



The Massachusetts New Homes with ENERGY STAR[®] Program

2011 Baseline Phase 1: Completion of Planning

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Submitted to:

**The Massachusetts New Homes with ENERGY STAR
Program**

Joint Management Committee

Submitted by:

NMR Group, Inc.

Dorothy Conant

50-2 Howard Street, Somerville, MA 02144

Phone: (617) 284-6230 Fax: (617) 284-6239

www.nmrgroupinc.com

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1 Introduction

In 2011, the Sponsors of the Massachusetts New Homes with ENERGY STAR[®] Program (Program) are conducting a baseline study of residential construction practices in buildings with one to four residential units. This study will include on-site inspections of 100 non-ENERGY STAR homes built to meet the new IECC (International Energy Conservation Code) 2009 code, which became mandatory in Massachusetts on July 1, 2010. The results of this study will be used to update the baseline or User Defined Reference Home (UDRH) used in calculating Program savings and to assess building code compliance at the beginning of a code cycle. This report describes the planning process for the 2011 Baseline Study and the work done to develop a sample of eligible homes to recruit from; on-site inspections will be conducted in the summer.

In addition, Massachusetts is participating in a code pilot study to assess a U. S. Department of Energy (DOE) code compliance checklist. The Massachusetts Department of Energy Resources (DOER) was awarded a grant from the DOE, to be administered by Northeast Energy Efficiency Partnerships, Inc. (NEEP), to conduct a code pilot study to assess DOE's new code compliance checklist. This provided an opportunity for collaboration between the program administrators (PAs) and DOER. The code pilot study includes a mini baseline study to assess code compliance in homes constructed at the end of the IECC 2006 code cycle. The mini baseline study will conduct on-site inspections and HERS (Home Energy Rating System) ratings of 50 non-ENERGY STAR homes.

2 Background

Sponsors of the Massachusetts New Homes with ENERGY STAR[®] Homes Program decided to conduct a residential new construction (RNC) baseline study in 2011 in order to update the baseline home used in calculating energy savings. Three adjoining states (Connecticut, New Hampshire and Rhode Island) then expressed interest in participating. The four states, all with RNC programs that include certifying ENERGY STAR homes, could potentially not only be conducting baseline studies at the same time, but collecting and reporting consistent data. The end result would be directly comparable residential new construction characteristics and practices for four states.

As anyone who has worked on an RNC baseline study knows, there are many steps that need to be taken and decisions that need to be made prior to implementation. A baseline team of program administrators and evaluation staff, energy efficiency consultants/advisors and implementation contractors was assembled to tackle these issues. The team began holding biweekly conference calls in September 2010. The challenge was to create an evaluation plan that would provide comparable information on core building characteristics while offering flexibility to meet individual state priorities and/or budget limitations.

Massachusetts's last baseline study had been conducted in 2005. Connecticut currently assumes that code is baseline, and believes that assumption is unrealistic. Rhode Island and New Hampshire have not

previously conducted baseline studies. All four states are interested in updating their baseline or User Defined Reference Homes (UDRH) used to calculate program savings. In addition, the sponsors of programs in states where the IECC 2009 Energy Code was implemented in 2010 are interested in assessing code compliance in the early stage of a new code cycle. The 2011 study results could serve as the baseline for measuring improvement in code compliance in later years.

3 Decision Making Process

The following are examples of the decisions that the baseline team needed to address to be prepared to conduct baseline studies in 2011:

- Whether or not to include homes that participated in RNC programs, including ENERGY STAR-qualified homes, in the sample of inspected homes
- Whether or not to include multi-family buildings and, if so, whether or not to address common areas in addition to residential units
- If multi-family buildings are included, whether to use one combined sample of single- and multi-family housing units or develop separate single- and multi-family samples
- How to address Massachusetts stretch code communities¹ in sampling and whether or not a different UDRH is needed for stretch code communities
- How to identify buildings permitted under the IECC 2009 Energy Code
- How to address building characteristics which are not easily identified in post construction inspections
- Whether or not to conduct HERS ratings
- How to define conditioned space
- Whether or not to include HVAC performance testing and, if so, on all or a sample of homes
- Whether or not to collect lighting and/or appliance data beyond what is required for HERS ratings
- Whether or not to collect information on renewables
- What incentive payment to offer homeowners who agree to an on-site inspection

¹ The Massachusetts “Stretch Energy Code” was developed to offer cities and towns the option of adopting a more aggressive energy code than the MA baseline energy code. Eighty-eight Massachusetts communities had adopted the Stretch Energy Code as of May 23, 2011.

- Whether or not to provide participating homeowners with a summary of their home's performance
- How to notify owners or occupants of any health or safety issues identified during inspections

The overall goal was to create an evaluation plan that would provide comparable information on core building characteristics while offering flexibility to meet individual state priorities and/or budget limitations.

After an initial discussion of the issues to be addressed, team members were asked to fill out a form giving their initial thoughts on how they thought several issues should be addressed. The purpose of this exercise was to identify areas where team members would likely find it relatively easy to reach agreement and areas that would require more discussion. The results of this exercise showed that there was initial general agreement on several issues, including:

- Not to include ENERGY STAR-qualified homes in the sample of inspected homes
- Use RESNET definitions of conditioned space
- Include a single-family sampling plan that matches the percentage of on-site inspections conducted in each county to the percentage of state-level permits issued in that county
- Address multi-family housing (Multi-family units account for 37% to 66% of ENERGY STAR housing units certified in RNC programs in the individual states.)

