The respondents characterize the homebuyers they serve as middle- to upper-income environmentally responsible, retirees and professionals. The architects reported that a vast majority of their clients usually hire their own contractor but some do ask them to act as the general contractor or to select the contractor.

Interactions Among Market Participants

This section characterizes how builders, subcontractors and architects influence the residential new construction market with regard to energy-efficiency. Information in this section was gleaned from respondent's answers and the author's general knowledge of the residential new construction industry. This shows the importance of builder and architect education and training to advance the knowledge and participation in an energy efficient program.

The general contractor or builder normally works from a detailed set of plans when constructing a home. These plans provide the specifications as to what energy-saving features and equipment will be included in the home. They also influence whether certain energy-efficient building practices are required.

The builder may work from plans that are purchased by the participant, those that have been developed by the homebuyer or by an architect hired by the homebuyer. In some instances the builder may have developed or adapted the plans him or herself. Under any of these scenarios, opportunities for addressing energy-efficiency concerns lie both in the specification details themselves and in interpreting those specifications. Thus, both the designer of the specifications (e.g., the architect) and the general contractor make decisions that influence the energy-efficiency of the home.

Subcontractors are an integral market actor in the process with differing knowledge of energy-efficient practices and in their skill and motivation to carry out more efficient practices. They may be responsible for selecting equipment or features peculiar to their specialty. As a result, subcontractors may heavily influence both the use of energy-efficient construction practices and the inclusion of energy-efficient features in new homes.

The general contractor is in a position to influence energy-efficient construction practices and the use of high-efficiency equipment in the selection of subcontractors and suppliers. In addition, the general contractor, in his or her role of providing coordination and quality control for the overall project has the authority to influence adherences to these practices.

B. AWARENESS OF ENERGY EFFICIENCY PROGRAMS AND PRACTICES AMONG BUILDERS AND ARCHITECTS

Each of the market actors interviewed was asked their awareness of the energy efficient home programs as well as energy-efficient practices and energy-saving equipment. They were asked both about their own awareness of these programs and options and their perception of the awareness of homebuyers. The results for each group are summarized below.

BUILDERS

Eight of ten builders reported being aware of programs intended to increase the construction and sales of more energy-efficient homes. The programs cited include ENERGY STAR®, MSHA Green Building Practices, LEED, NAHB Green Building Program, and Model Green Home Building Program.

Builders differ in their reports of homebuyer awareness or request for energy efficiency. They indicated the type of clients they work with expect high efficiency homes so they do not tend to ask for them. Builders indicate there is a considerable demand for energy efficient features, particularly with respect to heating costs, but they report those homebuyers who request energy efficient options quickly reject many of them when told the cost of these features. They typically reject additional insulation or an upgraded window in lieu of keeping cosmetic features in the home.

ARCHITECTS

All of the architects interviewed indicated familiarity with the 2004 Maine State Energy Code. All of these said that both the homes they designed in the past and their current projects are more energy-efficient than required by code.

One of the eight respondents indicated they are familiar with the ENERGY STAR® program and three were familiar with LEED.

Architects report the same type of demand for energy efficient features that builders do. They also hear them same types of reasons for rejecting those features when told of the cost. A majority, but not all, of the architects go a step further by presenting the client with the financial benefits of upgrading to higher efficient equipment and measures. They further explain to the client that granite counter tops, hardwood floors and tile can easily be upgraded down the road. They point out that it is much more difficult and disruptive after the home is completed to change windows and add additional insulation specifically to the walls.

Construction Practices And Quality As Reported By Builders And Developers

None of the builders and developers volunteered ideas with respect to improvements in construction practices and quality. The only relevant comments were made by a majority of the builders who credit the cost of energy as having the potential to raise—construction standards.

Among the builders interviewed, seven report normally offering newer insulation methods (Blow In Batts – BIB or sprayed in foam) or providing insulation that is above code. Table 1 below shows the number of respondents (of 10) reporting the use of each of these practices.

Table 36. Energy-Efficient Construction Practices in New Homes, According to Builders

Feature	Number (of 10) providing …	
	Normally	Sometimes
New wall insulation techniques	7	0
Wall insulation at code or higher	10	0
Soffit vents	9	0
Attic insulation at code or higher	10	0
2 *x* 6 framing	10	0
House air sealing	10	0
Solar PV	2	0
Mechanical ventilation	7	3
Insulated basements	7	0
Energy Star appliances	4	0
High – Efficient heating system	7	0

When asked what issues or practices pose a barrier to increasing energy efficiency in the residential new construction markets each of the 10 builders indicated they would be able to meet the demand of homebuyers willing to pay a premium for a home that exceeds Maine's state energy code. The respondents mentioned that most of the homebuyers they work with understand the value of energy efficiency but will reject many of the energy efficiency options when making financial decision during the construction process.

All of those interviewed claimed to specify high-efficiency heating equipment when soliciting bids from suppliers and subcontractors. Contrary to this claim and the information in Table 1 when asked how they obtain HVAC equipment (furnaces and boilers) 4 respondents indicated they specified AFUE ratings (Annual Fuel Utilization Efficiency) when soliciting bids from suppliers and 5 respondents indicated they did not specify AFUE ratings.

C. BUILDER AND ARCHITECT ACTIVITIES

Each of the market actors interviewed was asked questions both about their educational and promotional activities and their own sources of information on energy-efficient practices and energy-saving equipment.

BUILDERS

Builders generally believe that their own promotional activity is a major influence on the energy-efficiency decisions of homebuyers. They also appear to believe that this influence is most effectively in the one-to-one relationship between their clients and themselves. Advertising is far less important as most of their work comes from word-of-mouth referrals, but a few of them advertise in the local newspapers, on the Internet, in magazines (one builder has ads in Down East Magazine, Maine Boats and Harbors and Homes in Maine) and two at trade shows. However, many also seem to hope that any efficiency program that is designed will help promote them as high quality energy efficient builders.

Three out of ten builders report providing potential customers with materials that promote energy efficiency. The materials come from vendors, distributors, suppliers and government agencies.

A majority of those interviewed report receiving their energy efficiency information from their subcontractors and suppliers as well as the Internet. Those who responded said that the best information came from Internet.

Several builders believe that providing them with certain types of information and training would increase their ability to sell energy efficiency to homebuyers Although many focus on the need to increase the demand for energy efficiency, most are also supportive of professionally oriented seminars, both for themselves and for subcontractors, particularly with respect to the building as a system and new types of mechanical equipment, and renewable resources.

ARCHITECTS

Only one of the eight architects interviewed claims to be very knowledgeable about building energy efficiency into a house. A majority of those interviewed claim to have a good understanding of energy efficient options but were not experts and are always willing to learn new techniques to offer to their clients. Sources of information mentioned by the respondents include professional trade journals and associations, engineers and other consultants, the Internet, courses and conferences, equipment manufacturers, and subcontractors

Most of these respondents believe they would benefit from additional information resources and training. Among the topics mentioned are additional information on new and reliable technologies and equipment, building envelopes, the building as a system and how it behaves together, and renewable energy.

D. AWARENESS AND USE OF ENERGY-EFFICIENCY MORTGAGES AMONG MARKET ACTORS

Builders and developers, as well as architects, were asked a series of questions about their awareness of and their experience with energy-efficiency mortgages.

BUILDERS

Three builders indicated they were already aware of energy-efficiency mortgage programs. Four of the respondents indicated the availability of energy-efficiency mortgages to homebuyers would likely enhance their home sales. One builder, who targets high-end clients, indicated energy-efficient mortgages would probably not increase his overall sales, because most of his clients typically do not finance their homes.

None of the builders indicated that an effective energy-efficiency mortgage program would increase their own interest in exceeding the state building code since they claim all of their homes exceed the state code already.

ARCHITECTS

Three of the architects interviewed have heard of energy-efficiency mortgages, even though architects say they are not generally aware of their clients' efforts to obtain construction loans or mortgages. Two of these architects believe the availability of energy-efficiency mortgages would make a difference in their efforts to sell energy-efficient designs.

VI. RECOMMENDATIONS AND CONCLUSIONS

A. RECOMMENDATIONS

Maine's new home program should incorporate a number of strategies, including technical assistance, direct incentives, marketing and consumer education. The program should work closely with builders and other important stakeholders to encourage energy efficient homes that are also high performance buildings. Based on the research conducted for this study, including field testing and observations, discussions with homeowners and data analysis, we make the following recommendations to help improve program performance and maximize market impacts:

1. *Code Adoption and Enforcement* – Given the fact that more than 83% of new homes do not meet code in Maine, there are some real opportunities for raising the energy efficiency floor to attempt to improve the performance of new homes. There are many political and implementation issues associated with an energy code that would need to be resolved in moving forward, but there is also a lot of energy that could be saved if all new homes were constructed to the code levels that Maine has already adopted. If a robust Home Energy Rating System (HERS) infrastructure were developed through this residential new construction initiative, these raters could serve as a code support network. If builders were required to build to code and could demonstrate such through a Home Energy Rating, the costs of compliance could be rolled into the home costs so that buyers who benefit from lower energy costs would pay for these upgrades and services. Using HERS Raters for code support would relieve municipalities from any new mandates, would stimulate Maine "green collar" jobs and would introduce builders to energy professionals who could lead builders to higher tiers of the new homes program for greater energy savings.

2. *Builder Training* – Maine builders have a lot to learn about building performance and energy efficient construction. Comment and after comment from the Energy Raters pointed out building shortcomings and deficiencies. A comprehensive series of trainings targeted at builders with some inducements to get them to attend would go a long way towards improving the performance of the homes they build. Incorporating building science curricula at trade schools would start the process for the next generation of builders. Builder training is a long-term effort that needs to begin as a new homes program rolls out so that both work together to drive demand and supply of energy efficient homes, and need to continue into the future to ensure real market transformation of the new homes industry.

3. *Tiered Approach* – While many of the homes examined don't meet the energy code, there are some that are already doing pretty well in terms of energy performance. As the architect and builder surveys revealed, some of these people and businesses are building efficient homes without a program. What this demonstrates is that a program in Maine with "one size fits all" will likely not work because it won't meet the needs of all new homes customers. Adopting a program with multiple tiers that can allow entry into the program at multiple levels and which drives them to higher steps of performance would be the most effective approach.

4. *Manufactured Homes* – About a quarter of the new homes constructed each year in Maine are built in a factory. Quite a few of these homes are constructed in Maine, as well. A concerted focus on improving the energy efficiency of manufactured homes could yield lasting results since once certain approaches are changed in the factory situation, there is a high likelihood that those changes can stick and be applied to all future homes. There are also some opportunities to work with the national ENERGY STAR Homes program to build in energy improvements into the process for manufacturers. This market would benefit from participation in a new homes program.

5. *Electricity Focus* – There were a number of opportunities for electrical savings identified in the homes in the survey. These areas should be a focus of the new homes program in order to reduce electrical use.

   a) Electric Heat – Given the cost of electricity, it is hard to believe that new homes are still being built in Maine with electric heat. However, five percent of the homes in the study were heated with electricity.

   b) Cooling Systems – Residential cooling adds to the electric system peak in the summer. Building homes to avoid the need to install cooling in the first place in temperate areas of Maine is readily achievable and should be a focus of any new homes program. For those homes that choose to put in cooling, working to optimize efficiency and sizing will help reduce peak demand.

   c) Lighting – The study found that in the average of 70 light sockets per home, 80% of these were incandescent. Most all of these can be replaced with CFLs and should be focus of the new homes program.

   d) Appliances – Maine has done an effective job at moving the market to ENERGY STAR. While more than 60% of the major appliances found were ENERGY STAR labeled, there is still an opportunity to move the balance to ENERGY STAR as well.

   e) Clothes Dryers – Ninety one percent of homes have electric dryers. Drying clothes using a solar clothes dryer (clothes line) or gas dryer may provide some electrical savings opportunities.

6. *Coordinate Efforts with Oil and Natural Gas* – Oil is the heating and hot water fuel in three-quarters of the homes surveyed. Any efforts to coordinate with oil companies and the gas utilities to bring some of their resources and customer contacts into a new homes program would help make Efficiency Maine funds go further and would leverage additional customers.

7. *Technical Features* – Homes in the survey had quite a few energy- and building science-related shortcomings. These resulted in the relatively low HERS scores and code underachievement outcome. Some of these areas include:

   a) Building Science – It is clear from examining these homes that many builders do not understand how heat, moisture and air flow through buildings. Training to explain the basics of building science needs to be a fundamental objective for an new homes program.

b) Insulation – Maine homes lack insulation and are suffering due to poor installation of insulation where it is present. Most basements are completely uninsulated, attics have areas with either no or very little insulation and other building components suffer from the same lack of attention. Where insulation is installed, it is done so haphazardly without much regard to how it will perform. As a result, Maine homes use quite a bit more energy than they should. Focusing a new program on why, where and how to insulate should be a top priority.

c) Seal Ducts – In homes with ducts, quite of bit of both the heated and cooled air is lost homes due to leaky ducts. MESH should emphasize comprehensive duct sealing to reduce duct leakage to industry standards.

d) Reduce Infiltration – Maine homes were generally tighter than we expected we would find, about 2,000 CFM-50 and slightly above the ENERGY STAR Homes standards. However, there were quite a few leakage-reduction opportunities identified by the Energy Raters to tighten these homes further.

e) Oversizing – Both heating and cooling systems are generally oversized in Maine homes. This not only costs more to purchase an unnecessarily-large system, but also reduces system efficiencies.

f) Mechanical Ventilation – Despite the fact that Maine has a (voluntary) ventilation code, very few of the homes even had a mechanical ventilation system installed. Of those that did, most did not meet the state standards. Providing fresh air in tight homes is important for occupant health and building longevity and needs to be a program focus.

B. CONCLUSIONS

Plans for addressing the shortcomings uncovered in this study are under way as Efficiency Maine develops a residential new construction program. Some of the components of such a program and the associated plans could include the following:

- A multi-tiered set of standards with increasing incentive offerings including:
    - Code-compliance plus;
    - ENERGY STAR Homes;
    - Federal Tax Credit level (50% savings for heating and cooling energy); and
    - Approaching Zero Energy Homes.
- A focus on electrical savings, especially from CFLs;
- Builder/architect focus group(s) and interviews to inform program plans;
- Builder/trades/architect trainings to overcome shortcomings unearthed in this study and to prepare builders for code and program compliance;
- Promote and highlight participating leading builders and manufactured housing producers;
- Build a statewide accessible certified Energy Rater infrastructure;
- Coordinate efforts with existing homes program efforts; and
- Plan for supporting any new state code and then build an above-code program around that, phased in to ensure sufficient infrastructure and training before launch.

VII. APPENDIX A: TECHNICAL NEW HOME BASELINE CHARACTERISTICS DATA

Average, predominant and typical new home characteristics are presented below. Reported is the average value or most predominant characteristic identified in the study. Note that values may change in the final report due to the inclusion of a few more homes.

Feature	Characteristic	Units	Notes
General Information			
Conditioned Area	2,057	square feet	
Conditioned Volume	22,826	cubic feet	
Bedrooms	3.1		
House Type	Single-Family Detached	Predominant	
Foundation Type	Conditioned Basement	Predominant	
Building Shell Features			
Ceiling Insulation			
Ceiling Flat	30.8	Nominal R-value	
Vaulted Ceiling	31.3	Nominal R-value	
< R19	15.48	% Present	For ALL ceiling types
= R19	12.5	% Present	For ALL ceiling types
> R19 and < R30	10.7	% Present	For ALL ceiling types
= R30	3.6	% Present	For ALL ceiling types
> R30 and < R38	13.7	% Present	For ALL ceiling types
= R38	29.2	% Present	For ALL ceiling types
> R38	14.9	% Present	For ALL ceiling types
Above Grade Wall Insulation and Framing			
Above Grade Walls	17.5	Nominal R-value	
< R11	6.2	% Present	Cavity Insulation only
= R11	0.5	% Present	Cavity Insulation only
> R11 and < R13	0.0	% Present	Cavity Insulation only
= R13	8.6	% Present	Cavity Insulation only
> R13 and < R15	1.4	% Present	Cavity Insulation only
= R15	0.5	% Present	Cavity Insulation only
> R15 and < R19	73.8	% Present	Cavity Insulation only
= R19	1.4	% Present	Cavity Insulation only
> R19	7.6	% Present	Cavity Insulation only
2x4 Wall Framing	14%	Present	
2x4 (cond>ambient)	33%	Present	Percent 2x4 walls between conditioned and ambient spaces
2x6 Wall Framing	83%	Present	
Other	2%	Present	ICF; 2x8
Exposed Floor Insulation			
Exposed Floor (ALL)	15.3	Nominal R-value	
Exposed Floor (Cond>ambient)	23.1	Nominal R-value	
Foundation Wall Insulation			
Present	34%	Present	
No Insulation Present	66%	Present	For only foundation walls exposed to ambient conditions
Foundation Walls	3.4	Nominal R-value	
Slab Insulation			ALL slabs (Conditioned basements/crawls, heated garages etc)
Edge	12%	Present	
Edge	1.5	Nominal R-value	
Under	25%	Present	
Under	2.0	Nominal R-value	
Slab on Grade Insulation			
Edge	43%	Present	
Edge	4.4	Nominal R-value	
Under	29%	Present	
Under	1.9	Nominal R-value	
Combined	57%	Present	Insulation present under slab OR on perimeter

Feature	Characteristic	Units	Notes
Windows			
Window Type	Double/LoE - Viny	Predominant	
Average U value	0.37	U value	
LoE (Uo<=.36)	77%	Present	
Air Leakage (Infiltration)			
Blower-Door Tested	2,037	CFM50	
Air Changes per Hour at 50 Pascals	5.4	ACH-50	ESH Std. is <5
Mechanical Systems Features			
Heating Distribution System			
Ducted	14%	Present	
Hydronic	81%	Present	
Other (baseboard/unit heaters)	5%	Present	
Heating Fuel Type			
Natural Gas	4%	Present	
Propane	15%	Present	
Fuel Oil	75%	Present	
Electric	5%	Present	
Heating Efficiency			
Furnaces	87.7%	%AFUE	
Boilers	85.3%	%AFUE	
Cooling System Type			
Central Air Conditioning System	12%	Present	
Room Air Conditioner	34%	Present	
None	54%	Present	
Cooling System Efficiency			
Central Air Conditioning System	12.85	SEER	
Room Air Conditioner	10.42	EER	
Duct Leakage			
Leakage to Outside	269	CFM-25 to outside	
Leakage per 100 sq. ft.	10.0	CFM-25 per 100 sq. ft.	ESH Std. is <6
Ventilation System			
Present	18%		14% HRVs/ERVs, 4% exhaust-only
None	82%		Don't meet Maine Ventilation Components of Energy Code
Programmable Thermostat			
Heating	17%	Present (all homes)	
Cooling	33%	Present (homes w/ AC)	
Domestic Hot Water Type			
Conventional	13%	Present	
Instantaneous	5%	Present	
Integrated (Indirect-Fired Storage Tank)	63%	Present	
Combination tank	3%	Present	
Tankless coil	17%	Present	
Domestic Hot Water Fuel Type			
Natural Gas	1%	Present	
Propane	15%	Present	
Fuel Oil	71%	Present	
Electric	12%	Present	
Wood	1%	Present	
Domestic Hot Water Efficiency			
Natural Gas	0.86	Energy Factor	
Propane	0.80	Energy Factor	
Fuel Oil	0.73	Energy Factor	
Electric	0.90	Energy Factor	
Wood	0.70	Energy Factor	
Overall Weighted	0.76	Energy Factor	

Feature	Characteristic	Units	Notes
Lighting			
Light Fixtures Incandescent/Fluorescent			
Fluorescent Pin-Based	0	Present	
Fluorescent Screw-Based CFL	0	Present	
Total Fluorescent Fixtures	15%	Present	
Total Incandescent Fixtures	85%	Present	
Light Fixture Type/Controls			
Cans	17%	Present	
Dimmers	13%	Present	
Light Sockets Count			
Incandescent	50	Per Home	
Fluorescent	14	Per Home	
Halogen	6	Per Home	
LED	0	Per Home	
Other	0	Per Home	
Total	70	Per Home	
Light Sockets Percent			
Incandescent	71%	Present	
Fluorescent	20%	Present	
Halogen	8%	Present	
LED	0.1%	Present	
Other	0.2%	Present	
Total	100%	Present	
Appliances			
Refrgerator			
Average Consumption	647	kWh/Year	
ENERGY STAR Qualified	65%	Present	
Dishwasher			
Energy Factor	0.54	Energy Factor	
ENERGY STAR Qualified	68%	Present	
Freezer			
ENERGY STAR Qualified	10%	Present	
Clothes Washer			
ENERGY STAR Qualified	60%	Present	
Clothes Dryer Fuel Type			
Propane	9%	Present	
Electric	91%	Present	
Range/Oven Fuel Type			
Natural Gas	1%	Present	
Propane	12%	Present	
Electric	87%	Present	
Ceiling Fans			
Present	21%	Present	
Weighted Average Consumption	13.3	cfm/watt	
When Present	70.40	cfm/watt	
Small Household Appliance Summary			
Appliances per Home	10.8	Present	
Known ENERGY STAR Units	6%	Present	

VIII. APPENDIX B: DETAILED TABLES OF SUPPLEMENTAL SURVEY RESULTS

Tables in this appendix include data collected through the Maine Residential New Construction Baseline Study Data Collection Survey. The tables are populated with data queried from a Microsoft Access database and include information collected during the inspection of 76 Maine homes. The survey information includes home characteristics in the following different categories: General Building Information, Foundation Walls, Slab Floor, Frame Floor, Rim and Band Joist, Above Grade Walls, Window and Glass Doors, Doors, Ceilings, Skylight, Mechanical Equipment (Heating, Cooling and Domestic Hot Water), Duct System, Fireplaces, Room Air Conditioners, Exhaust Systems (Bathroom, Kitchen, Whole House), Lighting, Appliance (Dishwasher, Refrigerator, Freezer, Clothes Washer, Clothes Dryer), Small Household Appliances, Solar Systems and Sun Space.

