The Massachusetts New Homes with ENERGY STAR® Program
Version 3 Pilot Evaluation

FINAL REPORT

May 31, 2011

Submitted to:

The Massachusetts New Homes with ENERGY STAR Program

Joint Management Committee

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Table of Contents

EXECUTIVE SUMMARY I

FINDINGS II

Pilot Participants II

Builder Interviews III

HERS Rater Interviews III

HVAC Contractor Interviews IV

CONCLUSIONS V

RECOMMENDATIONS V

1 INTERVIEW SAMPLES 1

1.1 BUILDER SAMPLE 1

1.2 HERS RATER SAMPLE 5

1.3 HVAC CONTRACTOR SAMPLE 6

2 PILOT PARTICIPANTS 9

2.1 BUILDERS 9

2.1.1 Changes to Meet Version 3 Requirements 9

2.1.2 Builder Additional Time Required 10

2.1.3 Builder Difficulty Meeting Version 3 Requirements 10

2.1.4 Custom-Home Client Impact on Ability to Meet Version 3 Requirements 10

2.1.5 Builder Satisfaction 11

2.1.6 If You Had It to Do Over Again 11

2.2 HERS RATERS 12

2.2.1 Working with Pilot Builders 12

2.2.2 HERS Rater Satisfaction with the Pilot Process 13

2.3 HVAC CONTRACTORS 14

3 BUILDER INTERVIEWS 16

3.1 VERSION 3 TRAINING 16

3.1.1 Satisfaction with Version 3 Training Sessions 16

3.1.2 Additional Version 3 Training Needs 17

3.1.3 Training for Builders Who Did Not Participate in the Pilot or Training Sessions . 17
3.1.4 Should Training Include Information on Costs? 18
3.1.5 Best Training Approaches 19
3.2 BUILDING ENERGY STAR-QUALIFIED HOUSING 21
3.2.1 Value of the ENERGY STAR Label 23
3.2.2 Plans Going Forward 26
3.2.3 Value of HERS Rater Services 27
3.2.4 Paying Rater Fees if Not Subsidized by Program 28
4 HERS RATER INTERVIEWS 29
4.1 TRAINING 29
4.2 GOING FORWARD—WORKING WITH BUILDERS 30
4.3 VERSION 3 IMPACT ON COST OF HOMES 32
4.4 LIKELIHOOD OF BUILDERS MAKING CHANGES 33
4.5 IMPORTANCE OF BUILDING TO ENERGY STAR STANDARDS 36
4.6 NEW TECHNOLOGIES AND INCREASED SAVING OPPORTUNITIES 38
4.6.1 New Technologies 38
4.6.2 REM/Rate Modeling Issues 40
4.7 INCREASING SAVINGS 40
5 HVAC CONTRACTOR INTERVIEWS 42
5.1 CHECKLIST REQUIREMENTS AND STANDARD PRACTICES 42
5.1.1 Additional Cost to Meet checklist Requirements 45
5.2 HVAC CONTRACTOR TRAINING 46
5.2.1 HVAC Training Approaches 46
5.3 VALUE OF BEING ABLE TO MEET VERSION 3 HVAC REQUIREMENTS 48
5.4 HVAC DISTRIBUTOR INPUT 49
APPENDIX A PARTICIPANT BUILDER INTERVIEW GUIDE A-1
APPENDIX B NON-PARTICIPANT BUILDER INTERVIEW GUIDE B-1
APPENDIX C PARTICIPANT HERS RATER INTERVIEW GUIDE C-1
APPENDIX D NON-PARTICIPANT HERS RATER INTERVIEW GUIDE D-1
APPENDIX E PARTICIPANT HVAC CONTRACTOR INTERVIEW GUIDE E-1
APPENDIX F NON-PARTICIPANT HVAC CONTRACTOR INTERVIEW GUIDE. F-1

Tables

TABLE 1-1: TYPE OF HOUSING BUILT 2
TABLE 1-2: BUILDER DEMOGRAPHICS 2
TABLE 1-3: HERS RATER DEMOGRAPHICS 5
TABLE 1-4: HVAC CONTRACTOR DEMOGRAPHICS 6
TABLE 4-1: ENERGY STAR BUILDING EXPERIENCE 21

Figures

FIGURE 1-1: YEARS BUILDING HOMES 3
FIGURE 1-2: TOTAL NUMBER OF HOMES BUILT 3
FIGURE 1-3: NUMBER OF HOMES BUILT IN LAST TWO YEARS 4
FIGURE 1-4: PRICE RANGE OF HOMES BUILT 4
FIGURE 3-1: SATISFACTION WITH VERSION 3 TRAINING 16
FIGURE 3-2: BUILDER TRAINING APPROACHES 20
FIGURE 4-1: YEARS BUILDING ENERGY STAR HOMES 22
FIGURE 4-2: NUMBER OF ENERGY STAR HOMES BUILT 22
FIGURE 4-3: VALUE OF ENERGY STAR LABEL 23
FIGURE 4-4: ENERGY STAR INCREASES MARKETABILITY 23
FIGURE 4-5: BUYERS LOOKING FOR ENERGY STAR HOMES 25
FIGURE 4-6: PLANS FOR MEETING NEW REQUIREMENTS 26
FIGURE 4-7: VALUE OF HERS RATER SERVICES 27
FIGURE 4-8: LIKELIHOOD OF PAYING HERS RATER FEES 28
FIGURE 5-1: HOW DIFFICULT FOR BUILDERS TO INCORPORATE VERSION 3 REQUIREMENTS 30
FIGURE 5-2: ADDITIONAL TIME TO WORK WITH VERSION 3 HOMES 31
FIGURE 5-3: HOW BASIC FEES WILL CHANGE 31
FIGURE 5-4: IMPACT OF VERSION 3 ON COST OF HOMES 32
FIGURE 5-5: BUILDER WILLINGNESS TO NOT USE FIBERGLASS BATTS 34
FIGURE 5-6: BUILDER WILLINGNESS TO USE 24 INCH ON-CENTER STUD SPACING 34
FIGURE 5-7: BUILDER WILLINGNESS TO CONSIDER SIPS 34
FIGURE 5-8: BUILDER WILLINGNESS TO CHANGE HVAC CONTRACTORS 35