3.1 Reporting Options

Team members were sent copies of three baseline studies to review: the 2005 Massachusetts², 2008 Maine³ and 2009 Vermont⁴ baseline studies. In addition to providing information on building characteristics, each of these studies includes unique comparisons of results by different home groupings. Examples are: ENERGY STAR versus non-ENERGY STAR homes, custom versus spec homes, and homes in different geographic areas or sponsor service territories. Some studies included a survey of homeowners with survey responses compared to what was found on site. Other differences include the level of detail provided and use of graphics. Together, these three studies provided team members with a picture of the range of reporting options.

² Nexus Market Research Inc. (NMR) and D. Conant. 2006. *Massachusetts ENERGY STAR® Homes: 2005 Baseline Study Part I: Inspection Data Analysis*. Joint Management Committee.

³ Vermont Energy Investment Corp (VEIC), Energy & Resource Solutions, Inc. (ERS), and GDS Associates (GDS). 2008. *Maine Residential New Construction Technical Baseline Study*. Efficiency Maine: Maine Public Utilities Commission.

⁴ Nexus Market Research Inc. (NMR), RLW Analytics, Inc. (RLW) and D. Conant. 2009. *Overall Report—Vermont Residential New Construction Study*. Vermont Department of Public Service.

3.2 On-Site Inspection Options

A detailed list of on-site data collection options, including preliminary cost estimates for each option, was presented for discussion to provide potential study sponsors with a general idea of what the cost per on-site inspection would be under different scenarios. The list included the following options from which sponsors could choose:

- Use MA 2005 on-site data collection form
- Conduct HERS rating
- Conduct HVAC performance testing
- Provide Manual J assessment
- Provide REM/Rate compliance reports
- Conduct short on-site homeowner/occupant survey
- Collect hard-wired fixture lighting inventory by bulb type
- Collect basic renewable information
- Collect appliance model numbers
- Provide letter to homeowner on their home's performance
- Homeowner/occupant incentives

3.3 Multi-Family Housing Options

How to address multi-family housing became a much more complicated issue than anticipated. Views on how to address multi-family housing varied and generated a great deal of discussion. In general, team members initially supported:

- Separate single-family and multi-family housing samples
- Developing separate single-family and multi-family baseline homes
- Inspecting both buildings and units in multi-family buildings
- Collecting information on common areas

Background information was provided on multi-family housing permits, participation in RNC programs, and differences in the characteristics of participating single-family homes and multi-family units. The following three tables are examples of the multi-family background information provided.

Table 3- shows the number of multi-family units and buildings permitted in 2009 and multi-family ENERGY STAR-qualified units as a percentage of multi-family units permitted.

Table 3-: 2009 Multi-Family Unit Permits and ENERGY STAR Units

2009	Multi-Family Unit Permits	Multifamily Building Permits *	% 2009 Permit Units ENERGY STAR**
Connecticut (2+ Units/Building)	1,344	145	6%
Massachusetts (5+ Units/Building)	2,431	147	58%
New Hampshire (2+ Units/Building)	625	38	48%
Rhode Island (2+ Units/Building)	257	65	74%

* Projects may include more than one building.

**The 2010 MA Program certified 1,741 multi-family units in 2010; 65% of the 2,687 multi-family unit permits issued in 2010.

Table 3- shows the number and percentage of ENERGY STAR-Qualified multi-family projects and units in the 2010 Massachusetts Program with individually metered units, master metered units, and individual and central building heating and cooling systems.

Table 3-: MA 2010 Program Multi-Family Unit and Heating and Cooling System Metering

Number of Projects*	Percent of Projects	Number of Units	Percent of Units	Individual or Master Metered (Electric)	Individual or Master Metered (Gas)	Individual Unit or Central Building Heating System	Individual Unit or Central Building Cooling System	Heating System Type Boiler/Furnace/GSHP/ ASHP/etc.
14	36%	701	40%	Individual	Individual	Individual	Individual	Gas Furnaces/Boilers
8	21%	222	13%	Individual	Master Metered	Central	N/A	Gas Boiler
4	10%	78	5%	Master Metered	Master Metered	Central	N/A	Gas Boiler
3	8%	109	6%	Individual	Individual	Individual	N/A	Gas Boiler
2	5%	92	5%	Individual	Individual	Central	Individual	ASHP & HP
2	5%	107	6%	Master Metered	Master Metered	Central	Central	Gas Boiler
1	3%	120	7%	Individual	Individual	Central	N/A	Electric Resistance
1	3%	72	4%	Individual	Master Metered	Central	Individual	Gas Boiler
4	10%	231	13%	Various combinations				
39	100%	1,732	100%	← Totals				

* Does not include projects in Unitil territory.

Table 3- shows the characteristics of 2009 Massachusetts Program single-family and multi-family ENERGY STAR-qualified housing units.