IMPORTANT NOTE: All data in the tables below are calculated based on available data. Even though total number of homes audited is 76, data was not always available or not relevant for all homes. For example, data for annual kWh consumption were not recorded for all refrigerators in the homes surveyed and fewer than 76 data points are used in calculating averages. Fewer than 76 refrigerator consumption data points were included in results. Another example is for the calculation of average area for the 3rd floor spaces. The average square feet is based only on homes that have a 3rd floor (in this survey, only two homes) not on all 76 homes.

In other cases, data collected exceeded the number of homes in the survey. Some homes have more than one hot water system or mechanical heating systems or refrigerator. Alternatively, most homes have several exhaust systems, many light sockets, a multitude of small home appliances. In all of these cases, summations and averages are based on total data collected, not on the number of homes participating in the survey.

General Building Information:

Year House Completed	# Completions	%
2001	1	1%
2002	0	0%
2003	1	1%
2004	3	4%
2005	14	18%
2006	30	39%
2007	27	36%
Total	**76**	**100%**

	Is this an Energy Star Home?
Yes	0
No	63
Don't Know	13
Total	**76**

	Does the home comply with ME Residential Energy Code?
Yes	17
No	10
Don't Know	27
N/A	22
Total	**76**

	Is the home part of a larger development or subdivision
Yes	21
No	55
Total	**76**

	Is home Primary or Seasonal
Primary	73
Seasonal	3
Total	**76**

	If Seasonal, what season
Summer	1
All Seasons	2
Total	**3**

	# Days used per yr
Average	327

	Water Source
Municipal	29
Private	47
Total	**76**

	Sewer
Municipal	27
Septic	49
Total	**76**

	Front of home faces
North	13
Northeast	7
East	15
Southeast	5
South	15
Southwest	3
West	5
Northwest	12
No Answer	1
Total	**76**

	Number of Occupants
0	1
1	7
2	37
3	6
4	14
5	8
6	3
Total	**76**

	Basement area (sq ft)
Average	1,330
	# Homes
<1,000	13
1,000-1,499	34
1,500-2,000	13
> 2,000	5
None	11
Total	**76**

	1st Floor area (sq ft)
Average	1,453
	# Homes
<1,000	11
1,000-1,499	34
1,500-2,000	22
> 2,000	9
Total	**76**

	2nd Floor area (sq ft)
Average	1,196
	# Homes
<1,000	15
1,000-1,499	14
1,500-2,000	5
> 2,000	3
None	39
Total	**76**

	3rd Floor area (sq ft)
Average	796
	# Homes
<1,000	2
1,000-1,499	0
1,500-2,000	0
> 2,000	0
None	74
Total	**76**

	Total House less Basement (sq ft)
Average	2,057
	# Homes
<1,000	5
1,000-1,499	18
1,500-1,999	18
2,000-2,499	14
2,500-3,000	13
> 3,000	8
Total	**76**

	Total House less basement (sq fl)
Average	2,057
Minimum	576
Maximum	5,498

	Basement volume (cu ft)
Average	10,221
	# Homes
<10,000	37
0,000-14,900	20
5,000-20,000	7
> 20,000	1
None	11
Total	**76**

	1st floor volume (cu ft)
Average	12,518
	# Homes
<10,000	25
0,000-14,999	35
5,000-19,999	10
0,000-25,000	3
> 25,000	3
Total	**76**

	2nd floor volume (cu ft)
Average	9,322
	# Homes
<10,000	21
10,000-14,999	13
15,000-19,999	3
20,000-25,000	0
None	39
Total	**76**

	3rd floor volume (cu ft)
Average	6,468
	# Homes
<10,000	2
10,000-14,999	0
15,000-19,999	0
20,000-25,000	0
None	74
Total	**76**

	All floors except basement (cu fl)
Average	17,227

	Is there a crawl space vapor barrier?
Yes	0
No	4
Don't Know	8
N/A	64
Total	**76**

	Is basement thermostat controlled?
Yes	28
No	37
Don't Know	0
N/A	11
Total	**76**

Foundation Walls, Slab, Frame, Rim and Band Joist. Above Grade Walls, Ceiling Properties:

Foundation Wall Insulation Type	% by Type
Expanded Polystyrene	2%
Extruded Polystyrene	14%
Fiberglass, batts	5%
None	79%
Total	**100%**

Slab Floor Properties By Type	% by Type
Extruded Polystyrene	17%
Low Density urethane Foam	1%
None	82%
Total	**100%**

Frame Floor Properties By Type	% by Type
Cellulose + 1 in. Polystyrene	1%
Conditioned Basement	1%
Extruded Polystyrene	2%
Fiberglass, batts	40%
Fiberglass, blown	1%
High Density urethane Foam	5%
Isocyanurate	2%
Low Density urethane Foam	1%
None	47%
Total	**100%**

Rim and Band Joist Properties By Type	% by Type
Cellulose	1%
Expanded Polystyrene	2%
Extruded Polystyrene	3%
Fiberglass, batts	72%
Fiberglass, batts + 2 inch rigid	1%
Fiberglass, batts + Polystyrene	4%
High Density urethane Foam	1%
None	16%
Total	**100%**

Above Grade Walls Properties By Type	% by Type
Expanded Polystyrene	1%
Extruded Polystyrene	0%
Fiberglass, batts	87%
Fiberglass, batts + Polystyrene	1%
Fiberglass, batts +thermax	2%
Fiberglass, blown	0%
High Density Foam (SIP)	1%
Low Density urethane Foam	1%
None	6%
Total	**100%**

Ceiling Properties By Type	% by Type
2 in. rigid foam	1%
Cellulose	6%
Extruded Polystyrene	2%
FG Batt and Cellulose	1%
Fiberglass, batts	65%
Fiberglass, batts + Cellulose	2%
Fiberglass, batts + Fiberglass, blown	1%
Fiberglass, batts + Poly Barrier	1%
Fiberglass, batts + Polystyrene	1%
Fiberglass, batts + Thermax	2%
Fiberglass, batts crossed	1%
Fiberglass, blown	11%
Isocyanurate	1%
Low Density urethane Foam	1%
None	6%
Total	**100%**

Mechanical Heating Equipment Properties:

	Is this an Energy Star System?
Yes	42
No	29
N/A	1
Don't Know	11
Total	**83**

	Primary or secondary unit
Primary	72
Secondary	11
Total	**83**

	Where is the venting located?
Roof	48
Wall	32
N/A	3
Total	**83**

	Type of combustion exhaust
atural Draft	28
ower Vent	4
led Comb.	23
N/A	28
Total	**83**

Mechanical Cooling Equipment Properties:

	Is this an Energy Star System?
Yes	1
No	7
N/A	4
on't Know	3
Total	**15**

	Primary or secondary unit
Primary	13
N/A	2
Total	**15**

	Ductless mini-split system?
Yes	0
No	11
N/A	4
Total	**15**

Mechanical Domestic Hot Water Equipment Properties:

	Average kWh/yr
Average	4,888

	Primary or secondary unit
Primary	74
Secondary	3
Total	**77**

	Venting location
Roof	9
Wall	11
Unvented	1
N/A	56
Total	**77**

	Type of combustion exhaust
Natural Draft	6
Power Vent	1
Sealed Comb.	10
N/A	60
Total	**77**

	Are pipes insulated?
Yes	10
No	67
Total	**77**

Wood Stoves and Fireplace Properties:

	Wood Heat
Number of Wood stoves	16
Cords of wood burned in winter 2005/2006	49

	Fireplace location
Living Room	81%
Basement	3%
Great Room	3%
ter Bedroom	3%
Unknown	11%
Total	**100%**

	Fuel Type
Electric	3%
Natural Gas	3%
ellet Stones	3%
Propane	70%
Wood	19%
Other	3%
Total	**100%**

	Designated Air Supply
Yes	59%
No	24%
Don't Know	16%
Total	**100%**

	Tightly Fitted Doors
Yes	70%
No	14%
Don't Know	16%
Total	**100%**

	Venting
Roof	57%
Wall	35%
Unvented	5%
Don't Know	3%
Total	**100%**

Designated Air Supply by Fuel Type:

Count of Designated air supply	Designated air supply				
Fuel	Don't Know	N/A	No	Yes	Grand Total
Electric		1			1
Natural Gas				1	1
Other				1	1
Pellet Stones	1				1
Propane			6	20	26
Wood	4		3		7
Grand Total	5	1	9	22	37

Tightly Fitted Doors by Fuel Type:

Count of Tightly Fitted Doors	Tightly Fitted Doors			
Fuel	Don't Know	No	Yes	Grand Total
Electric			1	1
Natural Gas			1	1
Other	1			1
Pellet Stones	1			1
Propane		2	24	26
Wood	4	3		7
Grand Total	6	5	26	37

Venting by Fuel Type:

Count of Venting	Venting				
Fuel	Don't know	Roof	Unvented	Wall	Grand Total
Electric	1				1
Natural Gas				1	1
Other		1			1
Pellet Stones		1			1
Propane		12	2	12	26
Wood		7			7
Grand Total	1	21	2	13	37

Room Air Conditioner Properties:

	Statistics
e Size (btu/hr)	6,233
nate Age (yrs)	4
age kWh/year	no information
e EER Rating	10.3

Energy Star Appliance?		%
Yes	19	36%
No	16	30%
Don't Know	18	34%
Total	**53**	**100%**

Bathroom Exhaust Properties:

	Location of Bathroom Exhaust
1st Floor	22
oor Bathroom	9
2nd Floor	10
oor Bathroom	7
Bathroom	20
Basement	2
Ceiling	70
ntre of Room	1
Downstairs	1
irs Bathroom	1
all Bathroom	1
Main	1
ter Bathroom	7
ster Bedroom	3
Shower	3
irs Bathroom	2
Total	**160**

	Manufacturer
Air King	7
Broan	45
Fantech	3
Hunter	4
Huntington	5
NuTone	78
Panasonic	9
Ventline	2
Unknown	7
Total	**160**

	Vented to Outside
Yes	152
No	4
Don't Know	4
Total	**160**

	CFM
Average	77

	Sones
Average	2.8

	Controls
)n/Off Switch	152
Crank Timer	6
4 Hour Timer	2
rak controller	0
)eration/other	0
Total	**160**

	Hours On/Day
Average	2

	Serves as whole house exhaust?
Yes	2
No	158
Total	**160**

Kitchen Exhaust Properties:

	Type of Kitchen Exhaust
ıge Hood	42
ɔwn Draft	5
Filter	2
Total	**49**

	Vented to Outside
Yes	35
No	14
Total	**49**

	Manufacturer
Amana	1
Broan	8
E-Wave	1
Frigidair	5
GE	8
Jenn-Air	1
Kenmore	3
̈itchenaid	2
LG	1
Maytag	4
Sears	3
Sharp	1
Thermdor	1
entahood	3
Viking	1
Whirlpool	3
N/A	3
Total	**49**

	CFM
Average	173

	Sones
Average	5

	Controls
)ff Switch	49
ınk Timer	0
ɔur Timer	0
controller	0
tion/other	0
Total	**49**

	Hours On/Day
Average	1

	Serves as whole house exhaust?
Yes	0
No	49
Total	**49**

Whole House Exhaust Properties:

	Type of Whole House Exhaust
entilator	2
entilator	9
Total	**11**

	Manufacturer
tandard	1
Carrier	1
Fantech	3
Lennox	1
ebreath	1
Venmar	4
Total	**11**

	CFM
Average	114

	Sones
Average	1.3

	Controls
f Switch	0
k Timer	0
ır Timer	2
ɔntroller	1
ɔn/other	8
Total	**11**

	Hours On/Day
Average	16

	Serves as whole house exhaust?
Yes	10
No	1
Total	**11**

Ventilation Properties:

Ventilation Summary								
	Duct Blaster CFM@25 Total	Whole house attic fan	If yes, is there tight, insulated winter cover?	Clothes dryer vented to outside?	Do comb appl backdraft when exhaust appliances operating and house closed?	If yes, which combustion appliances backdraft?	Attachment between house & garage sealed?	Habitable spaces > 4% of floor area w/o operable windows?
Yes		4	2	70	2		36	4
No		70	3	2	43		9	71
Don't Know			1	1	18			
N/A		1	27	2	11		30	
No Answer	60	1	43	1	2	74	1	1
Boiler						2		
Minimum	121							
Maximum	2,802							
Average	1,168							
Total		**76**	**76**	**76**	**76**	**76**	**76**	**76**

Lighting Properties:

	# Sockets
Total # Sockets	5,345

Bulb Type	**# Bulbs**	**%**	**per Home**
Baseboard Lighting	3	0%	0
Cabinet Lighting	1	0%	0
CFL	536	10%	7
Fluorescent Tube	524	10%	7
Round Fluorsecent	1	0%	0
Halogen	449	8%	6
Heat Lights	2	0%	0
Incandescent	3,820	71%	50
LED	5	0%	0
Other	4	0%	0
Total	**5,345**	**100%**	70

Socket Type	**# Sockets**	**%**
Candelabra	283	5%
Edison-base	4,295	80%
Night Light	46	1%
Pin-base	721	13%
Total	**5,345**	**100%**

	Dimmer	**%**
Yes	707	13%
No	4,638	87%
Total	**5,345**	**100%**

	Recessed Can	**%**
Yes	891	17%
No	4,454	83%
Total	**5,345**	**100%**

	Hard-Wired Fixture	**%**
Yes	4,817	90%
No	528	10%
Total	**5,345**	**100%**

Sum Of LT sktn	Bulb type	Socket type	Dimmer	Recessed Can	Hard-wired
2	CFL	Edison-base	No	No	No
19	Incandescent	Candelabra	No	No	No
74	CFL	Edison-base	No	No	No
5	Halogen	Edison-base	No	No	No
340	Incandescent	Edison-base	No	No	No
3	Other	Edison-base	No	No	No
24	Incandescent	Night Light	No	No	No
5	LED	Night Light	No	No	No
18	Fluorescent tube	Pin-base	No	No	No
11	Halogen	Pin-base	No	No	No
2	Incandescent	Pin-base	No	No	No
1	Other	Pin-base	No	No	No
4	Incandescent	Candelabra	Yes	No	No
2	CFL	Edison-base	Yes	No	No
1	Incandescent	Edison-base	Yes	No	No
1	Halogen	Pin-base	Yes	No	No
1	CFL	Edison-base	No	Yes	No
3	Halogen	Edison-base	No	Yes	No
11	Incandescent	Edison-base	No	Yes	No
1	Incandescent	Edison-base	Yes	Yes	No
189	Incandescent	Candelabra	No	No	Yes
404	CFL	Edison-base	No	No	Yes
133	Halogen	Edison-base	No	No	Yes
2	Heat lights	Edison-base	No	No	Yes
2170	Incandescent	Edison-base	No	No	Yes
3	aseboard lighting	Night Light	No	No	Yes
1	Cabinet lighting	Night Light	No	No	Yes
1	Halogen	Night Light	No	No	Yes
2	Incandescent	Night Light	No	No	Yes
4	Incandescent	Night Light	No	No	Yes
8	CFL	Pin-base	No	No	Yes
506	Fluorescent tube	Pin-base	No	No	Yes
102	Halogen	Pin-base	No	No	Yes
2	Incandescent	Pin-base	No	No	Yes
1	ound Fluorescent	Pin-base	No	No	Yes
67	Incandescent	Candelabra	Yes	No	Yes
22	Halogen	Edison-base	Yes	No	Yes
283	Incandescent	Edison-base	Yes	No	Yes
2	Incandescent	Night Light	Yes	No	Yes
32	Halogen	Pin-base	Yes	No	Yes
8	Incandescent	Pin-base	Yes	No	Yes
4	Incandescent	Candelabra	No	Yes	Yes
39	CFL	Edison-base	No	Yes	Yes
102	Halogen	Edison-base	No	Yes	Yes
422	Incandescent	Edison-base	No	Yes	Yes
4	Incandescent	Night Light	No	Yes	Yes
17	Halogen	Pin-base	No	Yes	Yes
1	Incandescent	Pin-base	No	Yes	Yes
6	CFL	Edison-base	Yes	Yes	Yes
9	Halogen	Edison-base	Yes	Yes	Yes
258	Incandescent	Edison-base	Yes	Yes	Yes
11	Halogen	Pin-base	Yes	Yes	Yes
2	Incandescent	Edison-base	No	Yes	Yes

Dishwasher Properties:

	Dishwasher Statistics
Average Age (yrs)	2
Average Load per week	4
Average Energy Factor	0.65
Average kWh/yr	336

	Energy Star Appliance?	%
Yes	46	68%
No	12	18%
Don't Know	10	15%
Total	**68**	**100%**

Refrigerator Properties:

	Refrigerator Statistics
Average fresh food volume	19.53
Average Mo/Yr in Operation	12
Average Age (yrs)	2.59
Average kWh/yr	544

	Energy Star Appliance?	%
Yes	55	65%
No	19	22%
Don't Know	11	13%
Total	**85**	**100%**

	Type
Bottom Freezer	16
Interior Freezer	1
No Freezer	1
Side by Side	39
Top Mount Freezer	21
N/A	7
Total	**85**

	Door (through door ice?)
Yes	38
No	47
Total	**85**

Freezer Properties:

	Freezer Statistics
Average Volume	13.59
Average Mo/Yr in Operation	12
Average Age (yrs)	6.84
Average kWh/yr	325

	Energy Star Appliance?	%
Yes	2	10%
No	12	60%
Don't Know	6	30%
Total	**20**	**100%**

	Type	%
Chest	9	45%
Upright	11	55%
Total	**20**	**100%**

	Defrost	%
Automatic	8	40%
Manual	9	45%
Don't Know	3	15%
Total	**20**	**100%**

Clothes Washer Properties:

	Clotheswasher Statistics
Average Age (yrs)	3.0
Avg Loads/Week	5
Average kWh/yr	297
Average MEF	1.85

	Energy Star Appliance?	%
Yes	44	60%
No	17	23%
Don't Know	12	16%
Total	**73**	**100%**

	Type	%
Front Loader	32	44%
Top Loader	40	55%
Don't Know	1	1%
Total	**73**	**100%**

Clothes Dryer Properties:

	Clothes Dryer Statistics
g # in house	1

	Fuel Type	%
Electric	61	80%
Propane	7	9%
Don't Know	8	11%
Total	**76**	**100%**

	Clothes line installed outdoors?	%
Yes	15	20%
No	54	71%
Don't Know	7	9%
Total	**76**	**100%**

Small Household Appliances Properties:

Small Household Appliance		
Type	**Sum of Small Household Appliances**	**Number that are Energy Star**
Analog or Digital Cable TV	58	0
Computer Printer	67	4
Dehumidifier	20	1
Desktop Computer	74	4
Digital Satellite Box	34	1
Digital Video Recorders (e.g. TiVo)	18	0
DVD Player	99	6
ERV (dehumjdifier)	1	
Hot Tub	5	0
Humidifier	12	0
Laptop Computer	42	2
Large Screen TV (greater than 36")	43	10
Other	1	0
Standard Size TV (36" or less)	157	10
Stereo System	56	1
Swimming Pool (Heated)	0	0
Swimming Pool (Unheated)	6	0
Vaporizer	1	
VCR	66	5
Video Gaming System	38	1
Total	**798**	**45**

	If the house has a dehumidifier, how many months is it operational?
Average Months	5
# Homes	23

	If the house has a hot tub, what is the primary fuel?
Electric	75%
Propane	25%
# Homes	4

Solar System and Sun Spaces Properties:

	Solar & Sun
Solar System	0
ith Sun Space	5

Sun Space Notes	
1	Small sunroom on south side of house connected via French doors with livingroom. Owner says the room reaches 70F by 7:30 on sunny winter days.
2	Shaded by treeds and hill with ledge. Two skylightgs in roof. Much of the area is shaded with hillside as high as the windows.
3	2 Skylights - South O. 10' by 17' Energy Star Fan 56 inches Roof slant 45 degrees with 12" thickness in ceiling 6 inch walls/Tongue & Grove Crawl space Floor (foamed) Ceiling & Walls - fiberglass
4	East side Vinyl flooring Six feet opening into main house Inside walls are 2 X 4 construction
5	Solar room 15x17, cathedral ceiling, no slab or masonry load

General Observations:

Ranking of General Observations						
From Lowest (1) to Highest (5)	Construction Quality	%	Missed Energy Opportunities	%	Recommendations	%
#1 ranking	2	3%	3	4%	4	5%
#2 ranking	6	8%	15	20%	17	22%
#3 ranking	25	33%	37	49%	26	34%
#4 ranking	37	49%	17	22%	24	32%
#5 ranking	6	8%	4	5%	5	7%
Total	76	100%	76	100%	76	100%

Top Four Worse Energy Features That Can Be Improved:

Summary of Worst Energy Features								
Feature	1st Worst Energy Feature	%	2nd Worst Energy Feature	%	3rd Worst Energy Feature	%	4th Worst Energy Feature	%
A - Wall insulation installation			1	1%	2	3%	1	1%
B - Wall insulation R-values			1	1%	1	1%		
C - Wall air leakage	1	1%			2	3%	2	3%
D - Ceiling insulation installation	5	7%	12	16%	2	3%	1	1%
E - Ceiling insulation R-values	6	8%	8	11%	4	5%	1	1%
F - Ceiling air leakage	2	3%	4	5%	8	11%	2	3%
G - Basement insulation installation	2	3%	3	4%			1	1%
H - Basement insulation R-value (incl no ins)	27	36%	4	5%	3	4%	4	5%
I - Basement air leakage			3	4%	3	4%	1	1%
J - Window quality					1	1%		
M - House air leakage reduction (overall)	6	8%	4	5%	3	4%	4	5%
N - Furnace installation quality					3	4%	2	3%
O - Furnace efficiency (AFUE)	4	5%	1	1%	1	1%	1	1%
Q - Central air conditioning efficiency (SEER)							1	1%
R - Duct system installation					1	1%	1	1%
S - Duct system tightness			2	3%	2	3%		
T - Duct system insulation installation	1	1%						
U - Duct system insulation R-value	1	1%	1	1%	2	3%	1	1%
V - Water heater installation quality			3	4%			1	1%
W - Water heater efficiency (Energy Factor)			2	3%	1	1%		
X - House solar orientation					1	1%	3	4%
Y - Kitchen range hood quality/effectiveness	1	1%	2	3%	2	3%		
Z - Bathroom fan quality/effectiveness			1	1%	3	4%	11	14%
Size of House					1	1%		
No Answer	20	26%	24	32%	30	39%	38	50%
Total	**76**	**100%**	**76**	**100%**	**76**	**100%**	**76**	**100%**

Construction Quality Comments

Sloppy construction. The house was slapped up quickly, and you could tell just from looking at it.
Modular Home, Manufactured by ProFab in Canada
VERY POOR INSULATION INSTALLATION
ALL ICF CONSTRUCTION
Low end doublewide.
Curious framing details, poor insulation installation, open stove pipe chase in attic.
Some windows were very difficult to close.
Poor quality framing.
Well built in general.
Lumps in walls. Simpson strong ties visible in living room. Kitchen vented into the garage.
Seems lower quality than other modular homes that we audited.
no detail slab floor has radiant un balanced
Modular with issues

Missed Energy Opportunities By Builder Comments

basement insulation, attic air sealing, AC ducts, lighting
Misc Air Sealing in Basement, Rim Joist
UNINSULATED CEILING OF BASEMENT UNDER GARAGE, MISC AIR SEALING, INSULATE HATCH
MAJOR THERMAL BYPASS, UNINSULATED FRAMED FLOOR OVER GARAGE, UNDER LIVING SPACE
INSUFFICIENT SLOPED CEILING INSULATION
There is no insulation in the first floor or foundation.
Insulated to minimum standards.
The house is electrically heated. The living room overheats when the sun is out and over cools when it is not due to the large area of windows.
This relatively small house has two furnaces with 50 kBtu/hr of cooling!
Poor quality installation of insulation in the attic.
Leaky, typical installation of fiberglass batts in attic.
Attic insulated with insulsafe. Extremely low density with visible air passages makes it look ineffective to me.
Fiberglass insulation in ceiling was poorly installed. The slope over the stairs to the second floor wasn't fully insulated.
basement insulation wall insulation rim joists slab floor
Sealed Bulkhead Foundation Insulation Duct sealing Duct Insulation Attic Hatch
Attic insulation Wall Insulation slab floor not evenly heated attic hatch window quality
Attic Walls slab insulation
Heating system DHW system Ceiling insulation (up to R49) Basement foundation insulation attic hatch
attic insulation improvement around obstructions reset insulation in attic wall lighting slab insulation
Basement Wall Insulation Attic Insulation Heating System Efficiency way too low DHW not effective because of Boiler Attic hatch
Foundation Insulation on remaining exposed Air Infiltration Reduction
Add more attic insulation for an even R-value Improve basement wall insulation and dry out wet wall. Install HRV for home insulate foundation walls attic hatch Dehumidify basement
air infiltration change insulation type in attic insulate crawlspace foundation
Boiler efficiency DHW efficiency Basement foundation insulation Window U value slab insulation correct ventilation attic hatch
Attic insulation basement foundation insulation bulkhead air infiltration lighting
Higher grade material
Insulation installation in all components hatch to kneewall vapor barrier air sealing basement foundation slab insulation

Attic Insulation installation quality Foundation Insulation Slab Insulation Rim Joist Insulation Orientation Skylight placement
Heating and Hot water attic wall insulation interior wall communication with outside Basement insulation
heating system sizing duct insulation air infiltration slope insulation basement insulation slab floor insulation DHW tank versus On demand for one occupant duct leakage
Main and dining ceiling insulation basement insulation window efficiency air conditioners ducting A/C potentially oversized lighting
Attic insulation installation Attic hatch basement insulation continuation condition space boundaries
Attic insulation basement foundation insulation heating system efficiency DHW air infiltration attic hatch
attic insulation type wall insulation door to garage issue basement wall insulation rim joist insulation
Attic insulation wall insulation basement walls rim joist insulation bulkhead covered correctly duct insulation heating system hot water heater venting windows
Attic Hatch, use Cellulose in 2nd attic
Bay Windows attic and base Attic hatch
Basement foundation Addition floor insulation slopes insulation kneewall insulation air sealing connection to garage lighting
Foundation insulation on remaining foundation baffles for FG insulation

Recommendations for Energy Improvements Comments

1. Add 4-6" Cellulose to attic 2. Air seal around basement windows 3. Additional air sealing in rim joist 4. Better fit and gasketed sump drain cover 5. Replace dryer exhaust ductwork with rigid ductwork. 6. Vent range hood to outside 7. Install timers on bath fans
INSTALL CLOSED CELL SPRAY FOAM TO BRING INSULATION AT LEAST TO MAINE MEC LEVELS. INSTALL TIMERS ON BATH FANS. INSTALL ENERGY EFFICIENT LIGHTING.
INSULATE BASMENT WALLS, INSULATE CEILING OF WORKSHOP UNDER GARAGE, AIR SEALING, INSULATE ATTIC HATCH, INSTALL TIME DELAY SWITCHES
AIR SEALING, INSULATE HATCH, WINDOW COVERINGS, INSULATE REST OF FOUNDATION WALLS
BETTER INSULATION, SEAL ATTIC HATCH, WINDOW COVERINGS
RUN ERV UNIT REGULARLY, INSULATE FF OVER GARAGE
BASEMENT INSULATION, MECHANICAL VENTILATION, ADDITIONAL CEILING INSULATION
Use better insulation
Insulate floor and pipes. Improve attic insulation, seal stove pipe chase, don't use the propane fireplace, add better bath fans with timers. Install CFL lights.
Supply air needed for the furnace. It backdrafted during the CAZ test. Pipe insulation should be added to the hot water and heating pipes in unconditioned basement. Install CFL lights.
The foundation or the floor should be insulated. Pot lights should be sealed and insulated. More CFL lights should be installed.
Circulate hot air on sunny days to the back of the house. Remove propane fireplace. Install wood pellet stove. Add vent fans to master bath and kitchen.
Install CFLs where possible.
Rake out insulation in attic. Add a denser layer of cellulose to compact the very low density Insulsafe.
Air seal attic deck. Improve attic insulation. Increase attic insulation. Set back the thermostat (way back) when not occupied (most of the time).
Find best way to greatly reduce the temp when no one is home. Presently they leave the thermostat at 58F.
Air seal the attic deck and basement. Detail the insulation in the attic. Fix air leak in propane fireplace. Get programmable thermostats.
Insulate pipes. Air seal attic deck. Add cellulose to pack down the Insulsafe.
Insulsafe attic insulation seems too porous: cap with cellulose. Floor was insulated with the kraft paper down.
Insulsafe in attic needs cellulose cap.
The foundation wasn't originally designed for a house and thus has no insulation under the slab. It does have perimeter insulation.
Do a high quality job of insulating and finishing the upstairs.
improve exposed insulation install foundation insulation see above
Improve wall and ceiling insulation insulate slab exterior, major loss attic hatch
Correct attic wall insulation Reduce air infiltration Improve wall insulation installation Improve attic insulation to R-49
Replace or make unit more efficient, outside temp unit Increase attic insualtion Insulation foundation Replace bulbs

with CFLs
install insulation board on exterior see above
Replace boiler with at least 86% efficient unit Increase R-value in attic insulate basement walls/ bulkhead
Replace boiler with one above 86% AFUE with indirect DHW tank insulated foundation walls Install dedicated bath fan or HRV
thermax on all slopes air seal HRV correct attic insulation, add to R-49
Finish or install a sealed door to over garage Attic Hatch Reduce air infiltration Install HRV for home Many more
Higher R-value in attic Higher efficiency boiler or outside temp. unit Lighting to CFL Insulated slab/foundation with R-10 foam
Heating system efficiency DHW indirect tank installation continue R-value across all basment cap wall to garage, air infiltration in wall cavities
insulate ducting insulate basement insulation improve slope vapor barrier reduce air infiltration wrap HW tank or replace with on-demand
seal a/c ducting, espcially at floors/ceilings insulated basement walls improve attic insualtion air seal top of interior walls Replace lighting with CFL's
improve attic insulation continue the exterior foundation insulation define conditioned boundary by insulating, etc.
Attic insulation basement foundation insulaiton heating system efficiency install Indirect tank install CFLs
upgrade attic insulation replace door to garage insulate foundatin walls reduce infiltration install HRV or dedicated bath fan
There is not a lot of room for improvements. Install insulation in basement walls Correct the stairway ceiling anomoly of insualtion not keeping cooling of ceiling out.
Improve attic hatch to be sealed, improve mudroom and basement attic insulation by setting F.G. right or replace with cellulose to min. R-49
Attic hatch Fresh air kit on boiler run the HRV as directed

Other Comments

Garage was conditioned. Should be pushed outside boundary. Would need sealed, insulated mechanical room and pipe insulation. Garage ceiling should be ripped down and foamed.
No wind baffles in attic. Lighting efficiency could also be improved.
No blocking between vinyl overhangs and basement
No slab insulation/radiant floor. Installation of radiant tubes in basement ceiling (no radiant fins, only tubes passing through cavities that are enclosed by bubble pack)
Lack of pipe insulation
Lack of pipe insulation. Efficiency gains could also be made by addressing lighting.
Lack of pipe insulation. Band joist insulation is missing at radiator supply/returns.
Missing attic hatch; chimney chase
There is a fairly significant leak in the wall that separates the house from the garage (see photo of stained FG)
Plank sheathing on walls (100% ext.; some on int. too)
Foundation insulation needs to be extended to above grade The thermal boundary is disrupted on 2nd floor. Attic unconditioned air is circulating back into the conditioned area
Home was built as a rental property, and is currently unoccupied.
HOMEOWNER PAID FOR CLOSED CELL POLYURETHANE FOAM INSULATION, INSULATOR INSTALLED OPEN CELL FOAM AT MAJORLY DEFICIENT R-VALUES. MECHANICALS NOT APPROPRIATE FOR THIS CLIMATE ZONE - INLINE ELECTRIC FURNACE FOR HEAT, OVERSIZED A/C.
PRO FAB MODULAR CONSTRUCTION
ADD MORE CEILING INSULATION, INSULATE BASEMENT, WINDOW COVERINGS
MISSING PICTURES WITH MODEL INFO FOR APPLIANCES. NO DETAILED APPLIANCE DATA
This is a very large house with two occupants.
Owner should not use the unvented propane fireplace and should install a CO detector.
This house really need some mechanical ventilation. It is tight and only has one bathroom exhaust fan that vents into a soffit. Both occupants smoke.
This house wasn't completed and so there were no small appliances and no washer or dryer. The blower door test would probably improve slightly after completing the house. The heating systems and cooling capacity seems to be oversized by a factor of at least two.
This owner was very interested in energy savings. He has been adding insulation to the basement and is planning on heating with a woodstove from the basement.

The owner wanted the house to be as energy efficient as possible and was proud that all appliances were energy star listed.
This is a huge place for a camp for two people. The worst energy feature is the heat system design with furnaces and ducts in areas that aren't part of the living space but are heated to keep the ducts warm. This adds to the size of the already large house.
Air handler used for heating and cooling located in the attic has R4 insulation on extensive duct system that is mostly above the attic insulation. This decreases the efficiency of both heating and cooling. Hot water pipes from the boiler run the length of the basement without insulation.
Home needs ventilation. Wall A/C units need covers for winter.
This ventilator may be sized too large. Owners don't know how to best control them. The house is very tight but the foundation is a little leaky.
They could use some ventilation.
There was a plumbing leak in the master bathroom. The home company didn't show up for six months during which time the floor was soaked as well as the first few inches of the walls. The subfloor was replaced and the lower portion of the wall studs were removed and new pieces were attached. Lots of water accumulated in the ceiling of the master bedroom and stained the ceiling. The home company removed the insulation and replaced it and the sheetrock. The home had a lot of mold during this crisis and the homeowner mentioned that he hasn't felt well in a long time.
V-match pine on whole camp, no vapor barrier.
This home meets the tax credit. Wow, what a building and design. I am speechless.
2nd floor is being worked on to finish that had a high effect on these results
HRV is needed in this builders buildings. All other improvements are in the material choice.
The best design of the baseline study from the owner doing their own research.
Great House, very well built
Not enough issues to list. A very well built home.

IX. APPENDIX C: USER-DEFINED REFERENCE HOME DETAIL

BUILDING FILE REPORT

File Name: Maine Baseline.blg
Date: March 20, 2008

REM/Rate - Residential Energy Analysis and Rating Software v12.43 Vermont

Property/Builder: Rating

Building Name: Maine Baseline Home Org. Name: VEIC
Owner's Name: Phone No:
Prop. Address: Rater's Name: P Scheckel
City,St,Zip: , ME Rater's No.:
Phone No:
Rating Date: February 2008
Bldr's Name: Rating Type: Site Visit
Model: Reason: Informational
Development: Rating No.: ME BL1
Phone No:

General Building Information

Area of Cond. Space(sq ft): 2805
Floors on or Above-Grade: 2
Volume of Cond. Space: 22826
Number of Bedrooms: 3
Housing Type: Single-family detached
Level Type(Apartments Only): None
Foundation Type: More than one type
Enclosed Crawl Space Type: Unvented

Foundation Wall Info: 1 2 3

Name
Library Type ME,Bsm,Cond>amb ME,Bsm,Cond>gar ME,Bsm,Cond>EncCrawl
Length(ft) 80.9 10.3 2.2
Total Height(ft) 6.2 7.0 5.3
Depth Below Grade(ft) 4.3 5.7 2.1
Height Above Grade(ft) 1.9 1.3 3.2
Location Cond->ambient/grnd Cond->garage/grnd Cond->enclsd crwl/grnd
Uo Value 0.121 0.120 0.470

Foundation Wall Info: 4 5 6

Name
Library Type ME,Bsm,UNcond>Amb ME,Bsm,UNcond>Gar3 ME,Bsm,UNcond>OCrawl
Length(ft) 50.3 3.4 12.1
Total Height(ft) 6.3 7.5 3.1
Depth Below Grade(ft) 4.5 6.5 1.8
Height Above Grade(ft) 1.8 1.0 1.3
Location Uncond bsmt->amb/grnd Uncond bsmt->garage/grnd Uncond bsmt->open crwl/grd
Uo Value 0.164 0.215 0.206

Foundation Wall Info: 7 8

Name
Library Type ME,Bsm,EncCrawl>Gar ME,Bsm,CondCrawl>Amb

Length(ft) 0.7 3.0
Total Height(ft) 2.3 3.0
Depth Below Grade(ft) 1.3 2.0
Height Above Grade(ft) 1.0 1.0
Location Enclsd crwl->garage/grnd Cond crwl->amb/grnd
Uo Value 0.145 0.375

Foundation Wall: ME,Bsm,Cond>amb

Type: Solid concrete or stone
Thickness(in): 9.4
Studs: Wood, 2x4, 16" o.c.
Interior Insulation:
Continuous R-Value: 0.7
Frame Cavity R-Value: 1.5
Cavity Insulation Grade: 2.0
Ins top: 0.0 ft from top of wall
Ins Bottom: 0.0 ft from bottom of wall
Exterior Insulation:
R-Value: 1.9
Ins top: 0.0 ft from top of wall
Ins bottom: 0.0 ft from bottom of wall
Note:

Foundation Wall: ME,Bsm,Cond>gar

Type: Solid concrete or stone
Thickness(in): 9.0
Studs: Wood, 2x4, 16" o.c.
Interior Insulation:
Continuous R-Value: 0.7
Frame Cavity R-Value: 1.7
Cavity Insulation Grade: 2.0
Ins top: 0.0 ft from top of wall
Ins Bottom: 0.0 ft from bottom of wall
Exterior Insulation:
R-Value: 0.7
Ins top: 0.0 ft from top of wall
Ins bottom: 0.0 ft from bottom of wall
Note:

Foundation Wall: ME,Bsm,Cond>EncCrawl

Type: Solid concrete or stone
Thickness(in): 9.0
Studs: None
Interior Insulation:
Continuous R-Value: 0.0
Frame Cavity R-Value: 0.0
Cavity Insulation Grade: 1.0
Ins top: 0.0 ft from top of wall
Ins Bottom: 0.0 ft from bottom of wall
Exterior Insulation:
R-Value: 0.0
Ins top: 0.0 ft from top of wall
Ins bottom: 0.0 ft from bottom of wall
Note:

Foundation Wall: ME,Bsm,UNcond>Amb

Type: Solid concrete or stone
Thickness(in): 9.4
Studs: None
Interior Insulation:
Continuous R-Value: 0.9
Frame Cavity R-Value: 0.0
Cavity Insulation Grade: 1.0
Ins top: 0.0 ft from top of wall
Ins Bottom: 0.0 ft from bottom of wall
Exterior Insulation:
R-Value: 1.3
Ins top: 0.0 ft from top of wall

Ins bottom: 0.0 ft from bottom of wall
Note:

Foundation Wall: ME,Bsm,UNcond>Gar3

Type: Solid concrete or stone
Thickness(in): 9.0
Studs: None
Interior Insulation:
Continuous R-Value: 0.0
Frame Cavity R-Value: 0.0
Cavity Insulation Grade: 1.0
Ins top: 0.0 ft from top of wall
Ins Bottom: 0.0 ft from bottom of wall
Exterior Insulation:
R-Value: 0.0
Ins top: 0.0 ft from top of wall
Ins bottom: 0.0 ft from bottom of wall
Note:

Foundation Wall: ME,Bsm,UNcond>OCrawl

Type: Solid concrete or stone
Thickness(in): 10.2
Studs: None
Interior Insulation:
Continuous R-Value: 1.1
Frame Cavity R-Value: 0.0
Cavity Insulation Grade: 1.0
Ins top: 0.0 ft from top of wall
Ins Bottom: 0.0 ft from bottom of wall
Exterior Insulation:
R-Value: 1.1
Ins top: 0.0 ft from top of wall
Ins bottom: 0.0 ft from bottom of wall
Note:

Foundation Wall: ME,Bsm,EncCrawl>Gar

Type: Solid concrete or stone
Thickness(in): 9.5
Studs: Wood, 2x4, 16" o.c.
Interior Insulation:
Continuous R-Value: 0.0
Frame Cavity R-Value: 4.8
Cavity Insulation Grade: 2.0
Ins top: 0.0 ft from top of wall
Ins Bottom: 0.0 ft from bottom of wall
Exterior Insulation:
R-Value: 0.0
Ins top: 0.0 ft from top of wall
Ins bottom: 0.0 ft from bottom of wall
Note:

Foundation Wall: ME,Bsm,CondCrawl>Amb

Type: Solid concrete or stone
Thickness(in): 10.0
Studs: None
Interior Insulation:
Continuous R-Value: 0.0
Frame Cavity R-Value: 0.0
Cavity Insulation Grade: 2.0
Ins top: 0.0 ft from top of wall
Ins Bottom: 0.0 ft from bottom of wall
Exterior Insulation:
R-Value: 0.0
Ins top: 0.0 ft from top of wall
Ins bottom: 0.0 ft from bottom of wall
Note:

Slab Floor Info: 1

Name

Library Type ME,Slab1
Area(sq ft) 911
Depth Below Grade(ft) 4.0
Full Perimeter(ft) 109
Exposed Perimeter(ft) 68
On-Grade Perimeter(ft) 26

Slab Floor: ME,Slab1

Perimeter Insulation (R-Value): 1.6
Perimeter Insulation Depth (ft): 0.6
Under-Slab Insulation (R-Value): 2.0
Under-Slab Insulation Width (ft): 23.0
Slab Insulation Grade: 3
Radiant Slab: No
Note:

Frame Floor Info: 1 2 3

Name
Library Type ME,flr,Cond>Amb1 ME,flr,Cond>Gar1 ME,flr,Cond>UNconBsm1
Area (sq ft) 42 72 423
Location Btwn cond & ambient Btwn cond & garage Btwn cond & uncond bsmt
Uo Value 0.047 0.063 0.094

Frame Floor Info: 4

Name
Library Type ME,flr,Cond>EncCrawl1
Area (sq ft) 98
Location Btwn cond & enclsd crwl
Uo Value 0.136

Frame Floor: ME,flr,Cond>Amb1

Information From Quick Fill Screen:
Continous Insulation R-Value 0.0
Cavity Insulation R-Value 25.0
Cavity Insulation Thickness (in.) 6.5
Cavity Insulation Grade 2.0
Joist Size (w x h, in) 1.5 x 9.5
Joist Spacing (in oc) 16.0
Framing Factor - (default) 0.1300
Floor Covering HARDWOOD
Note:
Layers Paths
Cavity Framing Grade
Inside Air Film 0.920 0.920 0.920
Floor covering 0.680 0.680 0.680
Subfloor 0.820 0.820 0.820
Cavity ins 25.000 0.000 0.000
Continuous ins 0.000 0.000 0.000
Framing 0.000 8.125 0.000
0.000 0.000 0.000
Outside Air Film 0.920 0.920 0.920
Total R-Value 28.340 11.465 3.340
U-Value 0.035 0.087 0.299
Relative Area 0.850 0.130 0.020
UA 0.030 0.011 0.006
Total Component UA: 0.047
Total Component Area: 1.0
Component Uo: 0.047

Frame Floor: ME,flr,Cond>Gar1

Information From Quick Fill Screen:
Continous Insulation R-Value 0.0
Cavity Insulation R-Value 19.6
Cavity Insulation Thickness (in.) 6.0
Cavity Insulation Grade 3.0
Joist Size (w x h, in) 1.5 x 11.5
Joist Spacing (in oc) 16.0
Framing Factor - (default) 0.1300

Floor Covering HARDWOOD
Note:
Layers Paths
Cavity Framing Grade
Inside Air Film 0.920 0.920 0.920
Floor covering 0.680 0.680 0.680
Subfloor 0.820 0.820 0.820
Cavity ins 19.600 0.000 0.000
Continuous ins 0.000 0.000 0.000
Framing 0.000 7.500 0.000
0.000 0.000 0.000
Outside Air Film 0.920 0.920 0.920
Total R-Value 22.940 10.840 3.340
U-Value 0.044 0.092 0.299
Relative Area 0.820 0.130 0.050
UA 0.036 0.012 0.015
Total Component UA: 0.063
Total Component Area: 1.0
Component Uo: 0.063

Frame Floor: ME,flr,Cond>UNconBsm1

Information From Quick Fill Screen:
Continous Insulation R-Value 0.0
Cavity Insulation R-Value 10.1
Cavity Insulation Thickness (in.) 3.0
Cavity Insulation Grade 3.0
Joist Size (w x h, in) 1.5 x 9.5
Joist Spacing (in oc) 16.0
Framing Factor - (default) 0.1300
Floor Covering HARDWOOD
Note:
Layers Paths
Cavity Framing Grade
Inside Air Film 0.920 0.920 0.920
Floor covering 0.680 0.680 0.680
Subfloor 0.820 0.820 0.820
Cavity ins 10.100 0.000 0.000
Continuous ins 0.000 0.000 0.000
Framing 0.000 3.750 0.000
0.000 0.000 0.000
Outside Air Film 0.920 0.920 0.920
Total R-Value 13.440 7.090 3.340
U-Value 0.074 0.141 0.299
Relative Area 0.820 0.130 0.050
UA 0.061 0.018 0.015
Total Component UA: 0.094
Total Component Area: 1.0
Component Uo: 0.094

Frame Floor: ME,flr,Cond>EncCrawl1

Information From Quick Fill Screen:
Continous Insulation R-Value 0.0
Cavity Insulation R-Value 4.8
Cavity Insulation Thickness (in.) 1.4
Cavity Insulation Grade 2.0
Joist Size (w x h, in) 1.5 x 9.5
Joist Spacing (in oc) 16.0
Framing Factor - (default) 0.1300
Floor Covering HARDWOOD
Note:
Layers Paths
Cavity Framing Grade
Inside Air Film 0.920 0.920 0.920
Floor covering 0.680 0.680 0.680
Subfloor 0.820 0.820 0.820
Cavity ins 4.800 0.000 0.000
Continuous ins 0.000 0.000 0.000
Framing 0.000 1.750 0.000
0.000 0.000 0.000

Outside Air Film 0.920 0.920 0.920
Total R-Value 8.140 5.090 3.340
U-Value 0.123 0.196 0.299
Relative Area 0.850 0.130 0.020
UA 0.104 0.026 0.006
Total Component UA: 0.136
Total Component Area: 1.0
Component Uo: 0.136

Rim and Band Joist: 1 2 3

Name cond>amb cond>gar cond>attic
Area(sq ft) 131.2 11.5 4.3
Continuous Ins 0.7 0.7 0.0
Framed Cavity Ins 16.4 15.9 10.3
Cavity Ins Thk(in) 6.0 5.7 4.2
Joist Spacing 16.0 16.0 16.0
Location Cond -> ambient Cond -> garage Cond -> attic
Uo Value 0.052 0.054 0.076

Rim and Band Joist: 4

Name uncond bsm>amb
Area(sq ft) 26.5
Continuous Ins 0.4
Framed Cavity Ins 15.8
Cavity Ins Thk(in) 6.3
Joist Spacing 16.0
Location Uncond bsmt -> ambient
Uo Value 0.054

Above-Grade Wall: 1 2 3

Name
Library Type ME,AGW,Cond>Amb1 ME,AGW,Cond>Gar1 ME,AGW,Cond>attic1
Gross Area(sq ft) 1916.28 142.67 56.45
Exterior Color Medium Medium Medium
Location Cond -> ambient Cond -> garage Cond -> attic
Uo Value 0.071 0.077 0.078

Above-Grade Wall: 4 5 6

Name
Library Type ME,AGW,Cond>UNconBsm1 ME,AGW,UNcondBsm>Amb1 ME,AGW,Adiabatic1
Gross Area(sq ft) 22.00 23.60 10.78
Exterior Color Light Light Medium
Location Cond -> uncond bsmt Uncond bsmt -> ambient Cond -> another cond unit
Uo Value 0.106 0.079 0.073

Above-Grade Wall: ME,AGW,Cond>Amb1

Information From Quick Fill Screen:
Standard Wood Frame
Continuous Insulation (R-Value) 1.0
Frame Cavity Insulation (R-Value) 17.2
Frame Cavity Insulation Thickness (in) 5.1
Frame Cavity Insulation Grade 3
Stud Size (w x d, in) 1.5 x 5.5
Stud Spacing (in o.c.) 16.0
Framing Factor - (default) 0.2300
Gypsum Thickness (in) 0.5
Note:
Layers Paths
Cavity Framing Grade
Inside Air Film 0.680 0.680 0.680
Gyp board 0.450 0.450 0.450
Air Gap/Frm 0.000 0.000 0.000
Cavity ins/Frm 17.200 6.375 1.030
Continuous ins 1.000 1.000 1.000
Ext Finish 0.940 0.940 0.940
0.000 0.000 0.000
Outside Air Film 0.170 0.170 0.170
Total R-Value 20.440 9.615 4.270

U-Value 0.049 0.104 0.234
Relative Area 0.720 0.230 0.050
UA 0.035 0.024 0.012
Total Component UA: 0.071
Total Component Area: 1.0
Component Uo: 0.071

Above-Grade Wall: ME,AGW,Cond>Gar1

Information From Quick Fill Screen:
Standard Wood Frame
Continuous Insulation (R-Value) 0.0
Frame Cavity Insulation (R-Value) 17.8
Frame Cavity Insulation Thickness (in) 5.4
Frame Cavity Insulation Grade 3
Stud Size (w x d, in) 1.5 x 5.5
Stud Spacing (in o.c.) 16.0
Framing Factor - (default) 0.2300
Gypsum Thickness (in) 0.5
Note:
Layers Paths
Cavity Framing Grade
Inside Air Film 0.680 0.680 0.680
Gyp board 0.450 0.450 0.450
Air Gap/Frm 0.000 0.000 0.000
Cavity ins/Frm 17.800 6.750 1.030
Continuous ins 0.000 0.000 0.000
Ext Finish 0.940 0.940 0.940
0.000 0.000 0.000
Outside Air Film 0.170 0.170 0.170
Total R-Value 20.040 8.990 3.270
U-Value 0.050 0.111 0.306
Relative Area 0.720 0.230 0.050
UA 0.036 0.026 0.015
Total Component UA: 0.077
Total Component Area: 1.0
Component Uo: 0.077

Above-Grade Wall: ME,AGW,Cond>attic1

Information From Quick Fill Screen:
Standard Wood Frame
Continuous Insulation (R-Value) 0.2
Frame Cavity Insulation (R-Value) 16.8
Frame Cavity Insulation Thickness (in) 5.0
Frame Cavity Insulation Grade 3
Stud Size (w x d, in) 1.5 x 5.5
Stud Spacing (in o.c.) 16.0
Framing Factor - (default) 0.2300
Gypsum Thickness (in) 0.5
Note:
Layers Paths
Cavity Framing Grade
Inside Air Film 0.680 0.680 0.680
Gyp board 0.450 0.450 0.450
Air Gap/Frm 0.000 0.000 0.000
Cavity ins/Frm 16.800 6.250 1.030
Continuous ins 0.200 0.200 0.200
Ext Finish 0.940 0.940 0.940
0.000 0.000 0.000
Outside Air Film 0.170 0.170 0.170
Total R-Value 19.240 8.690 3.470
U-Value 0.052 0.115 0.288
Relative Area 0.720 0.230 0.050
UA 0.037 0.026 0.014
Total Component UA: 0.078
Total Component Area: 1.0
Component Uo: 0.078

Above-Grade Wall: ME,AGW,Cond>UNconBsm1

Information From Quick Fill Screen:
Standard Wood Frame
Continuous Insulation (R-Value) 0.0
Frame Cavity Insulation (R-Value) 11.3
Frame Cavity Insulation Thickness (in) 3.1
Frame Cavity Insulation Grade 3
Stud Size (w x d, in) 1.5 x 3.5
Stud Spacing (in o.c.) 16.0
Framing Factor - (default) 0.2300
Gypsum Thickness (in) 0.5
Note:
Layers Paths
Cavity Framing Grade
Inside Air Film 0.680 0.680 0.680
Gyp board 0.450 0.450 0.450
Air Gap/Frm 0.000 0.000 0.000
Cavity ins/Frm 11.300 3.875 1.030
Continuous ins 0.000 0.000 0.000
Ext Finish 0.940 0.940 0.940
0.000 0.000 0.000
Outside Air Film 0.170 0.170 0.170
Total R-Value 13.540 6.115 3.270
U-Value 0.074 0.164 0.306
Relative Area 0.720 0.230 0.050
UA 0.053 0.038 0.015
Total Component UA: 0.106
Total Component Area: 1.0
Component Uo: 0.106

Above-Grade Wall: ME,AGW,UNcondBsm>Amb1

Information From Quick Fill Screen:
Standard Wood Frame
Continuous Insulation (R-Value) 0.0
Frame Cavity Insulation (R-Value) 14.0
Frame Cavity Insulation Thickness (in) 4.4
Frame Cavity Insulation Grade 3
Stud Size (w x d, in) 1.5 x 5.5
Stud Spacing (in o.c.) 16.0
Framing Factor - (default) 0.2300
Gypsum Thickness (in) 0.5
Note:
Layers Paths
Cavity Framing Grade
Inside Air Film 0.680 0.680 0.680
Gyp board 0.450 0.450 0.450
Air Gap/Frm 0.930 1.375 0.930
Cavity ins/Frm 14.000 5.500 1.030
Continuous ins 0.000 0.000 0.000
Ext Finish 0.940 0.940 0.940
0.000 0.000 0.000
Outside Air Film 0.170 0.170 0.170
Total R-Value 17.170 9.115 4.200
U-Value 0.058 0.110 0.238
Relative Area 0.720 0.230 0.050
UA 0.042 0.025 0.012
Total Component UA: 0.079
Total Component Area: 1.0
Component Uo: 0.079

Above-Grade Wall: ME,AGW,Adiabatic1

Information From Quick Fill Screen:
Standard Wood Frame
Continuous Insulation (R-Value) 0.0
Frame Cavity Insulation (R-Value) 16.8
Frame Cavity Insulation Thickness (in) 4.4
Frame Cavity Insulation Grade 3
Stud Size (w x d, in) 1.5 x 5.5
Stud Spacing (in o.c.) 16.0
Framing Factor - (default) 0.2300

Gypsum Thickness (in) 0.5
Note:
Layers Paths
Cavity Framing Grade
Inside Air Film 0.680 0.680 0.680
Gyp board 0.450 0.450 0.450
Air Gap/Frm 0.930 1.375 0.930
Cavity ins/Frm 16.800 5.500 1.030
Continuous ins 0.000 0.000 0.000
Ext Finish 0.940 0.940 0.940
0.000 0.000 0.000
Outside Air Film 0.170 0.170 0.170
Total R-Value 19.970 9.115 4.200
U-Value 0.050 0.110 0.238
Relative Area 0.720 0.230 0.050
UA 0.036 0.025 0.012
Total Component UA: 0.073
Total Component Area: 1.0
Component Uo: 0.073

Window Information: 1 2 3

Name North
Library Type ME, baseline window1 ME, baseline window1 ME, baseline window1
U-Value 0.370 0.370 0.370
SHGC 0.450 0.450 0.450
Area(sq ft) 54.14 23.50 47.77
Orientation North Northeast East
Overhang Depth 0.7 0.8 1.5
Overhang To Top 1.8 0.9 1.3
Overhang To Bottom 3.3 2.3 3.4
Interior Winter Shading 0.78 0.71 0.81
Interior Summer Shading 0.67 0.60 0.67
Adjacent Winter Shading None None None
Adjacent Summer Shading None None None
Wall Assignment AGWall 1 AGWall 1 AGWall 1

Window Information: 4 5 6

Name
Library Type ME, baseline window1 ME, baseline window1 ME, baseline window1
U-Value 0.370 0.370 0.370
SHGC 0.450 0.450 0.450
Area(sq ft) 41.26 55.22 24.42
Orientation Southeast South Southwest
Overhang Depth 2.0 1.3 1.9
Overhang To Top 1.6 1.8 1.4
Overhang To Bottom 4.0 4.1 3.4
Interior Winter Shading 0.70 0.79 0.77
Interior Summer Shading 0.59 0.65 0.65
Adjacent Winter Shading None None None
Adjacent Summer Shading None None None
Wall Assignment AGWall 1 AGWall 1 AGWall 1

Window Information: 7 8

Name
Library Type ME, baseline window1 ME, baseline window1
U-Value 0.370 0.370
SHGC 0.450 0.450
Area(sq ft) 44.00 35.96
Orientation West Northwest
Overhang Depth 1.0 1.1
Overhang To Top 1.1 0.9
Overhang To Bottom 3.0 2.8
Interior Winter Shading 0.81 0.70
Interior Summer Shading 0.67 0.59
Adjacent Winter Shading None None
Adjacent Summer Shading None None
Wall Assignment AGWall 1 AGWall 1

Window: ME, baseline window1
U-Value: 0.370
Solar Heat Gain Coefficient: 0.450
Note:

Door Information: 1
Name door>gar
Opaque Area(sq ft) 77.3
Library Type ME, door1
Wall Assignment AGWall 1
Uo Value 0.242

Door: ME, door1
R-Value of Opaque Area: 3.2
Storm Door: No
Note:

Roof Information: 1 2
Name Vaulted Flat
Library Type ME,Ceil,Vaulted ME,Ceil,Flat
Gross Area(sq ft) 273.00 1374.00
Color Dark Dark
Radiant Barrier No No
Type(Attic) Vaulted Attic
Uo Value 0.049 0.037

Ceiling: ME,Ceil,Vaulted
Information From Quick Fill Screen:
Continous Insulation (R-Value) 0.6
Cavity Insulation (R-Value) 30.7
Cavity Insulation Thickness (in) 9.6
Cavity Insulation Grade 3.0
Gypsum Thickness (in) 0.500
Bottom Chord/Rafter Size(w x h, in) 1.5 x 9.8
Bottom Chord/Rafter Spacing (in o.c.) 16.0
Framing Factor - (default) 0.1412
Ceiling Type Vaulted
Note:
Layers Paths
Framing Cavity Grade
Inside Air Film 0.610 0.610 0.610
Gyp board 0.450 0.450 0.450
Cavity Ins/Frm 12.000 30.700 0.000
Continuous ins 0.600 0.600 0.600
Plywood 0.930 0.930 0.930
Shingles 0.400 0.400 0.400
0.000 0.000 0.000
Outside Air Film 0.170 0.170 0.170
Total R-Value 15.160 33.860 3.160
U-Value 0.066 0.030 0.316
Relative Area 0.141 0.809 0.050
UA 0.009 0.024 0.016
Total Component UA: 0.049
Total Component Area: 1.0
Component Uo: 0.049

Ceiling: ME,Ceil,Flat
Information From Quick Fill Screen:
Continous Insulation (R-Value) 7.6
Cavity Insulation (R-Value) 23.2
Cavity Insulation Thickness (in) 7.8
Cavity Insulation Grade 2.0
Gypsum Thickness (in) 0.500
Bottom Chord/Rafter Size(w x h, in) 1.5 x 5.5
Bottom Chord/Rafter Spacing (in o.c.) 16.0
Framing Factor - (default) 0.1412
Ceiling Type Attic

Note:
Layers Paths
Framing Cavity Grade
Inside Air Film 0.610 0.610 0.610
Gyp board 0.450 0.450 0.450
Cavity Ins/Frm 6.875 23.200 0.000
Continuous ins 7.600 7.600 7.600
0.000 0.000 0.000
0.000 0.000 0.000
0.000 0.000 0.000
Outside Air Film 0.610 0.610 0.610
Total R-Value 16.145 32.470 9.270
U-Value 0.062 0.031 0.108
Relative Area 0.141 0.839 0.020
UA 0.009 0.026 0.002
Total Component UA: 0.037
Total Component Area: 1.0
Component Uo: 0.037

Skylight Information: 1

Name
Library Type ME, baseline skylite1
U-Value 0.460
SHGC 0.470
Area(sq ft) 2.7
Winter Shading None
Summer Shading None
Orientation South
Pitch[?/12] 8
Ceiling Assignment Roof 1

Window: ME, baseline skylite1

U-Value: 0.460
Solar Heat Gain Coefficient: 0.470
Note:

Mechanical Equipment: General

Number of Mechanical Systems: 4
Heating SetPoint(F): 68.00
Heating Setback Thermostat: Not Present
Cooling SetPoint(F): 78.00
Cooling Setup Thermostat: Not Present

Heat: ME,Furn,103k,84.3afu

SystemType: Fuel-fired air distribution
Fuel Type: Fuel oil
Rated Output Capacity (kBtuh): 103.3
Seasonal Equipment Efficiency: 84.3 AFUE
Auxiliary Electric: 988 Eae
Note:
Location: Conditioned area
Performance Adjustment: 100
Percent Load Served: 14
Number Of Units: 1