FIGURE 5-9: BUILDER WILLINGNESS TO USE CONTINUOUS RIGID INSULATION SHEATHING 35
FIGURE 5-10: BUILDER WILLINGNESS TO USE ADVANCED FRAMING TECHNIQUES 35
FIGURE 5-11: BUILDER WILLINGNESS TO USE DOUBLE-FRAMED WALLS 36
FIGURE 5-12: VALUE OF HAVING HOMES ENERGY STAR QUALIFIED 36
FIGURE 5-13: HOW LIKELY BUILDERS WILL BE TO INCORPORATE VERSION 3 REQUIREMENTS 37
FIGURE 8-2: MANUAL J DONE 43
FIGURE 5-2: HVAC CONTRACTOR TRAINING APPROACHES 47
FIGURE 8-3: VALUE OF MARKETING ABILITY TO MEET VERSION 3 REQUIREMENTS 48
FIGURE 8-4: HVAC CONTRACTOR VERSION 3 TRAINING REQUIREMENT 49

Executive Summary

This report evaluates the Version 3 Evaluation Pilot (Pilot) conducted in 2010. The intent of the Pilot was to take a proactive approach to preparing the Massachusetts New Homes with ENERGY STAR Program (Program) and its participants for ENERGY STAR Version 3 Guidelines. By working with six builders and their Home Energy Rating System (HERS) raters to construct and verify homes that tried to meet Version 3 guidelines, the Pilot gathered direct, local information that will allow for adequate planning and preparation for the Version 3 changes and help minimize Program disruptions and ensure goal achievement. The ICF team implementing the Pilot met with the builders and HERS raters during construction including, typically, at least one on-site visit to each project. As described in the ICF report on the Pilot,

> *"For each project, the ICF team interviewed the builder and HERS rater to determine the greatest challenges meeting the new checklists and the more stringent HERS Index requirement. Each builder and HERS rater was interviewed at least twice during the construction process. During the interviews, the ICF team went over the new checklists line-by-line to ask questions. Specific attention was given to checklist requirements that were new or had changed since the Version 2 checklists."*

Two of the six homes met all Version 3 requirements and four did not; the builders of the four homes that failed to meet some Version 3 requirements knew during construction that their homes would not meet all the requirements. The final ICF report on Pilot implementation has more details, including a detailed analysis of each Pilot home.

The focus of this report is on lessons learned from the Pilot and issues the Program will face going forward to keep existing builders in the Program, as well as recruit new builders, as ENERGY STAR Version 3 requirements take effect.[1] In-depth interviews were conducted with 17 builders, 11 HERS raters, 10 Heating, Ventilating, and Air Conditioning (HVAC) contractors and one HVAC distributor. Interviewees include all six builders who participated in the Pilot and the HERS raters they worked with, as well as two of the HVAC contractors who worked on Pilot homes with ducted HVAC systems.

All six participating homes achieved the HERS indices they needed to meet Version 3 requirements, but only two homes passed all Version 3 checklist requirements. The two homes that had boiler heating systems and did not have ducts met all Version 3 requirements. The four homes that had ducted HVAC systems failed to meet HVAC checklist, QIV (Quality Installation

[1] As of 2011 the Massachusetts New Homes with ENERGY STAR Program does not require participating homes to be ENERGY STAR qualified; to qualify for incentives, participating homes are required to meet one of three performance Tiers based on savings compared to a baseline Massachusetts home. However, homes will be required to meet section 3 (Fully Aligned Air Barriers) and section 5 (Air Sealing) of the ENERGY STAR Version 3 Thermal Enclosure checklist (TEC).

Verification), and the TEC (Thermal Enclosure checklist) Grade I insulation installation requirements.[2]

Findings

Pilot Participants

Builders: Participating builders say they made very few changes in their building plans or building process for the Pilot homes. They say they found the changes required to meet Version 3 requirements easy to make. Four builders say there was no added construction time. All six builders say they received all the support they wanted or needed from ICF staff and their HERS raters to help them meet Version 3 requirements. All six builders who participated in the Pilot say they plan to have all their 2012 homes meet Version 3 requirements.