Table 3-: MA 2009 Program Single-Family and Multi-Family Unit Characteristics

2009 MA Program ENERGY STAR-Qualified Units	Single-Family Units (n=700)	Multi-Family Units (n=1,410)	All Units (n=2,110)
Lowest (best) HERS Index	-5	32	-5
Average HERS Index	65	65	65
Median HERS Index	68	65	66
Percent of Units with Gas Boilers	21%	70%	54%
Average AFUE of Gas Boilers	90	89	89
Percent of Units with Gas Furnaces	63%	26%	38%
Average AFUE of Gas Boilers	93	88	90
Percent of Units with Oil Boilers	4%	1%	2%
Average AFUE of Gas Boilers	85	85	85
Percent of Units with Other Heating Systems	12%	3%	6%
Average Air Conditioning SEER (n=451 SF and 1,151 MF)	13.6	12.6	12.9
Average Window U-Value	0.33	0.34	0.34
Average Duct Leakage (CFM25/100 ft ² conditioned space) (n=432 SF and 791 MF)	3.5	3.8	3.7
Air Infiltration Average Air Changes per Hour (ACH50) (n=686 SF and 1,407 MF)	4.1	4.1	4.1

As discussion on multi-family housing continued it became clear that interest in learning more about the multi-family housing market extended beyond data collection to create a separate baseline home for projects eligible to participate in the states’ existing RNC programs. Very often, multi-family projects do not clearly fit into traditional residential or commercial energy-efficiency programs. They may be one-story buildings or twenty-story high-rise condominium or apartment buildings, they may be low income

or luxury housing projects, they may be built under residential or commercial code, units may be individually or mass metered, and parts of a building may be served under residential rates and parts under commercial rates. Many projects are a mix of residential and commercial space. Listed below are some of the issues and ideas raised by team members with respect to multi-family buildings:

- Expand the sample of multi-family on-site inspections to include not just buildings eligible for participation in the states' RNC programs or ENERGY STAR qualification, but all types of multi-family buildings.
- If buildings are served entirely, or partially, by commercial and industrial (C&I) programs it will be important to have C&I representation early on to provide input on what data the C&I program administrators want or need to ensure the desired data are collected.
- The program that would claim the savings associated with commercial space should pay for collecting data/information on commercial space.
- Sampling multi-family housing projects is more complicated. To ensure access to all areas of multi-family buildings requires recruiting building managers or talking with developers who are likely to be able to provide building plans.
- HERS ratings will not be appropriate for evaluating large multi-family buildings—a different data collection approach will be needed.
- Last year the Environmental Protection Agency (EPA) approved buildings up to five stories for ENERGY STAR certification if they were permitted as residential. It is important to have a clear understanding of what is eligible for ENERGY STAR qualification and what is not.
- Look less at what EPA says and more at what the housing industry does. A three-story building with central HVAC systems qualifies as residential for purposes of ENERGY STAR, but this configuration defies single-family energy efficiency program designs. How a building is configured needs to be a top consideration.
- What potential savings in multi-family buildings are being overlooked and what savings can be captured by RNC programs? If the savings cannot be captured in RNC programs, for example savings associated with central HVAC systems, maybe these buildings belong in a C&I multi-family program.
- Unique energy-saving opportunities exist in qualified ENERGY STAR low-rise and mid-rise multifamily projects, projects that share many design and systemic similarities with non-qualified 4 to 8 story projects, specifically when above-code upgrades are incorporated into common area heating, cooling and lighting systems. An analysis of projects participating in a 4 to 8 Story Multi-Family Pilot Program in Massachusetts revealed that 31% of total square footage was non-residential space. (See Table 3-.) Examples of non-residential space are community rooms, hallways, stairs and elevators, laundry rooms, exercise rooms, etc. Also,

roughly 70% of savings was on non-residential metered accounts. Energy savings for these non-residential types of spaces cannot be captured with a HERS rating and will likely not be captured unless common areas are served by a C&I program. A majority of the pilot projects have a central, whole building boiler system with multiple commercial sized units and employ a central, whole building cooling system that typically includes chillers, a technology that is not REM/Rate friendly.

Table 3-: Massachusetts 4 to 8 Story Multi-Family Pilot

18 Project Survey	Stories	Total Building Square Footage	Residential Area Square Footage	Non-Residential Area Square Footage	% Common Area Square Footage	Whole Building Heating	Whole Building Cooling
Totals	87	1,449,165	1,003,170	445,995	31%	82%	67%
Average	5	80,509	55,732	24,778	31%	82%	67%

- High-efficiency pumps, motors and drives are routinely used in multi-family whole building heating and cooling systems; the tracking of these components/systems are not part of a typical RNC baseline study or addressed in HERS ratings.
- EPA’s ENERGY STAR Multi-family High-Rise Program will be introduced this year. Should the decision be made to offer the Multi-family High-Rise Program, which will not use HERS ratings to verify compliance, the on-site inspections for a baseline study of these buildings would be different from what is being done for single-family homes.
- With the focus on buildings permitted under the IECC 2009 Energy Code, a very limited number of multi-family buildings permitted under the new code will likely be ready for inspection by mid-2011 because it takes longer for multi-family buildings to complete.

After much discussion it was decided to defer studying multi-family housing until 2012.

3.4 Incentives and Feedback to Homeowners

Team members agreed early on to offer homeowners an incentive of \$150 dollars for allowing their home to be inspected and an additional \$50 for allowing performance testing of central air conditioning equipment. Team members also agreed that homeowners should be notified of any obvious health or safety issues identified during the on-site inspections. However, team members had different opinions on whether or not to provide information to homeowners about how their home performed. Some team

members thought providing this type of information would be important to homeowners and would be an incentive to participate while other team members did not want to provide this information because of liability concerns.