Heat: ME,Blr,103k,84.1afue

SystemType: Fuel-fired hydronic distribution
Fuel Type: Fuel oil
Rated Output Capacity (kBtuh): 103.3
Seasonal Equipment Efficiency: 84.1 AFUE
Auxiliary Electric: 330 Eae
Note:
Location: Uncond bsmnt/enclosed crawl
Performance Adjustment: 100
Percent Load Served: 86
Number Of Units: 1

Cooling Equipment: ME,CAC,58.6k,11.2

System Type: Air conditioner
Fuel Type: Electric
Rated Output Capacity (kBtuh): 58.6
Seasonal Equipment Efficiency: 11.2 SEER
Sensible Heat Fraction (SHF): 0.70
Note: adjusted SEER 12.85
Location: Conditioned area
Performance Adjustment: 100
Percent Load Served: 100
Number Of Units: 1

Water Heating Equipment: ME,DHW,int,oil,.76EF

Water Heater Type: Integrated
Fuel Type: Fuel oil
Energy Factor: 0.76
Recovery Efficiency: 0.82
Water Tank Size (gallons): 42
Extra Tank Insulation (R-Value): 0.1
Note:
Location: Conditioned area
Percent Load Served: 100
Performance Adjustment: 100
Number Of Units: 1

Duct System Information:

Name
Heating System ME,Furn,103k,84.3afu
Cooling System ME,CAC,58.6k,11.2
Supply Area(sq ft) 109.0
Return Area(sq ft) 32.0
# of Registers 1
Duct Leakage
Qualitative Assessment - Not Applicable
Total Duct Leakage: 240.00 CFM @ 25 Pascals
Supply Duct Leakage - Not Applicable
Return Duct Leakage - Not Applicable

Duct Information: 1 2 3

Type Supply Return Supply
Percent Area 11.0 13.0 20.0
R-Value 1.0 1.0 2.2
Location Conditioned basement Conditioned basement Unconditioned basement

Duct Information: 4 5 6

Type Return Supply Return
Percent Area 14.0 12.0 20.0
R-Value 1.4 2.6 2.6
Location Unconditioned basement Attic, under insulation Attic, under insulation

Duct Information: 7 8 9

Type Supply Return Supply
Percent Area 12.0 9.0 44.0
R-Value 5.0 5.0 1.6
Location Attic, exposed Attic, exposed Conditioned space

Duct Information: 10 11

Type Return Supply
Percent Area 44.0 1.0
R-Value 0.5 6.0
Location Conditioned space Exterior wall

Infiltration and Mechanical Ventilation

Whole House Infiltration
Measurement Type: Blower door test
Heating Season Infiltration Value: 2037 CFM @ 50 Pascals

Cooling Season Infiltration Value: 2037 CFM @ 50 Pascals
Mechanical Ventilation for IAQ
Type: None
Rate(cfm): 0
Sensible Recovery Efficiency(%): 0.00
Total Recovery Efficiency(%): 0.00
Hours per Day: 24.00
Fan Power (watts): 0.00
Ventilation Strategy for Cooling
Cooling Season Ventilation: Natural Ventilation

Lights and Appliances

Simplified Audit
Oven/Range Fuel Type: Electric
Clothes Dryer Fuel Type: Electric
Percent Fluorescent - Pin-Based: 6.40
Percent Fluorescent - CFL: 8.80
Refrigerator KWh: 647
Dishwasher EF: 0.54
Ceiling Fan CFM / Watt: 0.00

Notes

duct area adjusted by # homes with ducted distribution
heating systems in 2 locations due to split between cond'd (FHA) and uncond'd basement (blr)

X. APPENDIX D: LEAST-COST ANALYSIS CALCULATIONS

Maine ESLH improvements and costs

baseline rating index = 86

	Measure	Improvement units	Unit	Incremental Improvement $/unit	Adjustment	Adj $/unit	Improvement Cost	Annual Energy Cost Savings	ROI
IECC Code Index= 76	Increase ceiling flat insulation from R-30 to R-49	1,374	sq ft	$ 0.81	99%	$ 0.80	$ 1,099	$ 93	8%
	Improve wall insulation from R-19, grade 3 to R-19 grade 1	2,172	sq ft	$ 0.13	79%	$ 0.10	$ 224	$ 76	34%
	Decrease window U-factor from .38 to .35, SHCG from .45 to .40	326	sq ft	$ 1.00	81%	$ 0.81	$ 263	$ 23	9%
	Increase slab insulation, edge (down 1ft) and under (across 4ft), from R-2 to R-10	545	sq ft	$ 1.84	94%	$ 1.72	$ 939	$ 39	4%
	Increase floor over garage insulation from R-19 to R-21	72	sq ft	$ 0.10	60%	$ 0.06	$ 4	$ 2	46%
	Increase basement/crawlspace wall insulation from R-4 to R-10	976	sq ft	$ 1.84	66%	$ 1.21	$ 1,185	$ 236	20%
	Increase uncond'd basement duct supply insulation from R-2.2 to R-11	115	sq ft	$ 1.00	19%	$ 0.19	$ 22	$ 4	19%
	Increase uncond'd basement duct return insulation from R-1.4 to R-2	24	sq ft	$ 0.70	14%	$ 0.10	$ 2		0%
	Increase attic duct supply insulation from R-5 to R-11	69	sq ft	$ 0.74	19%	$ 0.14	$ 10		0%
	Increase attic duct return insulation R-5 to R-6	15	sq ft	$ 0.70	19%	$ 0.13	$ 2		0%
	Eliminate insulation in floor over unconditioned basement	423	sq ft	$ (0.65)	13%	$ (0.08)	$ (35)	$ (19)	54%
	Install exhaust-only ventilation system to meet ASHRAE 62.2-2003	1	each	$ 290	82%	$ 238	$ 238	$ (135)	-57%
	Downsize heating plant by 25% (103kBtu to 78kBtu)	1	each	$ (200)	100%	$ (200)	$ (200)	$ (14)	7%
	Downsize CAC from 5 ton to 2.5 ton	2.5	each	$ (200)	12%	$ (24)	$ (60)	$ 7	-12%
	IECC Code over Baseline Improvement totals						**$ 3,692**	**$ 312**	8%
					Improvement $/sq ft		**$ 1.32**	**Payback, yrs**	**11.8**
Maine RX Code Index= 78	Decrease window U-factor from .38 to .35, SHGC from .45 to .40	326	sq ft	$ 1.00	81%	$ 0.81	$ 263	$ 24	9.1%
	Increase ceiling flat insulation to R-38	1,374	sq ft	$ 0.75	55%	$ 0.41	$ 567	$ 50	8.8%
	Increase ceiling slope insulation to R-38 (incremental R30>R38 batts+2x10>2x12)	273	sq ft	$ 0.64	100%	$ 0.64	$ 175	$ 27	15.5%
	Increase basement/crawlspace wall insulation from R-4 to R-10	976	sq ft	$ 1.84	66%	$ 1.21	$ 1,185	$ 236	19.9%
	Increase slab insulation, edge (down 1ft) and under (across 4ft), from R-2 to R-10	545	sq ft	$ 1.84	94%	$ 1.72	$ 939	$ 39	4.2%
	Install exhaust-only ventilation system to meet ASHRAE 62.2-2003	1	each	$ 290	82%	$ 238	$ 238	$ (135)	-56.7%
	Maine Rx Code over Baseline Improvement totals						**$ 3,366**	**$ 241**	7%
					Improvement $/sq ft		**$ 1.20**	**Payback, yrs**	**14.0**
Estar Index= 70	Decrease air leakage from .73 to .50 CFM50/CFA (2037>1400CFM50, 31% reductio	637	CFM50	$ 0.71	65%	$ 0.46	$ 296	$ 183	62%
	Seal ducts from 9.6%CFM25 per CFA (269cfm25) to Energy Star level of 6% (168cf	101	CFM25	$ 400	9%	$ 35	$ 35	$ 133	375%
	Upgrade heatng plant from 84 to 85 AFUE	1	each	$ 200	82%	$ 164	$ 164	$ 14	9%
	Downsize heating plant from 78kBtu to 70kBtu	1	each	$ (64)	100%	$ (64)	$ (64)	$ -	0%
	Indirect water heater upgrade from .76EF to .78EF as a result of boiler upgrade	1	each	$ -	82%	$ -	$ -	$ 11	
	Reduce lighting and appliance consumption by 500 kWh/yr	1	each	$ 20	100%	$ 20	$ 20	$ 80	400%
	Energy Star over IECC Code Improvement totals						**$ 451**	**$ 421**	93%
	Energy Star over Baseline Improvement totals						**$ 4,144**	**$ 733**	18%
					Improvement $/sq ft		**$ 1.48**	**Payback, yrs**	**5.7**
EPACT Index= 61	Decrease air leakage from .50 to .32 CFM50/CFA (1400>900CFM50, 56% reduction	500	CFM50	$ 0.89	91%	$ 0.81	$ 405	$ 114	28%
	Eliminate duct leakage to outside	168	CFM25	$ 400	18%	$ 71	$ 71	$ 361	509%
	Increase CAC efficiency to 14 SEER with charge and airflow test	1	each	$ 276	12%	$ 33	$ 33	$ 25	75%
	Downsize CAC from 2.5 to 2 ton	0.5	each	$ (200)	12%	$ (24)	$ (12)	$ 2	-17%
	Reduce lighting and appliance consumption by additional 500 kWh/yr (total 1000)	1	each	$ 20	100%	$ 20	$ 20	$ 80	400%
	EPACT over Energy Star Improvement totals						**$ 517**	**$ 582**	113%
	EPACT over Baseline Improvement totals						**$ 4,661**	**$ 1,315**	28%
					Improvement $/sq ft		**$ 1.66**	**Payback, yrs**	**3.5**
Micro Index= 54 thermal, 40 w/RE	Decrease air leakage from .32 to .25 CFM50/CFA (900>700CFM50, 66% reduction o	1,337	CFM50	$ 0.96	100%	$ 0.96	$ 1,284	$ 40	3%
	Add 1 inch continuous rigid foam insulation to exterior walls for R-24 total wall	1,916	sq ft	$ 1.02	100%	$ 1.02	$ 1,954	$ 130	7%
	Install triple pane windows, U-.23, SHGC .44	326	sq ft	$ 25	100%	$ 25	$ 8,150	$ 202	2%
	Downsize CAC from 2 to 1.5 ton	0.5	each	$ (200)	12%	$ (24)	$ (12)	$ 4	-33%
	Add 1 inch continuous rigid foam insulation to roof slope for R-35 total	273	sq ft	$ 1.02	100%	$ 1.02	$ 278	$ 24	9%
	Install Heat Recovery Ventilation system @65% efficiency	1	each	$ 2,800	86%	$ 2,408	$ 2,408	$ 12	0%
	Reduce lighting and appliance consumption by additional 1000 kWh/yr (total 2000)	1	each	$ 40	100%	$ 40	$ 40	$ 160	400%
	Install 64 Sq Ft solar DHW system	1	each	$ 8,000	100%	$ 8,000	$ 8,000	$ 320	4%
	Install 3.5kW PV system	1.0	each	$ 21,000	100%	$ 21,000	$ 21,000	$ 602	3%
	EPACT over Energy Star Improvement totals						**$ 43,102**	**$ 1,494**	3%
	EPACT over Baseline Improvement totals						**$ 47,763**	**$ 2,809**	6%
					Improvement $/sq ft		**$ 17.03**	**Payback, yrs**	**17.0**

Maine RNC Improvement Summary								
		Baseline	IECC code	Maine Rx code	ENERGY STAR	EPACT	Micro	Micro RE
Consumption	HERS Index	86	76	78	70	61	54	40
	MMBtu, Heat & DHW	130.5	116.9	119.7	103.4	85.4	66.7	53.8
	kWh (lts, apps, cool)	10,294	10,400	10,454	9,910	9,132	8,488	4,721
	Annual Energy	$ 4,917	$ 4,605	$ 4,676	$ 4,184	$ 3,602	$ 3,030	$ 2,108
Savings	MMBtu, Heat & DHW	0	13.6	10.8	27.1	45.1	63.8	76.7
	kWh (lts, apps, cool)	-	(106)	(160)	384	1,162	1,806	5,573
	kW	-	1.179	-	0.662	1.240	2.226	2.226
	Annual Energy	$ -	$ 312	$ 241	$ 733	$ 1,315	$ 1,887	$ 2,809
Cost	Improvement Package Cost	NA	$ 3,692	$ 3,366	$ 4,144	$ 4,661	$ 18,723	$ 47,763

XI. APPENDIX E: BASELINE DATA COLLECTION SURVEY INSTRUMENT

RNC BASELINE STUDY DATA COLLECTION FORM

RNC BASELINE STUDY
DATA COLLECTION SURVEY

Note to Raters

- Reference NE HERS Manual and/or REM/Rate Help menus for all technical data definitions
- Please make sure all information throughout the document is completed and not left blank
- Questions within boxes are to be entered into REM/Rate data. Remaining questions are supplemental data to be entered into Access database

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SURVEY DOCUMENTATION (GSD)

REM/Rate File name ______________________________

Auditors name ______________________________
Date surveyed ______________________________

PARTICIPANT INFORMATION

Owner Name ______________________________
Address ______________________________
City, State Zip ______________________________
Phone Number ______________________________

Individual present during on-site survey ____________________

BUILDER INFORMATION

Builder Name	____________________
Company Name	____________________
Builder Address	____________________
City, State, Zip	____________________
Model Name/No.	____________________
Development Name:	____________________
Phone Number	____________________

SITE INFORMATION

Climate Location (City, St)	____________________
Electric Utility	____________________
Natural Gas Utility	____________________
Fuel Oil Supplier	____________________
Propane Supplier	

GENERAL BUILDING INFORMATION (GBI)

Mo/Yr House Completed	
Mo/Yr House Construction Started	
Is this an ENERGY STAR® Home?	☐ Yes ☐ No ☐ Don't Know ☐ N/A
Does your home comply with the ME residential energy code?	☐ Yes ☐ No ☐ Don't Know ☐ N/A
Is the home part of a larger development or subdivision?	☐ Yes ☐ No ☐ Don't Know ☐ N/A
Primary or Seasonal	☐ Primary ☐ Seasonal
If seasonal, when used	☐ Winter ☐ Summer
Number of days/yr	
Water Source	☐ Private (well, etc) ☐ Municipal
Sewer	☐ Septic tank ☐ Municipal
Front of the home faces	☐ N ☐ NE ☐ E ☐ SE ☐ S ☐ SW ☐ W ☐ NW
Number of Occupants	
Square Footage per Floor	Basement: 1st Fl: 2nd Fl: 3rd Fl:
Volume cu ft per Floor	Basement: 1st Fl: 2nd Fl: 3rd Fl:
Crawl space vapor barrier (circle)	☐ Yes ☐ No ☐ Don't Know ☐ N/A
Basement intentionally heated/ cooled? (thermostat controlled)	☐ Yes ☐ No ☐ Don't Know ☐ N/A
Annual Fuel Usage Permission slip signed	☐ Yes ☐ No

Area of Conditioned Space (sq ft)	
Volume of Conditioned Space (cu ft)	
House/Unit Type	☐ Single Family Detached ☐ Single family attached ☐ Multi-family Building ☐ Unit in Apt Bldg ☐ Mobile Home
No. Floors on or above grade	
Number of Bedrooms	
Foundation Type (e.g. slab, open/closed crawl space, conditioned, unconditioned, more than 1 type)	
Enclosed Crawl Space Type	☐ Vented ☐ Unvented ☐ Operable Vents ☐ N/A

NOTES

Foundation Walls Summary (FW)

Name	Type	Length (ft)	Height (ft)	Height above grade (ft)	Depth below grade (ft)	R Value	Grade (I, II, III)	Location (e.g. between conditioned/unconditioned space and ambient, garage, crawl space etc)	Insulation Type

Slab Floor Properties Summary (SF)

Name	Type	Area (sq ft)	Depth below grade (ft)	Full Perimeter (ft)	Total Exposed Perimeter (ft)	On-Grade Exposed Perimeter (ft)	R Value	Grade (I, II, III)	Insulation Type

Frame Floor Properties Summary (FF)

Name	Type	Area (sq ft)	Floor covering	R Value	Grade (I, II, III)	Location (e.g. between cond. space and attic, garage, ambient etc)	Insulation Type

Rim and Band Joist Properties Summary (RBJ)

Name	Area (sq ft)	Continuous Ins (R value)	Frame Cavity Ins (R value)	Cavity Ins Thickness (in)	Joint Spacing (in. oc)	Location (e.g. between conditioned/unconditioned space and ambient, garage, crawl space etc)	Insulation Type

Above Grade Walls Properties Summary (AGW)

Name	Type (stud type/spacing)	Gross Area (sq ft)	Ext Color (lt, med, dk)	R Value	Grade (I, II, III)	Location (e.g. between cond. space and attic, garage, ambient etc)	Insulation Type

Window and Glass Door Properties Summary

Name	Type (# panes, frame, LoE, Argon)	Area (sq ft)	U-Value	SH GC	Orient ation	Overhang Depth (ft)	Overhang: To top of window	Overhang: To bottom of window	Interior shading (win/sum)	Adjacent Shading (win/sum)	Wall Ass't

Door Properties Summary

Name	Type (steel, wood, solid, hollow etc)	Opaque Area (sq ft)	R-Value (opaque area)	Storm (y/n)	Wall Assignment

Ceiling Properties Summary (CP)

Name	Type (attic, vaulted)	Gross Area (sq ft)	Radiant Barrier (y/n)	Ext Color (reflective, light, med, dark)	R Value	Grade (I, II, III)	Insulation Type

Skylight Properties Summary

Name	Type (# panes, frame, LoE, Argon)	U-Value	SHGC	Pitch (?/12)	Area (sq ft)	Winter Shading Factor	Summer Shading Factor	Orientation	Ceiling Assignment

Mechanical Equipment Properties Summary (Heating)

System #	System Type (see codes)	Fuel Type	Rated Output (kBTUh)	System Efficiency (AFUE/COP)	Auxiliary Electric (Eae, kWh/yr)	# Units	Location (e.g. conditioned area, basement, attic)	Perf Adj (%)	Load Served (%)	Setpoint Temp (F)	Prog T-stat (y/n)

Mechanical Equipment Properties Summary (Heating, con't)

System # (from above)	Manufacturer	Model	Est. Age (yrs)	Energy Star (yes, no, don't know)	Primary or Secondary unit	Venting Location (Wall, Roof, Unvented)	Combustion Exhaust (e.g. Nat draft, Power Vent, Sealed comb.