HERS Raters: The HERS raters working with the builders of the Pilot homes say the builders did not try that hard to meet Version 3 requirements, but they did learn what would be expected in the future. Builders needed the most help with, and found it hardest to meet, Version 3 HVAC and TEC checklists. In several cases, the HVAC contractor could not meet Version 3 requirements. Achieving Grade I insulation installation, reducing thermal bridging and sealing sheetrock to the top plate at all attic/wall interfaces[3] were challenging for the builders. HERS raters say they spent much more time working with the Pilot homes than they do with a typical Version 2 home. HERS raters cited the things they would have liked to have seen done differently in the Pilot:

- More effort to get projects in the planning stage
- ICF push participants harder to achieve Version 3 compliance
- In-person kick-off and final debriefing meetings with all the participating builders and raters to address questions and concerns and provide cross pollination of ideas and experiences

HVAC Contractors: Neither of the two interviewed HVAC contractors who worked on Pilot homes knew that the homes were participating in the Pilot and neither said the purpose of the Pilot was explained to them. They also say there was nothing in their contracts with the builders about passing the Version 3 checklists. Neither HVAC contractor was aware that the Pilot homes they worked on failed to meet some of the requirements of the HVAC checklists. After being told what checklist requirements their homes failed, these HVAC contractors said they could address these issues in future homes; one estimated the added cost would be $200 and the other said for a 2,000 square foot home $15,000 installation it would add $300 to $500 dollars.

[2] The two interviewed HVAC contractors who worked on Pilot homes say there was nothing in their contracts with the builders requiring that the homes pass Version 3 HVAC checklists requirements; this may be because the homes were already under construction when they were recruited to participate in the Pilot.

[3] TEC checklist requirement: Sheetrock sealed to top plate at all attic/wall interfaces using silicone caulk, latex foam, or equivalent material. Construction adhesive shall not be used.

Builder Interviews

Interviewed builders say they would like more training in several areas to ensure they will be able to meet Version 3 requirements. Different builders prefer different training approaches, suggesting a variety of training approaches will likely be needed. Most builders (12 of 17) say they think their HVAC contractors could meet Version 3 requirements, but only three were **confident** that their HVAC contractors would be both able and willing to meet Version 3 requirements; those not confident are willing to consider hiring a different HVAC contractor who would guarantee meeting Version 3 requirements.

The majority of interviewed builders (10 of 17) say that being able to market their homes as ENERGY STAR qualified is very valuable and 11 say they think being ENERGY STAR qualified increases the marketability of their homes. Going forward, 16 of the 17 interviewed builders say they plan on having all the homes they build in 2011 be ENERGY STAR qualified and 13 say they plan to have the homes they build in 2012 meet the new Version 3 ENERGY STAR requirements. However, when asked how likely they would be to pay the HERS rater fees and continue to have their homes ENERGY STAR qualified if the Program no longer subsidized HERS rater fees, only five builders say they would definitely or be very likely to pay HERS rater fees if they were not subsidized.[4]

HERS Rater Interviews

All 11 HERS raters who certified ENERGY STAR homes in the 2010 Program were interviewed; two worked with the Pilot homes. At the time of the interviews, only three of the nine interviewed HERS raters who did not work with Pilot homes said they felt adequately trained/prepared to explain the Version 3 requirements to the builders they work with and to help them meet those requirements. (All raters plan on taking the two-day training required for raters verifying ENERGY STAR Version 3 homes.) Most interviewed HERS raters (7 of 11) think it will be somewhat or very difficult for the builders they work with to incorporate Version 3 requirements by 2012. They also expect to spend more time on inspections and support for a Version 3 home compared to a Version 2 home. Four say they expect their basic fees will increase for working with Version 3 homes, three say their fees will not change, and four say fee changes will vary significantly from builder to builder. Regarding making changes that could help meet Version 3 requirements, HERS raters say they think builders will be least likely to use double-framed walls and use something other than fiberglass batts to insulate floors; they will be most likely to consider using advanced framing techniques and hiring a different HVAC contractor. Looking ahead, only two HERS raters say the builders they work with will be at least somewhat likely to incorporate Version 3 requirements; three say it is unlikely and six expect it will vary significantly from builder to builder.

[4] All homes participating in the Program, whether or not they are seeking ENERGY STAR certification, will require working with a HERS rater.

HVAC Contractor Interviews

Five of the eight interviewed HVAC contractors who did not work on a Pilot home say they are aware of the Version 3 checklists. The interviewed HVAC contractors work primarily in the retrofit market, not new construction. They say they can't compete price-wise on new construction projects—builders want to pay as little as possible. Nine of the ten HVAC contractors are Cool Smart contractors; when asked about specific HVAC checklist requirements they tended to say they meet them on Cool Smart and new construction jobs, but not other jobs. The only two Version 3 requirements that all interviewed HVAC contractors say are their standard practice are sealing ducts with a mastic product and insulating ducts. No interviewed HVAC contractors say the Version 3 requirements to measure room-by-room air flow and pressure balance ducts are their standard practice. Interviewed HVAC contractors estimated that typical, non-Cool Smart HVAC contractors would charge an additional $500 to $3,000 per home for meeting Version 3 requirements, which is much higher than what the two HVAC contractors who worked on Pilot homes that failed to meet HVAC checklist requirements said it would have cost for them to make the changes necessary to meet checklist requirements.

Interviewed HVAC contractors say they currently have the in-house expertise to fulfill the Version 3 HVAC installation requirements, but would like additional training in several areas and want to know exactly what they will be expected to do. Before being interviewed, only three contractors were aware of the training required for HVAC contractors who work on Version 3 ENERGY STAR-qualified homes.[5] However, after being told of this requirement, eight of the ten contractors say they plan to attend the training and one said he has already completed the training.

The HVAC distributor says HVAC contractors will not want to work on Version 3 homes unless they are adequately compensated for the additional time and work involved in meeting Version 3 requirements, and that builders will continue to look for the lowest cost option. Based on his experience offering various training courses to HVAC contractors he says, currently, most HVAC contractors are not prepared to meet Version 3 HVAC checklist requirements and do not understand what they will be required to do.