3.5 Single-Family Sampling

Sample sizes to achieve 90% confidence and 10% precision were estimated for each of the four states assuming that the coefficient of variation (CV) would be comparable to the 2008 Vermont Baseline study CV of 0.49; this was considered to be a conservative assumption because it was higher than the 2005 Massachusetts Baseline study CV of 0.37. Table 3- shows that a sample of 64 homes would likely be sufficient to achieve the desired 90/10 precision in Connecticut, Massachusetts and New Hampshire and a sample of 59 homes in Rhode Island.

Table 3-: Calculated Single-Family Home Sample Sizes to Achieve 90/10 Precision

Coefficient of Variation	Connecticut 2011 Baseline	Massachusetts 2011 Baseline	New Hampshire 2011 Baseline	Rhode Island 2011 Baseline
0.49 VT Baseline	63	64	63	59
0.43 Avg. VT & MA	49	50	49	46
0.37 MA Baseline	36	37	36	35

Team members agreed on a sampling plan for single-family homes, based on 2010 Census permit data, that matches the percentage of on-site inspections conducted in a county to the percentage of state level permits issued in that county, with no more than two homes inspected in any one town to ensure broad geographic representation and avoid oversampling in any one socioeconomic area. Table 3- shows the targeted number of on-site inspections in each county in each state. Massachusetts defines single-family homes as housing units in buildings with one- to four units; Connecticut and Rhode Island define single-family homes as single-family detached or attached homes, which is consistent with the definition used by the U.S. Census Bureau for reporting single-unit housing permits issued.

Table 3-: Final Sampling Plans Based on 2010 Census Permit Data

Massachusetts County	Targeted Number of On-Site Inspections (n=100)	Rhode Island County	Targeted Number of On-Site Inspections (n=44)	Connecticut County	Targeted Number of On-Site Inspections (n=70)
Barnstable County	6	Bristol County	2	Fairfield County	14
Berkshire County	2	Kent County	6	Hartford County	17
Bristol County	8	Newport County	6	Litchfield County	4
Dukes County	2	Providence County	16	Middlesex County	7
Essex County	10	Washington County	14	New Haven County	12
Franklin County	1	RI Total	44	New London County	8
Hampden County	5			Tolland County	4
Hampshire County	4			Windham County	4
Middlesex County	23			CT Total	70
Nantucket County	1				
Norfolk County	9				
Plymouth County	10				
Suffolk County	1				
Worcester County	18				
MA Total	100				

3.6 Recruiting Single-Family Homes

Team members agreed early on that homes for the baseline study should be recruited through homeowners, not builders. Based on experience conducting other baseline studies, recruiting homes through builders is likely to result in a biased sample because only builders who are building to at least

code are likely to agree to have their homes inspected. Team members also agreed early on that the most efficient way of identifying the population of occupied newly constructed homes is to have the electric utilities provide lists of new permanent residential service requests that include addresses and contact information.

Two options for recruiting homeowners were discussed: 1) recruiting directly from the list of new permanent service requests and 2) conducting a phone survey of owners of newly constructed homes and recruiting as many homeowners as possible from survey respondents. One advantage of recruiting from survey respondents is that it supports a comparison of what owners say about their homes in the survey to what is found on site in the final baseline report. However, it is likely that additional homeowners, who will not have participated in the phone survey, will need to be recruited to reach the targeted number of sampled homes. These additional recruited homeowners could be asked to complete the full phone survey either by phone or at the time of the on-site inspection.

4 Budget Proposals

Once team members were fully informed on and had discussed what information could be collected during the on-site inspections, how to recruit homeowners and reporting options, representatives for each state were sent checklists of all available options to fill out and return. (See Appendix A: 2011 Baseline Single-Family On-Site Inspection and Reporting Options Checklist and Appendix B: 2011 Baseline Single-Family On-Site Survey Questions Checklist.) Using the checklist responses, detailed budget proposals were developed for each state and sent out for review.

5 Final Decisions

After reviewing budget proposals, three states decided to conduct single-family baseline studies in 2011: the Connecticut study will include inspection of 70 homes, Massachusetts 100 homes and Rhode Island 44 homes.⁵ The Massachusetts and Rhode Island studies will target homes built to meet IECC 2009 code requirements. (Massachusetts and Rhode Island adopted the IECC 2009 code in 2010; Connecticut did not.) Massachusetts will also conduct a home buyer survey. New Hampshire decided not to conduct a baseline study in 2011, but will be conducting a home buyer survey. The Massachusetts and New Hampshire home buyer surveys will each survey 100 owners of newly constructed ENERGY STAR homes and 100 owners of newly constructed non-ENERGY STAR homes.

⁵ While offering less precision, RI determined a 44 home sample was adequate for their needs. If the CV for the Rhode Island study is 0.37, which was the final CV for the 2005 Massachusetts Baseline Study, the estimated sample size to achieve 90% confidence and 10% precision is 35 homes.

In summary, all three single-family baseline studies will:

- Use a single-family sampling plan that matches the percentage of on-site inspections conducted in a county to the percentage of state level permits issued in that county.
- Conduct HERS ratings on each home
- HERS ratings will include code compliance reports and collection of information on renewables.
- Use RESNET conditioned space definitions
- Include HVAC performance testing
- Include Manual J assessments
- Capture ECM furnace fan information
- Individual study sponsors in each state will have the option to send letters to participating homeowners describing how their home performed.