Heating System Notes ____

____

Mechanical Equipment Properties Summary (Cooling)

System #	System Type (see codes)	Fuel Type	Rated Output (kBTUh)	System Efficiency (SEER/COP)	SHF	# Units	Location (e.g. conditioned area, basement, attic)	Perf Adj (%)	Load Served (%)	Setpoint Temp (F)	Prog T-stat (y/n)

Mechanical Equipment Properties Summary (Cooling, con't)

System # (from above)	Condensing Unit Manufacturer	Condensing Unit Model	Indoor Coil Manufacturer	Indoor Coil Model	Est. Age (yrs)	Energy Star (Yes, No, Don't know)	Primary or Secondary unit	Ductless mini-split system (y/n)

Cooling System Notes

Mechanical Equipment Properties Summary (DHW)

System #	System Type (see codes)	Fuel Type	Energy Factor	Recovery Efficiency	Tank Size (gal)	Extra Tank Insulation (R Value)	# Units	Location (e.g. conditioned area, basement, attic)	Perf Adj (%)	Load Served (%)	Setpoint Temp (F)	Prog T-stat (y/n)

Mechanical Equipment Properties Summary (DHW, con't)

System # (from above)	Manufacturer	Model	Est. Age (yrs)	kWh/yr (from Energy Guide label)	Primary or Secondary unit	Venting Location (Wall, Roof, Unvented)	Combustion Exhaust (e.g. Nat draft, Power Vent, Sealed comb.	Pipes Insulated (Yes-%, No)

DHW System Notes

Duct System Properties Summary

Name	Htg System #	Clg System #	# Return Registers	Supply Area	Return Area	Duct Leakage to Outside (% or Qualitative Default)

Duct System Properties Summary (con't)

Name (from above)	Location (e.g. conditioned area, basement, attic	Supply % Area	Supply R-Value	Return % Area	Return R-Value

Additional Heating and Cooling Systems (ADDHC)

Total number of woodstoves _______________

How many cords of wood did you burn in the winter of 2005/2006 __________

Fireplaces (FIRE)

Name	Location	Fuel (see fuel codes)	Designated Air Supply (y/n)	Tightly fitted doors (y/n)	Venting (Wall, Roof, Unvented)

Fireplace Notes

____

Room Air Conditioner Summary (RAC)
(includes units not installed, in storage for winter)

Total number of RAC's ______________________

Name	Manufacturer	Model	Indoor Coil Manufacturer	Size (Btu/hr)	Est. Age (yrs)	Energy Star (Yes, No, Don't know)	kWh/yr (from Energy Guide label)	EER Rating

Note: If Size (Btu/hr) not available, enter whether a window (1) or wall unit (2)

RAC Notes

____

Blower Door (BD)

Heating System Infiltration Value	____________
Cooling System Infiltration Value	____________
Infiltration Rate (e.g. CFM_{50})	

Select One:	☐ Pressurized ☐ Depressurized
Temp (indoor)	____________
Temp (outdoor)	____________
Basement door closed	☐ Yes ☐ No

Duct Blaster (DB)

Total Duct Leakage (CFM @ 25): ________

Notes

____

____

Mechanical Ventilation

Type	☐ Balanced ☐ Exhaust only ☐ Supply only ☐ Air cycler
Sensible Recovery Eff (%)	____________
Total Recovery Eff (%)	____________
Rate (cfm)	____________
Hours/day)	____________
Fan watts:	____________
Cooling season ventilation	☐ No ventilation ☐ Natural Ventilation ☐ Whole House Fan

Bathroom Exhaust (BE)

	A	B	C	D	E
Name					
Location					
Vented to Outside (Y/N)					
Manufacturer					
Model					
CFM					
Sones					
Controls 1-On/off switch 2-Crank timer 3-24 hour timer 4-AireTrak controller 5-Cont operation/other					
Hours On/day (if on timer)					
Serves as whole-house exhaust system (Y/N)					

Kitchen Exhaust (KE)

	A	B	C
Name			
Type 1-Range hood 2-Down draft 3-None 4-Other			
Vented to Outside (Y/N)			
Manufacturer			
Model			
CFM			
Sones			
Controls 1-On/off switch 2-Crank timer 3-24 hour timer 4-AireTrak controller 5-Cont operation/other			
Hours On/day (if on timer)			
Serves as whole-house exhaust system (Y/N)			

Kitchen Volume (cu ft): ______

Whole House Exhaust Type (WHE)

	A	B
Type 1-Combined with kitchen fan 2-Combined with bathroom fan 3-Central Heat Recovery Ventilator (HRV) 4-Central Energy Recovery Ventilator (ERV) 5- None		
Manufacturer		
Model		
CFM		
Sones		
Controls 1-On/off switch 2-Crank timer 3-24 hour timer 4-AireTrak controller 5-Cont operation/other		
Hrs on/day (if timer)		
Operates w/o occupant intervention with an override control? (Y/N)		

Whole House Attic Fan	☐ Yes ☐ No
If yes: tight, insulated winter cover?	☐ Yes ☐ No ☐ N/A
Clothes dryer vented to outside	☐ Yes ☐ No ☐ N/A
Do combustion appliances backdraft when all exhaust appliances (ventilation fans and clothes dryer) are operating simultaneously and house is closed up	☐ Yes ☐ No ☐ N/A
If yes for V7, which appliances backdraft?	☐ Boiler ☐ Furnace ☐ Water heater ☐ Wood stove ☐ Fireplace ☐ Other ________________
Is attachment between house and garage sealed to prevent migration of contaminants?	☐ Yes ☐ No ☐ N/A
Are there any habitable spaces, toilet and utility spaces larger than 4% of floor area without operable windows?	☐ Yes ☐ No

Lighting (LT)
Data for REM/Rate is to be tabulated using the NEHERS definition for Lighting:

*→Lighting efficiency is expressed as a ratio of qualifying light **fixtures** (fixtures that are fluorescent and/or controlled by a photo cell and motion sensor) to the total quantity of light fixtures in qualifying locations (locations that are subject to high use). Fluorescent lights can either be hard-wired (pin based) or screw in bulbs. Qualifying locations include fixtures located in kitchens, dining rooms, living rooms, family rooms, dens, bathrooms, hallways, stairways, entrances,*
bedrooms, garages, utility rooms, home offices and all outdoor fixtures mounted on a building or pole. This excludes plug-in lamps, closets, unfinished basements, and landscape lighting.

REM/Rate Lighting Fixture Detail
Enter total fixture counts for Qualifying Fixture % calculation

	Count	**% of Total**
Pin-based		
CFL		
Photo cell/motion sensor		
Non-Qualifying Fixtures		
TOTAL		**100%**

Supplemental Lighting Socket Detail
Enter detail for ALL light sockets (count sockets in qualifying locations and in non-qualifying locations where lights are on for more than 15 min/day)

Example: 10 incandescent lights, 6 recessed cans (2 on dimmers); 4 table lamps (1 on dimmer) = 4 entries

Total Socket Count	**Bulb Type** (Fl. tube, CFL, Incand, Halogen, LED, Other)	**Socket Type** (Pin-base, Edison-base, Candelabra, Night light)	**Dimmer** (y/n)	**Recessed Can** (y/n)	**Hard-Wired** (y/n)
4	Incand	Ed-base	N	Y	Y
2	Incand	Ed-base	Y	Y	Y
3	Incand	Ed-base	N	N	N
1	Incand	Ed-base	Y	N	N

Total Socket Count	**Bulb Type** (Fl. tube, CFL, Incand, Halogen, LED, Other)	**Socket Type** (Pin-base, Edison-base, Candelabra, Night light)	**Dimmer** (y/n)	**Recessed Can** (y/n)	**Hard-Wired** (y/n)

Supplemental Lighting <u>Socket</u> Detail (con't)

Total Socket Count	**Bulb Type** (Fl. tube, CFL, Incand, Halogen, LED, Other)	**Socket Type** (Pin-base, Edison-base, Candelabra, Night light)	**Dimmer** (y/n)	**Recessed Can** (y/n)	**Hard-Wired** (y/n)

Dishwashers (DW)

	A	B	C
Manufacturer			
Model			
Est. Age (yrs)			
Est. # Loads/Week			
Energy Star (Yes, No, Don't know)			
Energy Factor (EF)			
kWh/yr (from Energy Guide label)			

Refrigerators (RF)

	A	B	C
Manufacturer			
Model			
Fresh Food Volume (cu ft)			
# months/yr it operates			
Est Age (yrs)			
Energy Star (Yes, No, Don't know)			
kWh/yr (from Energy Guide label)			
Type: 1- Top Mount Freezer; 2 –Bottom Mount Freezer; 3-Side by Side			
Door: Through the door ice? (Yes, No, Don't know)			

Freezers (FZ)

	A	B	C
Manufacturer			
Model			
Volume (cu ft)			
# months/yr it operates			
Est Age (yrs)			
Energy Star (Yes, No, Don't know)			
kWh/yr (from Energy Guide label)			
Type: 1- Upright 2 – Chest			

Defrost: 1-Automatic ; 2-Manual ; Don't know			

Clothes Washer (CW)

	A	B	C
Manufacturer			
Model			
Est Age (yrs)			
Est # loads/wk			
Energy Star (Yes, No, Don't know)			
kWh/yr (from Energy Guide label)			
Modified Energy Factor (MEF)			
Type: 1 – Front loader (Horiz. Axis) 2 - Top loader			

Clothes Dryer (DR)

Total number of clothes dryers in house	
Fuel Type (see fuel type codes)	
Solar clothes dryer (clothes line) installed outside?	☐ Yes ☐ No

SMALL HOUSEHOLD APPLIANCES (SHA)

Type of Small Appliance	**Enter Number of Designated Appliances** (Enter 0 if none)	**# That are KNOWN ENERGY STAR units?** (Enter 0 if none and column A is > = to 1; Enter – if Column A is = 0)
Large Screen Television (greater than 36")		
Standard Size TV (36" or less)		
VCR		
DVD Player		
Stereo System		
Video Gaming System		
Digital Video Recorders (i.e. TiVo)		
Digital Satellite Box		
Analog or Digital Cable TV		
Humidifier		
Dehumidifier		
Desktop Computer		
Laptop Computer		
Computer Printer		
Hot Tub		
Swimming Pool (Unheated)		
Swimming Pool (Heated)		

(For the 4 questions below, if a home does not have the appliance or unit, leave blank. Enter 88 for Don't Know)

If the house has a dehumidifier(s), how many months is it operational?

_______ months

If the house has a humidifier(s), how many months is it operations?

_______ months

If the house has a hot tub, what is the primary fuel type? (use codes below)

____

If the house has a heated pool, what is the primary fuel type? (use codes below)

____

Solar System

Sun Space

General Observations (GOQO)
(Auditor to rank and record general observations after spending time in house completing survey)

Characteristics	**Ranking** 1 (lowest)	2	3	4	5 (highest)
Construction Quality					
Comments:					
Missed Energy opportunities by builder (1=many; 5-none)					
Comments:					
Recommendations for energy improvements (1=many; 5=none)					
Comments:					

Other Comments:

Qualitative Observations

Recommendations for top four (4) worse energy features that could be improved. Rank 1 (worst) to 4 (least). Place the letter of the feature next to each question.

A	Wall insulation installation	#1 Worst Energy Feature	______
B	Wall insulation R-values	#2 Worst Energy Feature	______
C	Wall air leakage	#3 Worst Energy Feature	______
D	Ceiling insulation installation	#4 Worst Energy Feature	______
E	Ceiling insulation R-values		
F	Ceiling air leakage		
G	Basement insulation installation (select only if insulation present)		
H	Basement insulation R-value (including no insulation)		
I	Basement air leakage		
J	Window quality		
K	Window U-value		
L	Window air leakage		
M	House air leakage reduction (overall)		
N	Furnace installation quality		
O	Furnace efficiency (AFUE)		
P	Central air conditioning installation quality		
Q	Central air conditioning efficiency (SEER)		
R	Duct system installation (craftsmanship of duct system, not including insulation)		
S	Duct system tightness		
T	Duct system insulation installation		
U	Duct system insulation R-value		
V	Water heater installation quality		
W	Water heater efficiency (Energy Factor)		
X	House solar orientation		
Y	Kitchen range hood quality/effectiveness		
Z	Bathroom fan quality/effectiveness		

Survey Input Codes

NOTE: You do not need to use numerical codes for data entry. System and fuel types are listed as reference

Mechanical Equipment Codes (HVAC)

System Type	
1 – Furnace	6 – Air to air heat pump
2 – Hot water boiler	7 – Ground source heat pump
3 – Steam boiler	8 – Portable space heater
4 – Electric baseboard	9 – Wood stove
5 – Electric radiant	99 - Other

Mechanical Equipment Codes (DHW)*

System Type	
1 – Conventional	5 – Tankless coil
2 – Indirect Fired	6 – High Efficiency
3 – Instantaneous	99 – Other
4 – Heat Pump	

*Note: For REM/rate data entry Tankless coil systems are listed in the "Integrated Space/Water Heating" library

Fuel Type	
1 – Oil	6 – Coal
2 – Natural Gas	7 – Kerosene
3 – Propane	8 – Solar
4 – Electric	88 – Don't know
5 – Wood	99 – Other

Residential New Construction

Baseline Study

Fuel Information Release Form

I hereby authorize release of my energy consumption history information for research and analysis purposes. I understand that it will be kept strictly confidential and may only be made public in aggregate, not attributed to any particular customer. My account information is provided below.

Electric Utility:	
Electric Account #	
Natural Gas Utility:	
Natural Gas Account #:	
Oil Dealer	Name:
	Address:
	Account Number:
LP Dealer	Name:
	Address:
	Account Number:
Wood Dealer	Name:
	Account Number:
	Number of Cords burned last year:
Other Fuel	Name:
	Account Number:
	Amount burned last year:

Thank you very much

Name: (please print)

Address:

Phone:

Signed Date

NOTES FOR ENTERING DATA INTO THE BASELINE DATABASE

Getting Started

- Open the Access file: EM RNC Baseline Database 10-08-07_ver1_XX.mdb
- Choose 'Enter Survey Data' on the Switchboard

Navigation of Database

- Survey level navigation buttons are on top left of General Survey Data page ("main page")
- Don't need to create new survey for first record, just begin entering data
- Once records are created, database will always open to first record
- Hot Keys: Press Alt + underlined letter to activate button (e.g. Alt + S creates a new survey)

Starting a New Survey

- Audit ID in top left.. If no number shows than no record has been created. Cannot enter Building Data Details
- Enter data into any field on the main page, you will see an AutoNumber generated in Audit ID field. Now a record has been created
- First field, REM/Rate file name provides unique link to participant's data in REM/Rate. Please follow RR naming convention (RF)
- For drop down fields can click on arrow, key in first letter or press 'Alt + down arrow'

Building Data Details

- Buttons follow data collection survey form: down then across
- Note header information. Shows what record you are entering data for.
- All fields with arrows contain pre-loaded dropdown information
- Try to use existing data in drop downs. Can enter other data by typing it into field
- Please use Notes field on General Building Information page to capture any general notes on the home where there is not a separate notes field for that data type (e.g. HVAC systems)

Multiple Data Forms

- Datasheet pages allow for quick data entry by tabbing through fields (e.g. Insulation detail pages, Lighting)
- For these pages, if you enter more data than fits in the window, a scroll bar will appear on the right
- Tabular pages require you to use the 'Add System' button to start a new record (e.g. HVAC)
- For these pages, use Record Navigation buttons to scroll through multiple data inputs
- To Delete a record highlight the row by clicking in the space to the left of the record with black arrow and press Delete button

Note on mouse scroll: If you have a mouse with a scroll button be aware that it will scroll through records (at detail and participant level)!

XII. APPENDIX F: BUILDER & ARCHITECT SURVEYS

Home Building Contractors

Depth Interview Discussion Guide

Assumes that recruiting script qualifies respondent as involved in constructing single-family detached homes. Assumes that proportion of time/revenues has also been asked already. **FOR ALL QUESTIONS, WE ARE ONLY INTERESTED IN SINGLE FAMILY DETACHED HOMES, NOT CONDOS, DUPLEXES, OR TOWNHOUSES. YOU MAY NEED TO REITERATE THIS A COUPLE OF TIMES DURING THE INTERVIEW.**

Introduction

I am___ from Efficiency Maine. We are working on designing a new home energy efficient program and are seeking input from builders and architects that will help us. Efficiency Maine is interviewing several builders who design single-family homes in Maine to learn more about the residential new construction market and the placement of energy-saving features and equipment in that market. We will be summarizing what our interviewees say, but we won't identify any individual or firm in that report.

Before we begin. I am specifically interested in *new, single-family, detached* homes, not in condominiums, duplexes, or townhouses. Whenever I say "homes," I'm referring to new, single-family, detached homes.

a) Identification and contact information for the Building Contractor

Name ______________________________

Title ______________________________

Company ______________________________

Address ______________________________

Phone ______________________________

Fax ______________________________

Interview Date______________________________

Start Time ______________________________

End Time ______________________________

b) Respondent niche

1. **Do you consider yourself a general contractor, a developer, or both?**
   - ☐ General contractor
   - ☐ Developer
   - ☐ Both
   - ☐ Other (please specify): ______________________(Possible Termination)______

2. **Overall, about how many single-family detached stick built homes did your company build in 2005? _______ in 2006?________ and in 2007?____________**

3. **Overall, about how many single-family detached manufactured homes did your company build in 2005?______ in 2006?______** and in 2007?______ N/A ____

4. **How many homes are included in a typical project for your company?**
   - ☐ Build one home at a time
   - ☐ A few homes in a subdivision or development—**approx how many**, on average?____
   - ☐ Moderate-sized subdivisions or developments— (10 to 30 homes) _______
   - ☐ Large subdivisions or developments— (More than 30 homes)? _______

5. **How do you sell the majority of the homes you build?**
   - ☐ Pre-sold and completed as custom job
   - ☐ Direct sale to homebuyers after completion
   - ☐ Sale of home through real estate agent after completion
   - ☐ Establish/contract with a sales office or real estate firm for the development/subdivision
   - ☐ Hand off to developer/corporation (IF HOMES HANDED OFF, TARGET REMAINING QUESTIONS ACCORDINGLY)
   - ☐ Other (specify:)

6. **In what counties in Maine do you typically build new homes?**

____
____
____

7. **How many years have you been a homebuilder/developer/general contractor?________**

8. **What percentage of the homes you build are**

   a. Spec-built _______
   b. Custom-built _______
   c. Spec Start/Custom Complete _______

Is there a better description of your own approach to building homes?

IF YES, How would you describe your own pattern?

____

____

9. Assuming that not 100% of the homes are in either direction –
Are there any major differences in how you build these homes? (Probe for Energy Efficiency either in features or building methods)

____

____

____

Volume data and demographics

10. About what percentage of the new single-family homes that you built last year (2007) are in each of the following size groups?

Size	Distribution
Under 1,500 square feet	%
1,500 to less than 2,000 square feet	%
2,000 to less than 2,500 square feet	%
2,500 square feet to less than 3,500 square feet	%
3,500 square feet to less than 4,500 square feet	%
4,500 square feet or more	%
Total	100%

12. And about what percentage of the new homes you built last year (2007) fall into each of the following price groups? DIFFERENTIATE IF AT ALL POSSIBLE BETWEEN HOUSE AND LOT AND HOUSE ALONE. FOCUS ON HOUSE ALONE, TO THE EXTENT POSSIBLE [IF UNABLE TO PROVIDE THESE APPROXIMATIONS:

Cost	House and lot	House alone
Under $150,000	%	%
$150,000 to under $250,000	%	%
$250,000 to under $350,000	%	%
$350,000 to under $500,000	%	%
$500,000 to under $750,000	%	%
$750,000 or more	%	%
Total	100%	100%

12a What is the average selling price of the new homes you built last year? _____________ (note whether this is for house and lot or for house alone)]

12b. Thinking about the homebuyer's costs—about how much does your average buyer pay per square foot of home (excluding land costs)? $______________ per square foot

12c.Thinking about your costs—what is your average cost per square foot of home (excluding **land costs)?** _$____________per square foot

13. Do you target a particular type of buyer (e.g., first-time, move-up, high-end)?
Yes ☐ No ☐

IF Yes, **What is the market you address most often?**

____

____

14. Does this affect the size and cost of the homes you build? Yes ☐ No ☐
If yes how?

____

____

15. In addition to realtors and word-of-mouth, do you use newspapers, flyers, radio, the Internet or other such means of advertising? Yes ☐ No ☐

If yes, **where?**

____

____

16. Do you refer to energy efficiency or Green building in any of your advertising?
Yes ☐ No ☐

If Yes, what proportion of the time, and in what types of media outlets?

____

____

____(PROBE USE OF NEWSPAPERS—COMMUNITY OR CITY, DIRECT MAIL, POINT-OF-SALE, RADIO—ALSO LOOKING FOR WHETHER—IF USED—ENERGY EFFICIENCY IS MENTIONED IN SOME TYPES OF ADVERTISING BUT NOT ALL; IF SO, WHICH?.)

Buyers' interests—particularly in energy efficiency

17. Do you typically install central air conditioning in your new homes? Yes ☐ No ☐

18. Have you seen any level of increase in demand for central cooling with your customers? Yes ☐ No ☐

19. Specifically, what types of energy-saving features or equipment are included in the "typical" home you build?

Check all that apply

INTERVIEWER: PROBE IN PARTICULAR FOR SPACE HEATING AND WATER HEATING EQUIPMENT, APPLIANCES, AND SHELL MEASURES A CHECKLIST (RELEVANT TO LATER QUESTIONS AS WELL) WOULD INCLUDE THE FOLLOWING:

☐ LOW-E WINDOWS; (SAME AS ENERGY STAR® WINDOWS)
☐ TRIPLE-GLAZED WINDOWS (TYPICALLY CANADIAN WINDOWS)
☐ INSULATED BASEMENT WALLS
☐ ATTIC INSULATION LEVEL OF R-38 OR HIGHER
☐ WALL INSULATION LEVEL OF R-19 OR HIGHER
☐ NEW INSULATION METHODS(LIST OUT:________________________________)
☐ 2 *X* 6 (RATHER THAN 2 *X* 4) FRAMING
☐ HOUSE AIR SEALING
☐ MECHANICAL VENTILATION SYSTEM
☐ HOT WATER (HYDRONIC) BOILER
☐ INDIRECT-FIRED WATER HEATING STORAGE TANK AS A ZONE OFF THE BOILER
☐ HIGH-EFFIC. HEATING SYSTEM;
IF GAS FURNACE (AFUE > 90%) OR OIL FURNACE OR GAS/OIL BOILER (AFUE > 85%) RATING OF FURNACE (_______) OR BOILER (________) THAT RESPONDENT CALLS HIGH EFFICIENT. IN WHAT PERCENTAGE OF HOMES DO YOU INCLUDE THIS APPLIANCE? __________%
☐ HIGH-EFFICIENCY GAS WATER HEATER (>64% ENERGY FACTOR):_______________
☐ MULTI-ZONE HEATING DISTRIBUTION SYSTEM
☐ PROGRAMMABLE THERMOSTAT(S)
☐ ENERGY STAR® APPLIANCES—REFRIGERATOR, OTHER (SPECIFY)
☐ FLUORESCENT LIGHTING. IF YES, HARD-WIRED FIXTURES OR CFLS? PERCENT OF EACH: HARD-WIRED ___________ CFLS___________
☐ R-10 OR HIGHER DUCT INSULATION
☐ DUCT SEALING
☐ HIGH/VERY HIGH SEER CENTRAL AIR CONDITIONER
SEER LEVEL THAT RESPONDENT CALLS HIGH EFFICIENCY _____________
☐ HEAT PUMP
☐ FANS (ATTIC/WHOLE HOUSE)
☐ SOFFIT VENTS
☐ SOLAR PV
☐ SOLAR HOT WATER SYSTEM
☐ OTHER ____

(INTERVIEWER: WHEN DISCUSSING FURNACE/BOILER EFFICIENCY, BE SURE TO DETERMINE AND RECORD THE DEFINITION OF EFFICIENCY USED. SOME RESPONDENTS MAY THINK OF **ANY** NEW EQUIPMENT AS NECESSARILY BEING VERY EFFICIENT [COMPARED TO OLDER UNITS])

20. Does that differ according to the communities or markets you serve?
Yes ☐ No ☐

If yes, how? NOTE THE DIFFERENT MARKETS DISCUSSED IN Q. 13.
____
____
PROBE FOR SPECIFICS OF FEATURES, AMENITIES, AND OPTIONS OFFERED. INCLUDE BOTH ENERGY-SAVING AND OTHERS. (THE IDEA IS TO GET SOME SENSE OF THE EXTRAS USED IN MARKETING AND TO INCREASE MARGIN, IN CONTRAST AGAINST WHAT THE BUILDERS DO IN THE AREA OF ENERGY-EFFICIENCY.)