[5] HVAC contractors who wish to install systems in ENERGY STAR Version 3 homes will be required to be 'credentialed' by an EPA–recognized third–party training and oversight organization (H-QUITO). HVAC contractors seeking to be credentialed by an H-QUITO must:

- Attend an HVAC QI/ENERGY STAR orientation training class offered by the H-QUITO;
- Submit an application to the H-QUITO that demonstrates that they possess the knowledge, skills, and abilities (e.g., through training, work experience, and/or company policies) to effectively deliver the HVAC Quality Installation services required in the ENERGY STAR HVAC QI checklist); and
- Be subject to quality assurance oversight by the H-QUITO.

Source: http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_hvac_contractors

Conclusions

The following conclusions are based on study findings:

- Many builders will find it hard to implement all Version 3 requirements in 2012. There will be a learning curve and there will be at least some increase in the cost of building a Version 3 compliant ENERGY STAR home.
- Given that only two interviewed HERS raters say the builders they work with will be at least somewhat likely to incorporate Version 3 requirements, the Program's decision to no longer require all participating homes to be ENERGY STAR qualified will help the Program retain currently participating builders and bring new builders into the Program.
- When interviewed, few builders or HVAC contractors felt they fully understood exactly what would be required to meet Version 3 requirements. Likewise, many HERS raters felt at least somewhat unprepared to clearly explain Version 3 requirements to builders and provide the support they would need to meet the new requirements. This situation should improve greatly as builders, HERS raters and HVAC contractors take the training required to work on homes seeking to comply with Version 3 requirements.
- Builders who attended training that addressed code changes, Version 3 requirements and changes in the 2011 Massachusetts Program found it confusing.
- Cost will be a key factor in builders' willingness to make the changes that will enable them to meet Version 3 requirements; depending on what a builder's current building practices are these changes could be anything from minor to significant.

Recommendations

Based on study findings, the NMR team makes the following recommendations. Several recommendations address training needs. It may be premature to determine **exactly** what training will be needed until builders, HERS raters and HVAC contractors have completed the training required to work on a Version 3 home and had a chance to become familiar with the guidebooks for the mandatory Version 3 checklists. When interviewed, none of the builders or HERS raters and only one of the HVAC contractors interviewed had completed the required training or, for HVAC contractors, completed the process to be credentialed.

- Keep training on code changes and Version 3 requirements separate, to the extent possible. Interviewed builders who attended training covering both topics found it confusing.
- Focus builder training on new TEC section 3 and section 5 requirements that are expected to be the most challenging for builders: One example is the TEC section 5 requirement that sheetrock be sealed to the top plate at all attic/wall interfaces using caulk, foam, or equivalent material. HERS raters say builders are trying out different approaches for meeting this requirement. It may require the sheetrock crew to come back a second time, which is costly and impacts the construction schedule. EnergyComplete™ from Owens

Corning is a spray on gasket that can be used at the same time the sheet rock is put up, but the cost is high.

- Offer training in a variety of formats and use trainers with hands-on experience: Some builders and HVAC contractors prefer classroom training; others prefer more hands-on field training. They also like the idea of having webinar presentations or videos of training presentations available online to view at their convenience. For all training, interviewees stressed the importance of using trainers who have extensive hands-on experience. Also, encourage HVAC contractors to take advantage of other available training options: ACCA (Air Conditioning Contractors of America) and supply houses offer several training options to help contractors interested in being prepared to meet Version 3 requirements.[6] HVAC contractors could also be encouraged to consider participating in the Cool Smart Program, which offers multiple training courses, including training to offer ENERGY STAR Quality Installations (ESQI).
- Include HERS raters in any Program sponsored HVAC contractor training: The interviewed HVAC contractors and distributor say it would be useful to have a HERS rater at trainings to explain exactly what HVAC contractors are expected to do in a qualifying home, especially if they are going to guarantee in their contract with the builder that the home will meet Program requirements.
- Review the timeline for moving to an open HERS rater market: Assess the potential negative impact on Program participation of asking builders to assume the full cost of HERS rater services at the same time that builders interested in meeting Version 3 requirements will likely need more HERS rater support and need to pay more for HVAC contractors able to meet Version 3 requirements. Hitting builders with two cost increases at the same time may negatively affect participation.

[6]https://www.acca.org/education/online/classes

1 Interview Samples

In-depth interviews were conducted with 17 builders, 11 HERS raters and 10 HVAC contractors. In addition, we talked with one HVAC distributor. The 17 interviewed builders include the 6 builders who participated in the Pilot; 10 who attended either the presentation on Version 3 requirements given by Sam Rashkin (EPA National Director ENERGY STAR for Homes) on July 30, 2010 in Lexington, MA or the Version 3 training session conducted by ICF on November 17, 2010 in Hadley, MA; and one large production builder who was unable to attend the training session he signed up for, but had someone else from his company attend and reviewed the information presented. Builder interviews were conducted from late January through early March 2011. Interviews ranged in length from 24 minutes to one hour; the average length of the interviews was 46 minutes for the 6 builders who participated in the pilot and 33 minutes for the other 11 builders.