6 Implementation

6.1 Recruiting Homes

Identifying Massachusetts and Rhode Island homes permitted and built to meet the new IECC 2009 code turned out to be a time-intensive process. The first step was to clean the lists of new permanent residential electric service requests provided by the utilities to remove multi-family projects and single-family homes still listed under the builder name. The next step was to call town building departments to find out if the homes on the cleaned new service request list were permitted to be built to meet IECC 2009 code. Building department cooperation varied; some departments provided information over the phone, others required that someone come in person to get the information or wanted a written request for information. In addition, some departments were unable to report when the permit for the home was applied for; this is an important date because IECC 2009 became mandatory in both Massachusetts and Rhode Island as of July 1, 2010. All permits applied for from July 1, 2010 on should be built to meet IECC 2009 code requirements. If the permit application date was not available, it was assumed that permits are typically issued within a month of the application and that homes with permits issued August 1, 2010 or later are homes permitted under IECC 2009. Connecticut did not adopt IECC 2009 in 2010, so all single-family homes on the list of new permanent service requests that had owner information were considered eligible to participate in the baseline study on-site inspections.

Owners of eligible homes will be sent letters telling them about the objectives of the study, what the on-site inspection will involve, how long it will take if they are called and agree to participate, and the \$150 incentive they will receive the day the inspection is conducted. In Massachusetts, the letters let homeowners know that the Massachusetts Department of Energy Resources and the Massachusetts Board of Building Regulations and Standards endorse this study. The letter also includes a list of

contacts, including phone numbers and email addresses, for each sponsor that homeowners may contact if they have any questions. Letters going to homeowners in Massachusetts explain that they may be called and asked to complete a 15 to 20 minute phone survey addressing what home buyers look for in a new home and the information sources they use; at the end of the survey these homeowners will be asked if they are interested in having their home inspected. Phone calls to recruit homes for the on-site inspections will start one week after the letters to eligible homeowners are mailed.

6.2 On-site Inspections

On-site inspections are expected to take two to four hours for most homes. Blower door testing will be conducted at all homes, duct leakage testing will be conducted in all homes with ducted HVAC systems, and HVAC performance testing will be conducted in all homes with central air-conditioning systems if weather conditions are appropriate for testing and the homeowner agrees to the testing; inspections at some large homes with multiple heating and cooling systems may take longer than four hours. All inspections will be conducted by HERS raters. Because many homeowners are not home during normal business hours, inspections will be scheduled for evenings or weekends as well as weekdays.

7 Status and Schedule

7.1 Mini Baseline Study of 50 IECC 2006 Homes

Inspections are being conducted for the mini baseline study of 50 Homes at the end of the IECC 2006 code cycle. As of May 30, 2011 on-site inspections had been scheduled at 48 homes and 35 on-site inspections had been completed. The goal is to complete all 50 inspections by June 10, 2011 and deliver a draft report in late June or early July and a final report in July 2011.

7.2 Baseline Study of 100 IECC 2009 Homes

The schedule for the baseline study of 100 IECC 2009 homes is:

- Letters mailed to eligible homeowners: Mid June 2011
- Home buyer phone survey: Late June to Mid July 2011
- Start recruiting homeowners and scheduling inspections: Late June 2011
- Start on-site inspections: July 2011
- Complete on-site inspections: September 2011
- Deliver draft report: November 2011
- Deliver final report: December 2011

APPENDIX A 2011 Baseline Single Family On-Site Inspection and Reporting Options Checklist

Information NMR Needs to Develop Budget Proposals for States

As discussed in the December 1, 2010 Baseline Team conference call this is the checklist of 2011 Baseline Study options we have discussed to date that study sponsors in each state should complete and return. NMR will use this information to develop budget proposals for each state. If at all possible, try to return the completed checklist before our next call on December 15, 2010.

There are two parts to the checklist. The first part addresses on-site inspections and the second part addresses the level of analysis and reporting desired.

Based on Baseline Team discussions, three of the on-site options are labeled “required.” These three options are conducting HERS ratings, data cleaning and state travel factors. Two options are no-cost options because they address information collected as part of the HERS rating. The two no-cost options are providing code compliance reports and collecting information on renewables.

As discussed in the Baseline Team conference calls, individual states may choose to include different on-site components. For example only some states may want to conduct HVAC performance testing, include Manual J assessments, collect appliance model numbers, or send a letter to homeowners telling them how their home performed, etc.

With respect to the level of analysis and reporting, the core purpose of the 2011 baseline study is to update UDRH assumptions and we assume this will be the main focus of all state reports. Beyond this, individual states may want to see different levels of analysis and/or comparisons of different subgroups of customers, etc.

Please feel free to add any on-site or reporting components not included in the checklist that you might like to see addressed in your state.

If you have any questions, please don't hesitate to call or email me.

State: _____

On-site Options

Check Desired Options	On-Site Component
Required	Conduct HERS Rating
	HVAC Performance Testing <i>(Estimate assumes one half of homes will have two central A/C systems. Actual cost will be based on time and materials not to exceed \$141 per A/C system per site.)</i>
	Manual J Assessment <i>(T.B.D.: between \$30 and \$60 depending on availability of software to extract data from REM/Rate files. Does not include one-time cost of developing calculation spreadsheet.)</i>
NA	Provide REM/Rate Compliance Reports and Compliance Under Prescriptive Path
	Conduct On-site Homeowner/Occupant Survey <i>(This is an estimate for now. Final cost per site will depend on what the final on-site survey looks like.)</i>
	Lighting Inventory <i>(Count of qualifying and non-qualifying hard-wired fixtures by room)</i>
NA	Collect Basic Renewable Information
	Collect Appliance Model Numbers
Required	Data Cleaning
	Letter to Homeowner on Homes Performance
Required	State Travel Factors
Required	Connecticut
Required	Massachusetts
Required	New Hampshire
Required	Rhode Island
	Homeowner/Occupant Incentive of \$150 per site including blower door and duct blaster testing
	Additional Homeowner/Occupant Incentive of \$50 per site for HVAC performance testing

Please check all options that you want addressed in your state’s baseline report.