21.What are the major reasons your company installs that/those feature(s)?
DO NOT READ; <u>CHECK ALL THAT APPLY</u> (PROBE TWICE) IN PART, TRYING TO GET AT WHAT DRIVES THE SPECS USED (SEE ALSO Qs REGARDING ROLE OF SUBCONTRACTOR, WHICH GET MORE SPECIFIC WITH REGARD TO THE ROLE OF THE SUBCONTRACTORS)

☐ Our standard practice

- ☐ Customer preference/demand
- ☐ Little difference in cost
- ☐ Improves home efficiency
- ☐ Makes our homes more competitive
- ☐ Everyone else does it/we have to keep up with the competition
- ☐ Subcontractor bids/practices/decisions
- ☐ Other (Specify):

____
____

22. Approximately how much do these energy-efficiency features add to the homebuyer's costs, per square foot of home? ____________________ per square foot

23. If cost is a limiting factor, in what order do you employ energy savings features/appliances (rank list from Q19)

24. If cost were not a consideration, what other energy-efficient design or construction practices and features would you include in your homes?
____
____

25. Considering the residential building code changes that went into effect in Maine in July 2004[5], about what percentage of the time do you build homes that are above the current Maine residential building code that are designed to reduce energy usage even more than required by code? _____________%

26. Has either the percentage of homes you build with energy-saving features changed at all since July 1, 2004? Yes ☐ No ☐
If yes, **please describe the changes that have taken place.**
____
____

IF YES, ASK THE FOLLOWING; IF NO, SKIP TO Q. 32

27. About when did the change begin? Probe for details.
____
____

28. What accounted for that change?
____
____
____

29. Do you see that trend increasing, decreasing, or staying the same?
____
____

[5] On March 30, 2004, P.L. 2003, chapter 580 was signed into law in Maine, paving the way for the Maine Model Building Code to take effect in municipalities throughout the State as of July 30, 2004.

30. Based on your experience, how much demand is there from homebuyers for energy-saving features or equipment for new homes?

____
____
____

31. IF demand, what particular features or options are most in demand?

____
____
____

32. To what degree would you say that buyers associate energy-saving equipment or features with home quality? RATE ON A 1 (LO) TO 10 (HI) SCALE.

1 2 3 4 5 6 7 8 9 10

ENERGY STAR® homes—Awareness, participation, attitudes

(Note DO NOT MENTION ENERGY STAR)

33. What programs advocating or supporting energy efficiency in residential new construction are you familiar with?

____

____

IF ANY MENTIONED, **Can you describe that/those to me?**

____

Who is sponsoring that/those program(s)?

____

IF NOT MENTIONED SPONTANEOUSLY, **Have you heard anything about energy efficient residential new construction programs sponsored by any gas or electric company in Maine?**

Yes ☐ No ☐

IF YES, **What do you know about it? Can you describe it to me?**

____

____

CHECKLIST; DO NOT READ

- ☐ HERS
- ☐ ENERGY STAR®
- ☐ ENERGY-CRAFTED HOMES
- ☐ Other (specify):

IF NOT MENTIONED EARLIER, **Have you heard anything about a program called ENERGY STAR® homes?** Yes ☐ No ☐

If NO, (skip to question 33)

IF YES OR MENTIONED EARLIER - **How did you learn about that program?**

____

____

Do you know who sponsors it?

____

Can you describe it to me? Yes ☐ No ☐

____
____

[READ TO ENSURE THAT ALL RESPONDENTS ARE KNOWLEDGEABLE FOR FUTURE QUESTIONS]

THE ENERGY STAR® HOMES IS A PROGRAM DEVELOPED BY THE U.S. ENVIRONMENTAL PROTECTION PROGRAM TO HELP PROMOTE HOMES THAT ARE COST-EFFECTIVE, ENERGY-SAVING, AND POLLUTION-PREVENTING. THE ENERGY STAR® GUIDELINES COVER SUCH THINGS AS INCREASED INSULATION, PREVENTING AIR LEAKAGE, HIGH PERFORMANCE WINDOWS, HIGH-EFFICIENCY HVAC SYSTEMS, AND ENERGY-EFFICIENT WATER HEATING, LIGHTING, AND APPLIANCES.

34. **If Maine adopts an ENERGY STAR® Homes program in the near future would your company plan to participate?** Yes ☐ No ☐
If No – skip to Q 36
Why/why not?
____
____
PROBE FOR DETAILS OF EXPERIENCE OR ANTICIPATED PARTICIPATION. INCLUDE THE FOLLOWING ISSUES:

a. **Have you built any ENERGY STAR Homes?** Yes ☐ or No ☐
IF YES, How many? What proportion of your assignments is that?
IF NO, Why not?
____
____
____

b. What percentage of your clients ask for an ENERGY STAR rated home?
____
____

35. **Would your anticipated participation in this program have any effects on the homes you build or specifications for homes that are part of the program(s)?** Yes ☐ No ☐

35a. Have you done things that you would not have done otherwise in terms of the specifications you provide, or with respect to the features or equipment you include? Yes ☐ No ☐

36. Can you list the Energy Star products that you are aware of?

____
____
____
____
____

37. Are your suppliers or subcontractors aware of Energy Star products?
Yes ☐ No ☐

38. How do you obtain the Energy Star products that you need to install in your homes?

READ LIST.
Directly from Manufacturer ☐
Directly from Distributor ☐
Use Sub-Contractors ☐
Other ☐

39. Do you specify high-efficiency (or ENERGY STAR®-labeled) products when you solicit bids from your suppliers or subcontractors? Yes ☐ No ☐

If Yes, Which ones?

____
____
____

If No, Why not?

____
____
____
____

40. Would your anticipated participation in an energy efficient home program lead to any changes in your normal practice—that is, with what you do for homes that are *not* part of the program(s)? Yes ☐ No ☐ *PROBE FOR DETAILS*

____
____
____
____

41. **Overall, would you say that programs to increase energy efficiency in residential new construction would be helpful to your practice, have no effect, or hurt your practice?** ____**Why do you say that?**

____

____

____

42. Do you market homes that include energy-saving equipment, features, or option any differently than you market homes that just meet the Maine state energy code?
Yes ☐ No ☐

IF YES, **What specific things do you do?**

____

____

____

____

42.a Do you provide promotional materials for energy-saving equipment, features, or option ?
Yes ☐ No ☐
IF PROVIDE PROMOTIONAL MATERIALS, **Where do you get those materials?**

____

____

____

43. Do you ever use materials from (ENERGY STAR® or from a gas or electric company) to promote your homes? Yes ☐ No ☐
IF YES, Which?

____

____

____

44. How have buyers responded to the homes that include energy-saving equipment, features, or options?

____

____

45. In your experience, what concerns do customers raise about homes that include energy-saving features or equipment?

____

____

____

45a. **About what percentage of the time do these issues come up?** ______________%

45b. If concerns arise how to you address them?

____

____

____

46. Have you found buyers willing to pay more for homes that include energy-saving equipment or features that go beyond the Maine state energy code? Yes ☐ No ☐

47. Have they responded positively to the energy-saving options you offer?
Yes ☐ No ☐

IF YES, **Which ones in particular?**

____

____

____

IF NO, **Why not?**

____

____

____

48. Overall about how much more are buyers willing to pay in terms of a percentage of the home price, based on the energy-efficient equipment or features your company typically includes?
____________________%

49. Based on your experience, how much demand is there from homebuyers for energy-saving equipment, features, or options? ____________________%
INTERVIEWER—PREVIOUS QUESTION ASKS THE PERCENTAGE INCREASE AN INTERESTED BUYER WILL ACCEPT. THIS QUESTION ASKS THE PERCENTAGE OF INTERESTED BUYERS.

Why do you think that is? (In other words, so low—or, so high)

____

____

____

49a. Has there been any change over the past couple of years in either the percentage of interested customers or the reasons for their interest or lack of interest? Yes ☐ No ☐

Why?

____

____

50. Do you think energy efficient home programs and energy savings promotions have influenced the market? Yes ☐ No ☐
How? Or, **Why not?**

____

____

____

51. In your opinion, other than rebates or higher energy costs, what would help increase buyer demand for energy-saving features or equipment in new homes? What would help create a permanent change in the market—so that buyers would regularly think about energy efficiency?

____

____

____

(i) Barriers

52. Suppose that a homebuyer wanted to buy a home that exceeds the Maine state energy code and is willing to pay a premium of up to 5% for the appropriate energy-saving equipment, features, or options. Is there anything that might get in the way of your company's meeting the demands of such a buyer? Yes ☐ No ☐

____

____

____

PROBE FOR SUCH THINGS AS SUBCONTRACTOR BID SPECS, LIMITED ABILITIES OR TRAINING OF THE SUBS, EQUIPMENT AVAILABILITY, MORTGAGE QUALIFICATIONS, LOCAL CODES OR ENFORCEMENT, ETC.

53. How do you obtain the HVAC equipment (furnaces/boilers) that you need to install in your homes? *READ LIST.*

Directly from Manufacturer ☐
Directly from Distributor ☐
Use Sub-Contractors ☐
Other (Specify) ☐

54. Do you specify the AFUE rating (Annual Fuel Utilization Efficiency) rating for the HVAC equipment (furnaces/boilers) when you solicit bids from your suppliers or subcontractors? Yes ☐ No ☐

IF YES, What level do you specify for furnaces? For boilers? Why do you choose that level?

____

____

____

INTERVIEWER: 90 AFUE FURNACES OR BETTER QUALIFY AS HIGH EFFICIENCY. FOR BOILERS, THE CUT POINT IS 85 AFUE OR BETTER.

55How do you obtain the insulation that you need to install in your homes?

READ LIST.

Directly from Manufacturer ☐
Directly from Distributor ☐
Use Sub-Contractors ☐
Other ☐

56. Do you specify insulation standards when you solicit bids from your suppliers or subcontractors? Yes ☐ No ☐

IF BARRIERS REGARDING INSULATION WERE MENTIONED IN RESPONSE TO Q. 56 – Probe to find out more details—**WHAT ARE THEY? HOW OFTEN DO THEY ARISE? HOW MUCH ADDITIONAL TIME, MONEY, OR HASSLE DO THEY CREATE? HOW DOES THE RESPONDENT DEAL WITH THEM? IS THE SITUATION STATIC/GETTING WORSE/GETTING BETTER? WHAT WOULD HELP TO REDUCE THESE BARRIERS?**

____
____
____

Builder's information and communication

57. Who or what do you think has the most influence on the energy-saving equipment or features your company includes in the homes they build?

Influencer	*Most Important/Reason(s)*

LIST ALL MENTIONED. PROBE ROLE OF SUPPLIERS, COMPETITORS, LENDERS, REALTORS, BUYERS, SUBS, AND UTILITIES. ALSO PROBE RATIONALE REGARDING WHICH ONES MATTER MOST.

58. Which of the following sources of information would you say are very important to you and which are somewhat or less important? Interviewer: insert either V=Very or L =Less in each box

- ☐ **Other professionals in your firm**
- ☐ **Other builders in the area**
- ☐ **Professional associations**
- ☐ **Government sources**
- ☐ **Gas or electric companies**
- ☐ **Environmental groups**
- ☐ **Supply Houses**
- ☐ **Equipment manufacturers**
- ☐ **Home shows or trade shows**
- ☐ **Efficiency Maine**
- ☐ **Trade Journals**
- ☐ **Other Sources** **List:**_______________________________________

IF YES, **Which of your sources provide the best information?**
____
(PROBE FOR SUFFICIENCY, CURRENCY, AND TRUSTWORTHINESS)?

59. What sort of information do you need that you are not receiving now?

____

____

____

60. How would you like to receive this information? Would it be best delivered by (READ LIST):

- ☐ **Personal visits** (BY WHOM?) ______________________________
- ☐ **Breakfast meetings**
- ☐ **Seminars or workshops**
- ☐ **Trade shows or demonstrations**
- ☐ **Direct mail**
- ☐ **Periodicals**
- ☐ **Internet**
- ☐ **Some other form** (SPECIFY) ______________________________

61. What sort of energy-related information would help you to build more new homes with those features or equipment?
____
____

62Would there be any training about energy-efficient features or equipment or very energy efficient homes that might be of value to you? Yes ☐ No ☐

IF YES, **What is that training and what would be the best way and the best time to provide it?**

____

____

62a. Do you think this sort of training would also be of value to others in your company?
Yes ☐ No ☐

62b. How about for your subcontractors? Yes ☐ No ☐
(PROBE FOR DETAILS THAT MIGHT BE OF HELP, AND FOR WHOM. ALSO PROBE FOR CREDIBLE SOURCES OF TRAINING.)

____

____

Energy-efficiency mortgages (OMIT AND GO TO CLOSE IF RESPONDENT SIMPLY HANDS OFF HOMES— Q. 9d)

63Have you ever heard of energy-efficiency mortgages for new homes?
Yes ☐ No ☐ (If NO – SKIP to Q. 66)

63a. IF YES, Do you know if these types of mortgages are available in your area?
Yes ☐ No ☐

63b. IF YES, **About what proportion of the banks or other financial institutions you work with offer such mortgages?** _____________%
WHICH ONES?

____

____

64. Has the availability of this financing option helped the sales of your company's homes? Yes ☐ No ☐
Why/why not?

____

____

65. Has either the availability of these mortgages or their effect on sales changed over the last 2-3 years? Yes ☐ No ☐

In what way? Why do you think that is?

____

____

____

66. IF *NO TO QUESTION 63, PROVIDE BRIEF DESCRIPTION OF THE ENERGY EFFICIENCY MORTGAGE CONCEPT.*

Would the availability of energy-efficiency mortgages to people interested in your homes be likely to make a difference in your sales? .Yes ☐ No ☐

Why/Why not?

____

____

67. Would energy efficiency mortgages affect your interest in building homes that exceed the state energy code? Yes ☐ No ☐

If yes why?

Those are all the questions I have. Thank you very much for your time and your help. Do you have any more you would like to add or suggestions as we design an ENERGY STAR new homes program?

(b) Draft Interview Guide for Maine Architects – January 8, 2007

Identification and contact information for Maine Architectural Firm

Name ______________________________

Title ______________________________

Firm ______________________________

Address ______________________________

____

____

Phone ______________________

Fax ______________________

E-mail (if any) ______________________

Interview date ______________________

Start time _____________

End time _____________

Intro

Thank you again for agreeing to this interview. As I mentioned earlier, Efficiency Maine is interviewing several architects who design single-family homes in Maine to learn more about the residential new construction market and the place of energy-saving features and equipment in that market. We will be summarizing what our interviewees say, but we won't identify any individual or firm in that report.

One last thing, before we begin. I am specifically interested in *new, single-family, detached* homes, not in condominiums, duplexes, or townhouses. Whenever I say "homes," I'm referring to new, single-family, detached homes.

c) Respondent niche

1. **How long has your architectural firm been in business?**
   ____

2. **How large is your firm—how many professional architects and engineers practice in this office?**
   ____

3. **Is this office the only one for your firm or are there others?** Only One ☐ Others ☐

4. *IF OTHERS,*
   Are any of these other office in Maine? Yes ☐ or No ☐ *IF SO*, **How many offices?** ______________________
   How many professional architects or engineers work out of that/those office(s) (determine total number for Company)**?** ______________

5. **What are your major responsibilities with the firm**?
   ____
   ____

6. **Do you only design new homes in Maine or do you also write the specifications for the contractors and for the equipment to be installed**? Only Design ☐ Design & Specs ☐
   INTERVIEWER, NOTE WELL—REFERENCES TO SPECIFICATIONS LATER IN THE INTERVIEW ARE TO BE INCLUDED OR ELIMINATED ON THE BASIS OF THE ANSWER TO THIS QUESTION.

7. **And how long have you been with this Company**?
   ____

8. **How would you characterize your firm's specialties?**

____

____

9. **What sets it apart from other architectural or design firms in Maine?**

____

____

10. **What percentage of your firm's professional assignments involves designs for single family detached homes?** ______________________%

10a.Are all of those for new homes or do some involve designing additions or renovations?

____ *IF INVOLVE ADDITIONS OR RENOVATIONS,*

10b. **About what percentage of all the single-family detached home assignments involve designing additions or renovations?** _____________________% *REMIND RESPONDENT THAT THE INTERVIEW SHOULD FOCUS ON NEW HOMES.*

11. **And how many have you personally led?** __________________________________

The Client Base

12. **What percent of the time do you work for the following clients?**
    Individual **Homebuyers** ________%
    Contractors/Developers________%
    Other ________% type?______________

13. **What sort of buyer market do contractors or developers target? (E.G., MIDDLE-INCOME, RETIREE, MOVE-UPS, FIRST-TIME BUYERS**

____

____

[All accept those—if any—who work exclusively for contractors or developers]

13a. How would you characterize your firm's ultimate clientele—the homebuyers—for assignments involving new home design See notes

____

____

(IF NOTHING SPONTANEOUSLY OFFERED, PROBE AGE, INCOME, EDUCATION, FAMILY FORMATION STAGE—DOUBLE-INCOME, NO KIDS; WITH YOUNG KIDS; WITH TEENS; EMPTY NESTERS; ETC.)

IF A DIVERSE CLIENTELE, TRY TO ESTABLISH WHAT ARE THE PREDOMINANT CHARACTERISTICS—THE MODEL CLIENT; ALSO, WHAT TYPE OF CLIENT IS SECOND-MOST COMMON?

14. **About what percentage of your clients obtain their general contractor in each of the following ways?**

___% Not relevant— only working for general contractor or developer
___% Ask you to act as general contractor or to hire the general contractor
___% Hire their own general contractor
___% Act as their own general contractor
___% Other (please specify) ____
100% Total

Client leadership on energy efficiency

15. **What percentage of your clients specifically request that the new home be energy-efficient or include energy-efficient features? ________%**

[*Skip this Question if respondent explicitly says NONE to initial question in this series]*
15a. What particular energy-saving features or equipment do your clients discuss with you or ask you

to consider or specify in the homes you design?

____

____

FOCUS THIS QUESTION ON WHAT, IF ANYTHING, CLIENTS REQUEST—NOT ON THE ARCHITECT'S SUGGESTIONS.
LIST ALL MENTIONED; PROBE THE PERCENTAGE OF TIME EACH IS MENTIONED OR DEMANDED; INDICATE WHICH, IF ANY, ARE DEMANDED RATHER THAN SIMPLY BROUGHT UP FOR CONSIDERATION.