There are now 29 HERS rating companies that builders can choose to work with listed on the masssave.com website. The 11 interviewed HERS raters represent the 11 rating companies that certified homes in 2010; 2 of the interviewed raters worked with the builders of the 6 Pilot homes. HERS rater interviews were conducted from late January through late February 2011. Interviews ranged in length from one-half hour to two and one-half hours; the average length of the interviews was just over one hour.

The ten interviewed HVAC contractors include two of the four contractors who worked on Pilot homes with ducted HVAC systems. Two contractors who worked on Pilot homes with ducted systems were not interviewed. These contractors agreed to being interviewed, but were not available when called at the scheduled interview time; this happened several times with each of these contractors. HVAC contractor interviews were conducted from late January through early May 2011. Interviews ranged in length from 28 minutes to 1 hour 20 minutes; the average length of the interviews was 52 minutes.

1.1 Builder Sample

Sample demographics are summarized in Table 1- and Table 1-. Table 1- shows the types of housing built by interviewed builders. One builder who participated in the Pilot has only built single-family detached homes and one of the builders who did not participate in the pilot builds only million-dollar-plus luxury homes; 15 of the 17 interviewed builders build multiple types of housing. The “other” housing category includes two builders who participated in the Pilot and five other builders. Of the two builders who participated in the Pilot, one does some small commercial building and one does renovations and additions. Of the five other builders, one does renovations, one does gut rehabs, one does some light commercial work, one does remodeling and light commercial, and one says he is a general contractor who does everything—renovations, commercial and industrial projects.

Table 1-: Type of Housing Built

Type of Housing Built	V3 Pilot Builders (n=6) (Multiple Responses)	Other Builders (n=11) (Multiple Responses)	All Builders (n=17) (Multiple Responses)	Percent of All Builders (n=17)
Single-Family Detached	4	11	15	88%
Single-Family Attached	3	9	12	71%
Multi-Family Market Rate	3	6	9	53%
Multi-Family Affordable	2	6	8	47%
Multi-Family Low Income	2	6	8	47%
Other	2	5	7	41%

Table 1- summarizes how long the interviewed builders have been building homes, how many homes they have built, how many homes they have built in the last two years, and the price range of homes they have built. As shown, both groups of builders, those who participated in the Pilot and those who did not, include a mix of small and large builders with various years of building experience and builders of all types of housing, from low-cost affordable housing to high-cost luxury homes.

Table 1-: Builder Demographics

Builder Demographics	V3 Pilot Builders (n=6)	Other Builders (n=11)	All Builders (n=17)
How long have you been building homes? (Years)			
Minimum	2	11	2
Maximum	23	40	40
Average	14	30	24
Median	15	30	27
About how many homes have you built?*			
Minimum	3	25	3
Maximum	900	3,000	3,000
Average	181	583	432
Median	21	88	71
How many homes have you built in the last two years?			
Minimum	1	1	1
Maximum	30	500	500
Average	13	59	42
Median	7	7	7
Price Range of Homes			
Minimum	$75,000	$100,000	$75,000
Maximum	$1,000,000	$3,000,000	$3,000,000

* One large production builder simply said he has built thousands of homes.

The following figures show the number of interviewed builders falling into various categories of building experience, number of homes built, number of homes built in the last two years and price range of homes built. Figure 1- shows that 8 of the 17 builders have been building homes for 21 to 30 years, 3 from 2 to 10 years, 3 from 11 to 20 years, and 3 from 31 to 40 years.

Figure 1-: Years Building Homes

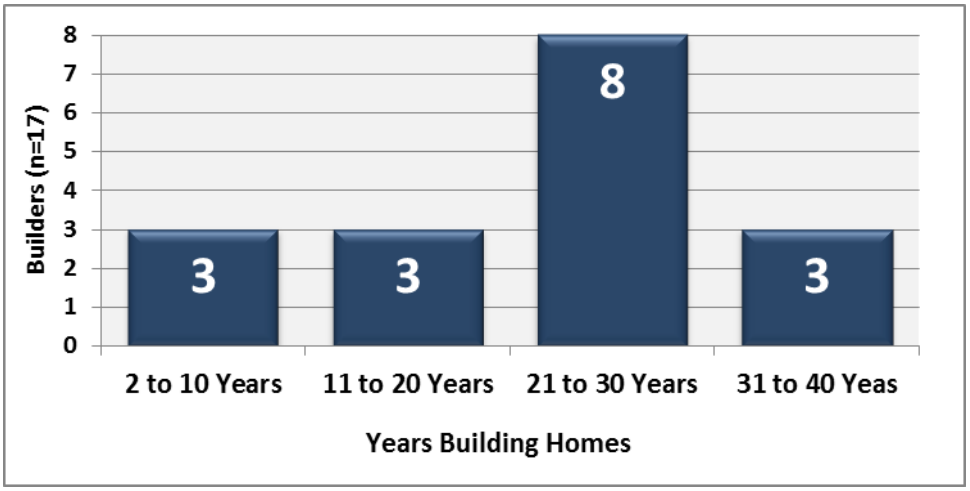
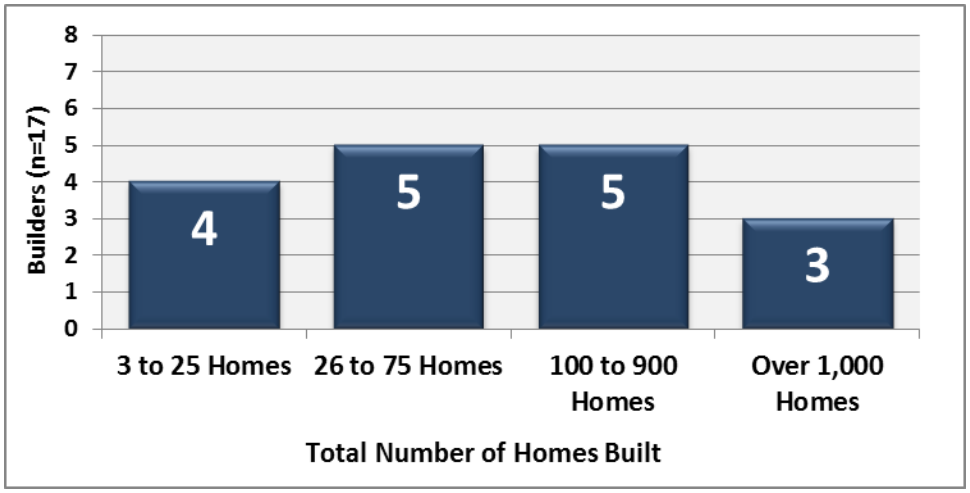