General Level of Analysis and Reporting Desired

_____ **Maine report:** straightforward presentation of quantitative results–little discussion

_____ **MA 2005 report:** somewhat more detailed and more graphics

_____ **VT 2008 report:** very detailed and comparisons of several groups of homes

_____ Comparison to previous baseline study findings

_____ Comparison to ENERGY STAR-qualified homes (*Note: CT may want comparison to all RNC Program participating homes.*) We would need to verify that the program implementation contractor can provide this information or provide data files we could use to calculate min/max/average data etc.

_____ **Massachusetts:** compare stretch code and non-stretch code community homes

_____ Other specific comparisons desired (*Note that we assume at least some comparisons of homeowner groups based on information collected as part of the baseline study will be included in even the basic analysis. Examples include looking at results by sponsor service area or other geographic areas, custom versus spec-built homes, attached versus detached homes, homeowners aware of ENERGY STAR homes versus those who are not, etc. What we are looking for here is an indication of any specific comparisons you might like to see.*)

_____ Analysis of homeowner on-site survey data, assuming some questions are asked on site, and comparison to on-site findings

_____ If a full scale home buyer survey is conducted and participants in the baseline study are recruited from that survey, conduct a full analysis comparing on-site findings to participants’ survey responses.

_____ Conduct full scale phone survey of new-home buyers: assume 100 buyers of ENERGY STAR homes and 100 buyers of non-ENERGY STAR homes

_____ Include analysis of compliance with code under three code compliance approaches:

- Overall Building UA Compliance
- Annual Energy Cost Compliance
- Prescriptive Path.

_____ Presentation of final results

_____ Any known budget restrictions: Please fill in amounts as appropriate. Please check “no budget restrictions” if there are no fixed budget restrictions at this time and you are simply looking for NMR to provide a preliminary budget estimate based on your selection of the options you would like to incorporate in the 2011 baseline study.

_____ Budget limit for baseline study of single family housing

_____ Budget limit for baseline study of multifamily housing

_____ Total budget limit—for both single family and multifamily housing

_____ No set budget restrictions at this time

_____ Other: Please explain.

Timing: When proposed budget is needed to submit to others for approval. _____

APPENDIX B 2011 Baseline Single-Family On-site Survey Questions Checklist

Below are all the questions asked on site in the 2008 Vermont and 2005 Massachusetts baseline studies. Following up on Wednesday's conference call, please indicate for each question if you would ask it on site, would not ask the question, or would ask the question in a phone survey of buyers of new homes. In some cases you may want to ask the question on site and also in the phone survey. Please note that this exercise is to get an initial idea of what team members would like to see in an on-site survey. Responses will be summarized and presented for discussion in the next conference call.

Also several team members expressed interest in possibly conducting a full-scale home buyer/owner phone survey and recruiting participants for the 2011 Baseline Study from home buyers/owners who completed the phone survey, please indicate below if you:

_____ Would like to conduct a phone-based full blown homebuyer survey and recruit participants for the 2011 Baseline Study from survey respondents. (*This is what was done in the Vermont study.*)

_____ Would like to recruit homeowners for the baseline study from new service requests and conduct a short survey of the homeowner on site at the time of the inspection (*This is what was done in the Massachusetts study.*)

_____ Other: This could be a combination of questions asked on site and by phone of participants recruited from new service requests or some other approach.

Vermont On-Site Survey Questions:

1. **YES___ NO___ IN FULL PHONE SURVEY___** Thinking of your home as it is right now, are you aware of any additional things that could be done to save energy in your home, either electricity or heating fuel?
 - _____
2. **YES___ NO___ IN FULL PHONE SURVEY___** What factors have kept you from taking action on these? (DO NOT READ LIST, CHECK ALL. TRY TO GET UP TO 3 RESPONSES ALONG WITH PRIORITY 1 - 3).
 - Cost too much / can't afford it / don't have the money / etc.
 - Don't have the skill or knowledge / not sure how to do it / etc.
 - Don't have the tools
 - Need someone to show me
 - Need someone to help me
 - Physically unable to do it

- Other
(SPECIFY)_____.

3. **YES___ NO___ IN FULL PHONE SURVEY___** Are you satisfied with the thermal comfort of your home? ___Y ___N

If No, ask what are the concerns and record below:

4. **YES___ NO___ IN FULL PHONE SURVEY___** What is the one thing about the thermal performance of your house you would most like to change?