CHECKLIST INCLUDES, BUT IS NOT LIMITED TO, THE FOLLOWING:

☐ LOW-E WINDOWS; (SAME AS ENERGY STAR® WINDOWS) ____% of time
☐ TRIPLE-GLAZED WINDOWS (TYPICALLY CANADIAN WINDOWS) ____% of time
☐ INSULATED BASEMENT WALLS ____% of time
☐ ATTIC INSULATION LEVEL OF R-38 OR HIGHER ____% of time ☐ WALL INSULATION LEVEL OF R-19 OR HIGHER ____% of time ☐ NEW INSULATION METHODS(LIST OUT) ____% of time ☐ 2 *X* 6 (RATHER THAN 2 *X* 4) FRAMING ____% of time
☐ HOUSE AIR SEALING ____% of time ☐ MECHANICAL VENTILATION SYSTEM ____% of time ☐ HOT WATER (HYDRONIC) BOILER
☐ INDIRECT-FIRED WATER HEATING STORAGE TANK AS A ZONE OFF THE BOILER ____% of time ☐ HIGH-EFFIC. HEATING SYSTEM; ____% of time IF GAS FURNACE (AFUE > 90%) OR OIL FURNACE OR GAS/OIL BOILER (AFUE > 85%) RATING OF FURNACE (_______) OR BOILER (________) THAT RESPONDENT CALLS HIGH EFFICIENT. IN WHAT PERCENTAGE OF HOMES DO YOU INCLUDE THIS APPLIANCE? __________%
☐ HIGH-EFFICIENCY GAS WATER HEATER (>64% ENERGY FACTOR): ___% of time ☐ MULTI-ZONE HEATING DISTRIBUTION SYSTEM ____% of time
☐ PROGRAMMABLE THERMOSTAT(S) ____% of time
☐ ENERGY STAR® APPLIANCES—REFRIGERATOR, OTHER (SPECIFY)____% of time

☐ FLUORESCENT LIGHTING. IF YES, HARD-WIRED FIXTURES OR CFLS? ____% of time
ERCENT OF EACH: HARD-WIRED ___________ CFLS___________
☐ R-10 OR HIGHER DUCT INSULATION ____% of time
☐ DUCT SEALING ____% of time
☐ HIGH/VERY HIGH SEER CENTRAL AIR CONDITIONER ___% of time
SEER LEVEL THAT RESPONDENT CALLS HIGH EFFICIENCY _____________
☐ HEAT PUMP ____% of time
☐ FANS (ATTIC/WHOLE HOUSE) ____% of time
☐ SOFFIT VENTS ____% of time
☐ SOLAR PV ____% of time
☐ SOLAR HOT WATER SYSTEM ____% of time ☐
OTHER ____
Tightness of home

16. **Do clients offer any ideas related to energy efficiency that you tend to *discourage*?**
Yes ☐ No ☐ *IF YES*, **Which ones? Why?**
____
____
____

17. **In your experience, what factors affect whether or not a client brings energy-saving suggestions forward?**
____
____

IF NO RESPONSE, PROBE FOR EDUCATION, THE ECONOMY, COMMITMENT TO ENVIRONMENTAL ISSUES, CONCERN ABOUT MONTHLY ENERGY BILLS, TECHNOPHILIA, PROMOTIONS BY UTILITY COMPANIES, ETC.); ALSO CONSIDER PROBING THE CONVERSE—THAT IS, WHAT SORTS OF CLIENTS ARE ONLY INTERESTED IN THE OBSERVABLE—E.G., KITCHEN CABINETRY?

18. **Have you seen any recent changes in any of these factors or in the frequency with which clients bring up the issue of energy savings over the past year or so?**

19. Yes ☐ or No ☐ *YES, PROBE WHAT THE CHANGES HAVE BEEN AND THE RESPONDENT'S BELIEFS ABOUT THE RELEVANT REASONS*
____
____

Knowledge and sources of information

20. **To what extent would you consider yourself an expert on designing energy efficiency into a home?**
____
Why would you say that? *PROBE FOR ANY SPECIFIC TRAINING IN THIS AREA*.
____
____

21. **How important is the issue of energy-efficiency to your firm or to you personally?**

____

____

22. **What tradeoffs, if any, would you make in the design or specifications of a home to increase its energy efficiency?**

____

____

23. **Where do you get information on the subject of energy efficiency?**

____

____

24. **Which of the following sources of information would you say are very important to you and which are somewhat or less important?** Interviewer: insert either V=Very or L =Less in each box

- ☐ **Other professionals in your firm**
- ☐ **Other architects in the area**
- ☐ **Professional associations**
- ☐ **Government sources**
- ☐ **Gas or electric companies**
- ☐ **Environmental groups**
- ☐ **Contractors or subcontractors**
- ☐ **Equipment manufacturers**
- ☐ **Home shows or trade shows**
- ☐ **Efficiency Maine**
- ☐ **Trade Journals**
- ☐ **Other Sources** **List:**_______________________________________

25. **Of the information sources we've just discussed, which 2 or 3 provide you with the most current information?**

____

____

26. **And which offer the most trustworthy information?**

____

____

27. **Among these various sources of information, do you believe you have enough resources on energy efficiency to develop and carry out energy-efficient designs and specifications?**

____

____

28. **Which home design or architectural magazines or journals do you subscribe to and find useful for keeping up to date with energy efficient building practices?**

____

____

29. **Is there any type of training on energy-efficiency issues, benefits, technologies, or features that would be of benefit to you or others in your firm?** Yes ☐ No ☐

Type:

____

____

28a. Is that training available, so far as you know? Yes ☐ No ☐
28b. IF YES, **Where and from whom would that be?**

____

____

Architect leadership on energy efficiency

30. **Are you familiar with the energy-efficiency requirements of the new Maine building code enacted in 2004[6]?** Yes ☐ or No ☐ IF NO, *SKIP TO Q. 33.*

[If YES]

31. **Prior to July 1, 2004, about what proportion of the time did you design or specify homes that were more energy-efficient than required by the Maine building code that was in effect at that time?**
____%

32. **Are any of the homes that you have designed or specified since July 1, 2004 more energy-efficient than required by the new state building code?** Yes ☐ or No ☐

33. **When you work with a client, what energy-saving features or equipment do you normally include in your designs as a standard item and which do you typically recommend** ? CHECKLIST INCLUDES, BUT IS NOT LIMITED TO, THE FOLLOWING: (RECORD BY CHECKING THOSE THEY NORMALLY INCLUDE, AT THE LEFT.)

Std	Rec			
☐	☐	LOW-E WINDOWS; (SAME AS ENERGY STAR® WINDOWS)	A ☐	R ☐
☐	☐	TRIPLE-GLAZED WINDOWS (TYPICALLY CANADIAN WINDOWS)	A ☐	R ☐
☐	☐	INSULATED BASEMENT WALLS	A ☐	R ☐
☐	☐	ATTIC INSULATION LEVEL OF R-38 OR HIGHER	A ☐	R ☐
☐	☐	WALL INSULATION LEVEL OF R-19 OR HIGHER	A ☐	R ☐
☐	☐	NEW INSULATION METHODS(LIST OUT:____________________)	A ☐	R ☐
☐	☐	2 *X* 6 (RATHER THAN 2 *X* 4) FRAMING	A ☐	R ☐
☐	☐	HOUSE AIR SEALING	A ☐	R ☐

[6] On March 30, 2004, **P.L. 2003, chapter 580** was signed into law in Maine, and the Maine Model Building Code took effect in municipalities throughout the State as of July 30, 2004.

☐ ☐ MECHANICAL VENTILATION SYSTEM A ☐ R ☐
☐ ☐ HOT WATER (HYDRONIC) BOILER A ☐ R ☐
☐ ☐ INDIRECT-FIRED WATER HEATING STORAGE TANK AS A ZONE OFF THE BOILER A ☐ R ☐
☐ ☐ HIGH-EFFIC. HEATING SYSTEM; A ☐ R ☐

IF GAS FURNACE (AFUE > 90%) OR OIL FURNACE OR GAS/OIL BOILER (AFUE > 85%) RATING OF FURNACE (_______) OR BOILER (________) THAT RESPONDENT CALLS HIGH EFFICIENT. IN WHAT PERCENTAGE OF HOMES DO YOU INCLUDE THIS APPLIANCE? __________%

☐ ☐ HIGH-EFFICIENCY GAS WATER HEATER (>64% ENERGY FACTOR) A ☐ R ☐
☐ ☐ MULTI-ZONE HEATING DISTRIBUTION SYSTEM A ☐ R ☐
☐ ☐ PROGRAMMABLE THERMOSTAT(S) A ☐ R ☐
☐ ☐ ENERGY STAR® APPLIANCES-REFRIGERATOR, OTHER (SPECIFY) A ☐ R ☐
☐ ☐ FLUORESCENT LIGHTING. A ☐ R ☐
☐ ☐ R-10 OR HIGHER DUCT INSULATION A ☐ R ☐
☐ ☐ DUCT SEALING A ☐ R ☐☐ ☐
HIGH/VERY HIGH SEER CENTRAL AIR CONDITIONER A ☐ R ☐
SEER LEVEL THAT RESPONDENT CALLS HIGH EFFICIENCY ______________
☐ ☐ HEAT PUMP A ☐ R ☐
☐ ☐ FANS (ATTIC/WHOLE HOUSE) A ☐ R ☐
☐ ☐ SOFFIT VENTS A ☐ R ☐
☐ ☐ SOLAR PV A ☐ R ☐
☐ ☐ SOLAR HOT WATER SYSTEM A ☐ R ☐
☐ ☐ OTHER ____

34. **In your experience, which of these do clients readily accept and which do they tend to reject?** (RECORD ABOVE, AT RIGHT)

35. **If you meet resistance, how hard do you tend to sell these features?**
____

34a. **What arguments do you use?**
____
____

35. **How do you deal with clients who seem to be interested only in such things as the cabinetry and the tile designs?**
____
____

35a. IF RESPONDENT SAYS HE/SHE SELLS AGAINST RESISTANCE, **About how often would you say you are successful in getting the client to accept this/these energy-saving feature(s) or equipment?**
____
____

36. Are there particular types of clients to whom you recommend these options and others to whom you do not recommend them? Yes ☐ No ☐ IF YES, **Why is that?**

____

____

36. If you meet resistance, how hard do you tend to sell the options or equipment?

____

____

37a. What arguments do you use?

____

____

37b. IF RESPONDENT SAYS HE/SHE SELLS AGAINST RESISTANCE, **About how often would you say you are successful in getting the client to accept this/these energy-saving feature(s) or equipment?**

____________%

38. Thinking about the energy-saving features and equipment that you either recommend as options or include as standard practice—what are the major reasons you do that? *PROBE; DO NOT READ*

- ☐ Past customer preference/demand
- ☐ Little difference in cost
- ☐ Improves home efficiency
- ☐ Makes our homes more competitive
- ☐ Everyone else does it/have to keep up with the competition
- ☐ Our firm's commitment to our clients
- ☐ Our firm's commitment to the environment
- ☐ Other (specify): ______________________________________

39. Suppose that you have a client who wants a great deal of window area in his or her new home—more than is recommended for energy efficiency. How would you handle that request?

____

____

____

____

____

IF RESPONDENT SAYS HE/SHE WOULD TRY TO DISCOURAGE THE CLIENT, FOLLOW UP BY ASKING WHAT IF CLIENT PERSISTS.

PROBE FOR THE TRADEOFFS THE ARCHITECT WOULD MAKE. E.G., ADDING WALL INSULATION OVER AND ABOVE THE MINIMUM, SO AS TO COMPENSATE FOR THE ADDED GLAZING AREA.

39a. What other sorts of tradeoffs have you made or would you make to achieve overall energy efficiency of the home, even if specific components are not as efficient as might be recommended?

____

____

____

39b. Are you comfortable with the way in which the Maine building code focuses on the overall energy use in order to achieve efficiency in the home or would you rather have more prescriptive standards?

Yes ☐ No ☐

Why/why not?

____

____

____

40. If cost were not a consideration, what other energy-saving options and equipment would you include in your homes?

____

____

____

Programs: Awareness, experience, attitudes

41. What programs advocating or supporting energy efficiency in residential new construction are you familiar with?

____

____

41a. IF ANY MENTIONED, **Can you describe that/those to me?**

____**41b.**

Who is sponsoring that/those program(s)?

____

41c. IF NOT MENTIONED SPONTANEOUSLY, **Have you heard anything about energy efficient residential new construction programs sponsored by any gas or electric company in Maine?** Yes ☐ No ☐

41d. IF YES, **What do you know about it? Can you describe it to me?**

____

____

CHECKLIST; DO NOT READ

☐ HERS
☐ ENERGY STAR®
☐ ENERGY-CRAFTED HOMES
☐ Other (specify):

41e. IF NOT MENTIONED EARLIER, **Have you heard anything about a program called ENERGY STAR® homes?** Yes ☐ No ☐

If NO, (skip to question 41)

41f. IF YES OR MENTIONED EARLIER - **How did you learn about that program?**

____

____

41g. Do you know who sponsors it?

____

41h. Can you describe it to me? Yes ☐ No ☐

____

____

[READ TO ENSURE THAT ALL RESPONDENTS ARE KNOWLEDGEABLE FOR FUTURE QUESTIONS]

THE ENERGY STAR® HOMES IS A PROGRAM DEVELOPED BY THE U.S. ENVIRONMENTAL PROTECTION PROGRAM TO HELP PROMOTE HOMES THAT ARE COST-EFFECTIVE, ENERGY-SAVING, AND POLLUTION-PREVENTING. THE ENERGY STAR® GUIDELINES COVER SUCH THINGS AS INCREASED INSULATION, PREVENTING AIR LEAKAGE, HIGH PERFORMANCE WINDOWS, HIGH-EFFICIENCY HVAC SYSTEMS, AND ENERGY-EFFICIENT WATER HEATING, LIGHTING, AND APPLIANCES.

42. **If Maine adopts an ENERGY STAR® Homes program in the near future would your company plan to participate?** Yes ☐ No ☐
If No – skip to Q 44
Why/why not?

____

____

PROBE FOR DETAILS OF EXPERIENCE OR ANTICIPATED PARTICIPATION. INCLUDE THE FOLLOWING ISSUES:

b. **Have you designed any ENERGY STAR Homes?** Yes ☐ or No ☐
IF YES, How many? What proportion of your assignments is that?
IF NO, Why not?

____

____

b. **What percentage of your clients ask for an ENERGY STAR rated home?**

____

____

43. **Would your anticipated participation in this program have any effects on the homes you design or specifications for homes that are part of the program(s)?** Yes ☐ No ☐

Would you do things that you would not have done otherwise in terms of the specifications you provide, or with respect to the features or equipment you include? Yes ☐ No ☐

44. Can you list the Energy Star products that you are aware of?

____

45. What about your builders. Are they aware of Energy Star products? Yes ☐ No ☐

No Q46

47. Do you specify high-efficiency (or ENERGY STAR®-labeled) products when you solicit bids from your builders or subcontractors? Yes ☐ No ☐

If Yes, Which ones?

____

If No, Why not?

____

48. Would your anticipated participation in an energy efficient home program led to any changes in your normal practice—that is, with what you do for homes that are *not* part of the program(s)? Yes ☐ No ☐ *PROBE FOR DETAILS*

____

49. Would you expect to see any effects of this program on your clients or on the builders you work with? Yes ☐ No ☐

IF YES, **Please describe those changes and the time frame in which you have seen them or expect them to occur.**

IF NO, Why not?

50. Overall, would you say that programs to increase energy efficiency in residential new construction would be helpful to your practice, have no effect, or would hurt your practice?
Yes ☐ No

Why do you say that?

Perceived barriers to designing/building energy-efficient homes

51. In your experience, what are the major barriers to increasing the number of energy-efficient single-family detached homes that are designed and built in Maine?

PROBE What are the critical barriers to energy-efficient design, if any? And what are the critical barriers to getting energy-efficient designs built and built properly?

52. What are the barriers to getting energy-efficient single-family homes designed in Maine?

PROBE FOR DETAILS; E.G., What makes you say that? Can you give me any examples?
IF POSSIBLE, PROBE FOR EACH ASPECT—PERCEPTIONS OF CUSTOMER KNOWLEDGE, INTEREST, WILLINGNESS TO PAY—IDEA IS TO GET WAR STORIES FROM ARCHITECTS WHO HAVE DISCUSSED ENERGY-SAVING FEATURES OR TECHNOLOGIES WITH CLIENTS OR ATTEMPTED TO GET CLIENTS TO INCLUDE THOSE FEATURES/TECHNOLOGIES IN THEIR HOMES.

53. How do you think that problem/those problems might be overcome?

PROBE Who should do that? How could that be done? What role would you see being played by architects like yourself?

54. How about technology? Are there any supposedly energy-saving features or equipment that you keep out of the homes you design because you don't believe they are reliable or effective?
Yes ☐ No ☐

IF YES, PROBE FOR DETAILS: What features or equipment is that? Have you had any direct experience with them? What is the problem with it/them?

55. To what extent would you say the problem of increasing the stock of energy-efficient homes is one of contractors and subcontractors who are unmotivated, not knowledgeable, or not trained?

PROBE FOR DETAILS, E.G., What makes you say that? Can you give me any examples? How much of the problem rests with code inspections?

56. Have any of these barriers—client awareness, product performance, contractor training, or others—become more important or less important over the past 2-3 years? Yes ☐ No ☐

56a. IF SO, Which ones?

56b. Why do you believe this has occurred?

Energy-efficiency mortgages

57. Are you generally aware of your clients' efforts to get construction loans or mortgages?
Yes ☐ No ☐

If NO, THANK AND TERMINATE]

[If YES]
58. Have you ever heard of energy-efficiency mortgages for new homes? Yes ☐ No ☐

58a. IF YES, **Do you know if these types of mortgages are available in the Maine?** Yes ☐ No ☐

58b. Has this been of any help in selling your clients on energy efficiency? Yes ☐ No ☐

(i) If yes, THANK AND TERMINATE

58c. IF NO, **Would the availability of energy-efficiency mortgages be likely to make a difference in your selling your clients on energy efficiency?** Yes ☐ No ☐

58d. Would that affect your own interest in designing or specifying gas-heated homes that exceed the state energy code? Yes ☐ No ☐

Those are all the questions I have. Thank you very much for your time and expertise. Do you have any more you would like to add or suggestions as we design an ENERGY STAR new homes program?

XIII. APPENDIX G: TELEPHONE RECRUITING SCRIPT

Residential Baseline Study Recruiter Script

Hello:

My name is Nancy Knowlton and I'm calling regarding the Efficiency Maine, Residential New Construction Program sponsored by the Maine Public Utilities Commission.

I am calling to invite you to participate in an important study of building construction techniques in new homes that have been occupied since January 1, 2005. The results of the study will be used to plan and design a Residential New Construction Program here in Maine.

This is not a telemarketing call. I am not trying to sell you anything.

If you agree to participate, you will receive $100 which will be given to you by the Efficiency Maine Representative that conducts the survey in your home.

We estimate the entire survey will take approximately 3 hours, depending on the size and complexity of your home.

If you would like to verify this information, you can call Efficiency Maine at 1-866-376-2463.

Is this something you are interested in participating in?

No - thank them for their time and terminate the call.

Yes – I need to ask you a few more questions and describe the scope of the survey we would like to perform. (Continue below)

**** IF THEY WANT TO KNOW WHO IS SPONSORING THE RESIDENTIAL NEW CONSTRUCTION BASELINE STUDY:** Efficiency Maine, a program of the Maine Public Utilities Commission is sponsoring this Residential New Construction Baseline Study. They can get more information about Efficiency Maine at www.efficiencymaine.com

Also, if necessary, they can contact Richard Bacon, the Program Manager of the Efficiency Maine Residential Program if they need more information. His phone number is 207-287 -8349)

Additional Questions

The survey will last for approximately 3 to 4 hours with 15 minutes devoted to interview questions.

No preparation is required on your part except to not have a wood stove burning when we do the site visit.

An Efficiency Maine representative will visit your home and collect various construction data including: insulation levels and quality, window and door data, square footage of the heated and unheated space, heating/cooling system equipment, etc. We will also conduct a blower door air leakage test on the home.

You will receive $100 in for participating in the survey and your name will not be used in any way. General contact and demographic information will be collected - but this is just for research purposes and will only be used by the research team.

Will you be able to take part in this baseline study?

- ☐ NO - Not interested - thank them for their time and terminate the call.
- ☐ YES - READ BELOW

1. When was your home built? Month: ____20______
2. When did you move into your home? Month:__________20__
3. Do you have a woodstove? ☐ Yes ☐ No.

   If Yes, can it be shut down and have the ashes cold when we arrive so that we don't back draft the stove when we do the blower door air leakage test? .
4. Do you have central air conditioning? ☐ Yes ☐ No
5. Do you have a warm air furnace (with ducts) or a hydronic boiler (with pipes that circulate heating water)? (Circle one)
6. Do you know the square footage of your home? _____________SQ. FT

Setup date, time and get directions to the home

Date:___________________, Time:_________________ AM or PM (Circle one)

We will need an adult at home while we are conducting the survey to provide access to the house and to answer some questions.

If for any reason you are unable to be home during the chosen time, please give us a call as soon as possible. This will enable us to find a replacement. You can contact at me at 1-866-376-2463.

So we will send you a confirmation letter, may I please get your name and address? RECORD IN THE EXCEL DATABASE, ALONG WITH THE DATE AND TIME OF THE INTERVIEW.

We look forward to your participation. Again my name is Nancy Knowlton.

Thank you for your time.