Figure 1- shows that the builder sample includes a mix of small builders and large production builders.

Figure 1-: Total Number of Homes Built



Consistent with Figure 1-, Figure 1- shows that the builder sample includes multiple builders who built 1 or 2 homes, 3 to 5 homes, 6 to 12 homes, or 20 to 30 homes in the last two years. The sample also includes two production builders who build single-family market-rate spec homes; one of these companies is based in Massachusetts and one is a national company.

Figure 1-: Number of Homes Built in Last Two Years

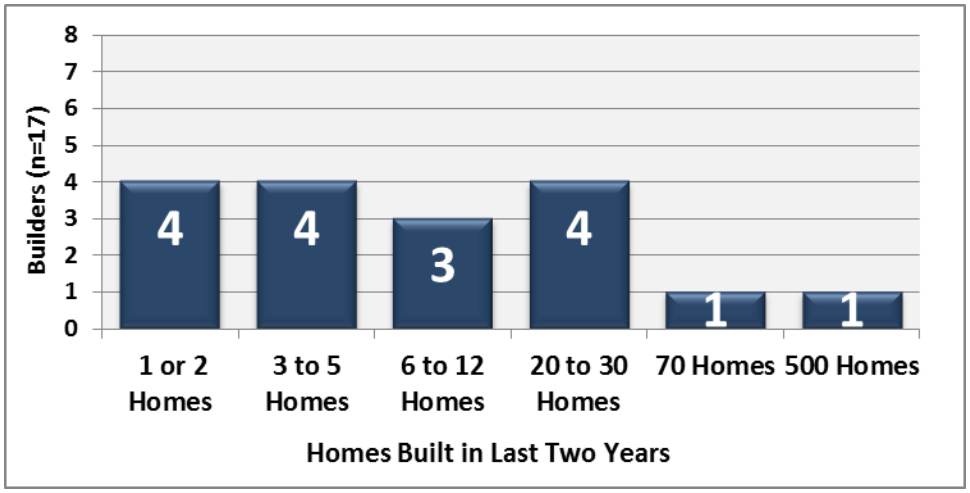
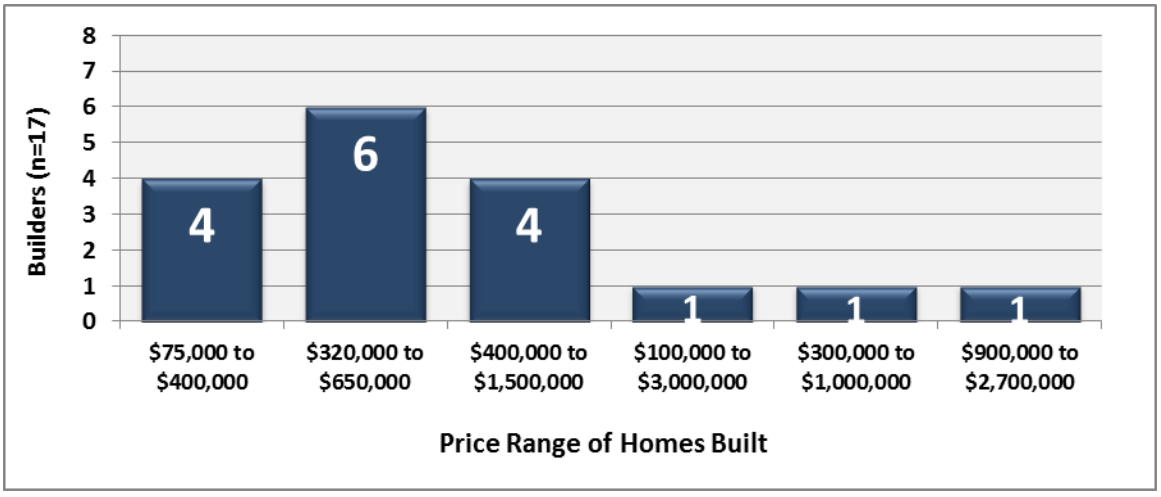


Figure 1- shows builders by the price range of the houses they build. As shown, ten interviewed builders say all their homes are priced $650,000 or lower. Seven builders build homes priced at $1,000,000 or higher. Five of these seven builders build a mix of moderate priced homes and luxury homes; one has built everything from small attached apartment units selling for roughly $100,000 to a $3,000,000 custom home; and one builds only high-cost luxury homes.