5. **YES___ NO___ IN FULL PHONE SURVEY___** I am going to read a list of some reasons why people participate in energy conservation programs. On a scale of 0 to 10, with 0 meaning not at all a reason for you, and 10 meaning a very important reason to you, please rate each reason as I read it:

	Not at All → Very Important											
	0	1	2	3	4	5	6	7	8	9	10	
A. It's good for the environment	0	1	2	3	4	5	6	7	8	9	10	NC
B. It saves money on your electric bill	0	1	2	3	4	5	6	7	8	9	10	NC
C. It saves money on your fuel bill	0	1	2	3	4	5	6	7	8	9	10	NC
D. Your neighbors/friends recommended it	0	1	2	3	4	5	6	7	8	9	10	NC
E. It helps to keep everyone's electric rates down	0	1	2	3	4	5	6	7	8	9	10	NC
F. It will reduce the need for new power plants	0	1	2	3	4	5	6	7	8	9	10	NC
G. It makes your home more comfortable	0	1	2	3	4	5	6	7	8	9	10	NC
H. It prolongs the life of my home	0	1	2	3	4	5	6	7	8	9	10	NC
I. It prolongs the life of my H&AC equipment	0	1	2	3	4	5	6	7	8	9	10	NC

6. **YES___ NO___ IN FULL PHONE SURVEY___** Where would you look for information on available conservation programs?

- The internet. (If so, have you been to EVT's website? ___Y ___N)
- Other (list all)

7. **YES___ NO___ IN FULL PHONE SURVEY___** Would you be willing to pay \$250 for an assessment by a certified contractor? ___Y ___N

8. **YES___ NO___ IN FULL PHONE SURVEY___** If no CFLs are found in the home: Show the customer a CFL. Are you familiar with this type of energy efficient light bulb that you could use in place of a traditional screw-in incandescent bulb?

___Yes – Have you thought about using this type of bulb?

If Yes: Why did you decide not to?

If Yes or No: What might encourage you to try them?

9. **YES___ NO___ IN FULL PHONE SURVEY___** If a second refrigerator or freezer is present and in use: How often do you have this refrigerator or freezer plugged in? Is it plugged in:
1. All the time
 2. Most of time
 3. Occasionally
 4. Never
 5. (Don't know)
10. **YES___ NO___ IN FULL PHONE SURVEY___** Have you considered removing your second refrigerator or freezer?
 ___Yes – What has kept you from removing it?
 ___No – Under what conditions would you consider removing it?
11. **YES___ NO___ IN FULL PHONE SURVEY___** If you were to remove your second refrigerator or freezer, what would you do with it?
- Sell it
 - Trash it
 - Give it to someone else
 - Other

YES___ NO___ Homeowner verification of receipt of incentive payment: My signature below is provided only to verify that I did receive an incentive in the amount of \$_____ for my participation in the VT Residential Market Assessment Evaluation, as previously agreed upon.

2005 Massachusetts On-Site Survey Questions:

YES___ NO___ IN FULL PHONE SURVEY___ Name of Builder or Development:

1. **YES___ NO___ IN FULL PHONE SURVEY___** *(Note: I would ask this on site even if it was asked as part of a full phone homebuyer survey to verify the phone response.)* Which of the following best describes how you purchased your home?
- ___ A. Purchased land and worked with an architect and/or builder to design and build the home.
 - ___ B. Had a house plan and a lot and hired a contractor/builder to build the home.
 - ___ C. Purchased a lot from a builder, selected one of several house plans offered by the builder and selected from various available upgrade options.
 - ___ D. Purchased a home that was under construction and selected from various available upgrade options.
 - ___ E. Purchased a finished home.
 - ___ F. Other→Please describe: _____
2. **YES___ NO___ IN FULL PHONE SURVEY___** How comfortable would you say your home is?

- A. Very comfortable
- B. Somewhat comfortable
- C. Somewhat uncomfortable
- D. Very uncomfortable
- E. Don't know

Comments: _____

3. **YES___ NO___ IN FULL PHONE SURVEY___** Do you have any complaints about your home?
- A. Yes
 - B. No

If yes, would you describe your complaints? _____

4. **YES___ NO___ IN FULL PHONE SURVEY___** Did your builder or real estate agent talk to you about energy efficiency or the benefits of energy-efficient windows, heating and cooling equipment, insulation, etc.?
- A. Yes
 - B. No
 - C. Do not remember

Comments: _____

5. **YES___ NO___ IN FULL PHONE SURVEY___** Did you ask your builder or the real estate agent marketing your home about energy efficiency?
- A. Asked about energy efficiency
 - B. Did not ask about energy efficiency
 - C. Do not remember

Comments: _____

6. **YES___ NO___ IN FULL PHONE SURVEY___** How important was *getting a home that is energy efficient* in your decision to buy or build this particular home? Using a scale from 0 to 10, where 0 is "one of the least important features" and 10 is "one of the most important features." Please circle your response:

One of the least important features	One of the most important features
0	10
1	
2	
3	
4	
5	
6	
7	
8	
9	

7. **YES___ NO___ IN FULL PHONE SURVEY___** How strongly do you agree or disagree with the following statement: "All new homes are equally energy-efficient"?

- A. Strongly agree
- B. Agree
- C. Neither agree or disagree
- D. Disagree
- E. Strongly disagree
- F. Do not know

8. **YES___ NO___ IN FULL PHONE SURVEY___** How energy efficient do you think your home is compared to other new homes?