Figure 1-: Price Range of Homes Built



1.2 HERS Rater Sample

Interviewed HERS raters include raters from all the rating companies with certified homes in the 2010 MA Program. Table 1- summarizes how long the interviewed HERS raters have been certified HERS raters, how long they have been certifying homes in the MA Program, how many ENERGY STAR homes they have certified, and how many builders they are currently working with in the Program. As shown, interviewed HERS raters have been certified from two to ten years: the average is four years and the median is three. They have been certifying homes in the Program from two to four years; the average and median are three years. They have certified from 5 to 550 ENERGY STAR homes; the average is 152 homes and the median is 60. They are currently working with from 1 to 60 builders in the Program; the average is 24 builders and the median is 20.

Table 1-: HERS Rater Demographics

HERS Rater Demographics	HER Raters (n=11)
How many years have you been a HERS rater?	
Minimum	2
Maximum	10
Average	4
Median	3
How long have you been certifying homes in the Program?	
Minimum	2
Maximum	4
Average	3
Median	3
About how many ENERGY STAR homes have you certified?	
Minimum	5
Maximum	550
Average	152
Median	60
How many builders are you currently working with in the Program?*	
Minimum	1
Maximum	60
Average	24
Median	20

1.3 HVAC Contractor Sample

Sample demographics are summarized in Table 1-. As shown, the 10 interviewed HVAC contractors have been HVAC contractors for 7 to 36 years; the average is 18 years and the median is 20. Their companies have from 3 to 65 employees; the average is 17 employees and the median is 8. Hourly rates range from $50 to $132; the average is $82 and the median is $85.

Table 1-: HVAC Contractor Demographics

HVAC Contractor Demographics	HVAC Contractors (n=10)
How many years have you been an HVAC contractor?	
Minimum	7
Maximum	36
Average	18
Median	20
How large is your company (number of employees)?	
Minimum	3
Maximum	65
Average	17
Median	8
What is your hourly installation rate per worker? (n=9 one contractor refused)	
Minimum	$50
Maximum	$132
Average	$82
Median	$85
Do you install boilers (wet work including piping) as well as furnaces and air conditioning?	
yes	10
Do you design and fabricate duct systems or contract the work out?	
Design Only	4
Design and Fabricate	3
Depends on Job	2
Contract Work Out	1
Are you NATE (North American Technician Excellence) certified?	
Yes	8
No	2
Have you installed HVAC systems in ENERGY STAR homes?	
Yes	7
No	3

All ten install boilers (wet work including piping) as well as furnaces and air conditioning systems; one also mentioned that he installs biomass and solar systems.[7] Four only design duct

[7] Other interviewed HVAC contractors may install similar systems. The interview guide did not ask about biomass and solar system; one HVA contractor simply volunteered this information.

systems, three design and fabricate duct systems, and two say it depends on the job—in some cases they only design the duct system and in others they design and fabricate the system. One HVAC contractor contracts out his duct design and fabrication work.

Eight of the interviewed HVAC contractors are NATE (North American Technician Excellence) certified and nine are Cool Smart QIV (Quality Installation Verification) Participating Contractors; four are Premier Cool Smart contractors.[8] In addition, four of the interviewed HVAC contractors mentioned that they are certified to handle refrigerants[9] and two that they have BPI (Building Performance Institute) certification. Other certifications mentioned by individual contractors are: Comfort Institute certification, LEED (Leadership in Energy and Environmental Design) certification, Level I certification with infrared FLIR™ cameras, and Level 1 thermographer with Infrared Training Center. In addition to Cool Smart training, six contractors have attended manufacturer training, four have attended training at supply houses, and three have attended ACCA (Air Conditioning Contractors of America) training. The interviewed HVAC contractors are likely better trained than the typical HVAC contractor working on new construction projects. This was intentional; the goal was to interview contractors who had attended training on Version 3 HVAC requirements or were at least somewhat familiar with the Version 3 HVAC checklists.

Seven of the ten interviewed HVAC contractors say they have installed HVAC systems in ENERGY STAR homes. Five of these seven HVAC contractors report installing HVAC systems in ENERGY STAR homes for from one and one-half to six years; the average is four years and the median is five. Two HVAC contractors did not say how many years they have been installing systems in ENERGY STAR homes; one says he installs one or two systems a year in ENERGY STAR homes and the other, who worked on a Pilot home, says he does not know because he does not know if the homes he works on are ENERGY STAR.

Four of the seven interviewed HVAC contractors who say they have installed systems in ENERGY STAR homes were able to report how many ENERGY STAR-qualified homes they have worked on. These four contractors say they have installed HVAC systems in from 3 to 64 ENERGY STAR-qualified homes; the average is 32 homes and the median is 30. One of these contractors, who reports installing systems in 20 ENERGY STAR homes, says the homes were all in one development. Another reports installing systems in 40 ENERGY STAR homes and says that 30 of these homes are in the development where one of the Pilot homes was built. The development where the Pilot home was built was the first ENERGY STAR project this HVAC contractor worked on. Of the three HVAC contractors who say they have installed systems in

[8]All Cool Smart participating contractors are, at a minimum, trained in QIV testing procedures and have completed and passed at least five QIV tests in the past year. Premier Contractors have also been trained in duct diagnostics and have submitted at least three ENERGY STAR Quality Installation (ESQI) forms in addition to the five QIV tests.