- A. Much more energy efficient
- B. Somewhat more energy efficient
- C. About as energy efficient as most other new homes
- D. Somewhat less energy efficient
- E. Much less energy efficient
- F. Do not know

Why do you say that? _____

9. **YES___ NO___ IN FULL PHONE SURVEY___** *(Note: I would ask this on site even if it was asked as part of a full phone homebuyer survey to verify the phone response. When analyzing the Vermont phone survey responses to this question I came to the conclusion that many homebuyers who said they selected the building component may have been involved in the decision, but did not really specify the component. For example, they may have decided to install a boiler rather than a furnace, but had no input on the efficiency of the heating system; they may have selected the style of window, but not the U-value; they may have specified that they wanted central air conditioning, but not the SEER; etc.)* If you purchased your home before it was completed and had the opportunity to choose various options for your home, please fill in the following table by putting an X in the column that best describes who made the decision for each of the following components in your home:

Option	I specified	Builder chose	Selected from options offered by the builder	Do not know
Windows				
Heating System				
Central Air Conditioning				
Water Heater				
Kitchen Appliances				
Framing (2 x 4 or 2 x 6)				
Type of insulation				
Level of insulation				
Lighting fixtures				

10. **YES___ NO___ IN FULL PHONE SURVEY___** In the following table, please put an X in the column that best describes how energy efficient you believe each of the listed components is in your home, including putting an X in the “ENERGY STAR® Labeled” column if you know it is an ENERGY STAR-labeled product.

Home Component	ENERGY STAR Labeled	Very energy efficient	Average	Not energy efficient	Do not know
Windows					
Heating System					
Central Air Conditioning					
Water Heater					
Refrigerator					
Dishwasher					
Clothes Washer					
Type of insulation					
Level of insulation					
Lighting fixtures					

11. **YES___ NO___ IN FULL PHONE SURVEY___** Have you ever seen or heard of the ENERGY STAR label?

- A. Yes
- B. I’ve seen it but don’t know what it means
- C. No
- D. Do not know

Comments: _____

12. **YES___ NO___ IN FULL PHONE SURVEY___** Have you ever seen or heard of a newly constructed home being referred to as an ENERGY STAR home?

- A. Yes
- B. No (SKIP TO QUESTION 21)
- C. Do not know (SKIP TO QUESTION 21)

Comments: _____

13. **YES___ NO___ IN FULL PHONE SURVEY___** Where did you first hear about ENERGY STAR homes?

14. **YES___ NO___ IN FULL PHONE SURVEY___** Are you aware of the ENERGY STAR Homes Program funded by Massachusetts (*would customize*) utilities and energy efficiency providers, specifically tailored for Massachusetts (*would customize*) home buyers and builders?
 ___ A. Yes
 ___ B. No
 ___ C. Do not know
15. **YES___ NO___ IN FULL PHONE SURVEY___** Did you know about ENERGY STAR homes before you started shopping for your new home, or did you learn about ENERGY STAR homes after you started shopping?
 ___ A. Already knew before I started shopping
 ___ B. Learned after I started shopping
 ___ C. Do not remember
16. **YES___ NO___ IN FULL PHONE SURVEY___** Did you visit an ENERGY STAR home while you were shopping for your home?
 ___ A. Yes → How many ENERGY STAR homes did you visit? ___
 ___ B. No
 ___ C. Do not know
17. **YES___ NO___ IN FULL PHONE SURVEY___** Did any builders or real estate agents you talked to while shopping for a home bring up the subject of ENERGY STAR homes?
 ___ A. Yes → What did they tell you about ENERGY STAR homes?

 ___ B. No
 ___ C. Do not remember
18. **YES___ NO___ IN FULL PHONE SURVEY___** Did you ask any builders or real estate agents about ENERGY STAR Homes when you were making your plans for building or buying a home?
 ___ A. Yes → What did they tell you about ENERGY STAR homes?
 ___ B. No
 ___ C. Do not remember
19. **YES___ NO___ IN FULL PHONE SURVEY___** Have you visited the energystarhomes.com website? (*customize website address*)
 ___ A. Yes
 ___ B. No (SKIP TO QUESTION 21)
 ___ C. Do not remember (SKIP TO QUESTION 21)
20. **YES___ NO___ IN FULL PHONE SURVEY___** Did you find the website useful?
 ___ A. Yes → What did you find most useful? _____

- B. No → What do you think would make the website more useful to people shopping for a new home? _____
21. **YES** **NO** **IN FULL PHONE SURVEY** Are you a first-time home buyer, or did you already own a home before you bought this one?
 A. First-time home buyer
 B. Already owned home
 C. Don't know or prefer not to answer
22. **YES** **NO** **IN FULL PHONE SURVEY** Including yourself, how many people live in your household most of the year?
 A. Number of year-round occupants _____
 B. None—seasonally occupied
 C. Prefer not to answer
23. **YES** **NO** **IN FULL PHONE SURVEY** What is the highest level of education that you have completed?
 A. Less than high school
 B. High school graduate
 C. Technical or trade school graduate
 D. Some college
 E. College graduate
 F. Some graduate school
 G. Graduate degree
 H. Prefer not to answer
24. **YES** **NO** **IN FULL PHONE SURVEY** What is your age?
 A. 18 to 24
 B. 25 to 34
 C. 35 to 44
 D. 45 to 54
 E. 55 to 64
 F. 65 or over
 G. Prefer not to answer
25. **YES** **NO** **IN FULL PHONE SURVEY** What category best describes your total household income in 2004, before taxes?
 A. Less than \$35,000
 B. \$35,000 to \$49,999
 C. \$50,000 to \$74,999
 D. \$75,000 to \$99,999
 E. \$100,000 to \$149,999
 F. \$150,000 or more
 G. Prefer not to answer

Other Questions

Please list any other questions you would like asked on site at the time of the inspection:

- 26. _____
- 27. _____
- 28. _____
- 29. _____
- 30. _____
- 31. _____

THANK YOU!