[9] All interviewed HVAC contractors are likely certified to handle refrigerants. Interviewees were asked if they were NATE certified and if they worked with the Cool Smart Program, and then asked if they had any other industry certifications. It was an open-ended question and some interviewees likely simply did not mention that they were certified to handle refrigerants.

ENERGY STAR-qualified homes, but were unable to say how many ENERGY STAR homes they have worked on, two say they install systems in a few custom ENERGY STAR homes each year and one does not know if the homes he works on are in the Program.

Only one of the four HVAC contractors who worked on Pilot homes with ducted HVAC systems is on the list of contractors participating in the Cool Smart Program. This contractor was interviewed; the builder he worked with in the Pilot was not satisfied with his work and has since changed HVAC contractors.

2 Pilot Participants

Six builders and two HERS raters participated in the Pilot. One HERS rater worked with five of the builders and the other worked with one builder.

2.1 Builders

All six builders who participated in the Pilot say they learned about the Pilot from their HERS rater. Three builders say their homes were in the planning stage and three say they had started construction when they learned about the pilot. When asked why they decided to participate in the Pilot they responded:

- *"I was happy to do it: the timing was right, the incentive was better and it involved only a little extra time to meet with people."* (Architect)
- "*It sounded intriguing and I thought it would be fun.*"(Owner/Builder)
- "*It seemed that with the structure of that house, and using SIPS* (Structural Insulated Panels)*, it fit in without having to do a lot more.*" (Custom-Home Builder)
- "*Since we started working with ENERGY STAR, in every house we improve one thing. We just like to know what is coming up. We feel good about the fact that for very low income families we can be in the forefront of saving energy costs and making it better for the environment. We have economic limits, but love to see what we can do with limited resources to make this work.*"(Builder of Affordable Housing)
- "*Mainly because my HERS rater encouraged me to—he thought the building was almost in compliance anyway. It was a good thing for us to do so we opted to do it.*" (Production Builder)
- "*I thought it would be something good to do and a good opportunity for me to learn more about the Program, for one thing. My HERS rater gave me ideas of how to improve even more what I am doing now.*" (Production Builder)

2.1.1 Changes to Meet Version 3 Requirements

Builders were asked how their building plan, building process, choice of HVAC equipment, choice of HVAC contractor and budget changed because of participation in the Pilot and effort to meet Version 3 requirements. Builders mentioned very few changes. Three builders say they did not make any changes; they were already working with their HERS raters and up to speed. However, one of these builders decided to work with a different HVAC contractor after participating in the Pilot. Three builders described the minor changes they made as follows:

- *"We knew about ENERGY STAR during the planning and designing. Some insulation details changed—got beefed up."* (Production Builder, Single-Family Attached Home)
- *"Nothing really changed, we were just more conscientious. We did add some back-up equipment, basically for ventilation because we have radiant heat."*(Custom Home)

- *"We analyzed tradeoffs and were able to add triple glazed windows and downsize the HVAC system. Access to our HERS rater made it possible to analyze tradeoffs."* (Custom Home)

2.1.2 Builder Additional Time Required

Builders were asked how much additional time was required to meet Version 3 requirements. One builder says it took no additional time and three say there was no additional construction time, but from 5 to 20 additional hours for meetings and administrative paperwork. One builder says it took one extra 10 hour day. One said it did not take much additional time for the Pilot home, but building a different house using a different construction method would add more time.

2.1.3 Builder Difficulty Meeting Version 3 Requirements

Builders were asked what changes required to meet Version 3 requirements they found most difficult to meet, or understand, and what changes they found relatively easy to meet. Five of the six builders found the changes easy to make. One builder says she didn't need to make any changes. Two say the changes were all easy, one says the changes were pretty easy, and one says that, for the most part, the changes were not very challenging. The builder who described the changes as "pretty easy" commented:

> *"We just squeaked in there to be honest. We were thinking we might have to do some on-site solar and that would have been a stretch. We did set up the home as renewable ready—chases from boiler to roof and the roof pitch is correct. We did everything we could to reduce the heat load; it was not worth spending another $23,000 for a solar water system. We did look into it in some detail."*

The sixth builder, a production builder, says the performance requirements were easiest because he was already meeting a lot of them. He found the Pilot requirements relatively easy to comply with since he was already at that level because he was also participating in the NAHB (National Association of Home Builders) Green Program. However, he says the additional paperwork for mechanical equipment was bothersome and it took time to get his HVAC subs to keep up with it. He added, "*It was time consuming and it doesn't add value or productivity to my product*."

2.1.4 Custom-Home Client Impact on Ability to Meet Version 3 Requirements

Two of the Pilot homes are custom homes. The builders of these homes were asked what role the homeowner played in making decisions that affected the ability or likelihood that the home would be able to meet Version 3 requirements. One, a builder/architect, says the owners were interested in energy efficiency, but that price was a limitation for them—they were very budget sensitive. This architect would have liked to do more, saying she typically incorporates solar options. The other builder of a custom home says:

> *"The clients were interested. They didn't care about the ENERGY STAR label so much, but going through the Program allowed us to work with our HERS rater and do modeling*

etc. and the owners were excited about the amount of analysis going on. The owners were willing to pay for triple glazed windows—they could see the energy savings and increased comfort benefits."

2.1.5 Builder Satisfaction

All six builders who participated in the Pilot say they received all the support they wanted or needed to help them meet Version 3 requirements. ICF personnel and the HERS raters who worked with the Pilot builders say that the builders whose homes failed to pass all Version 3 requirements knew they were not going to qualify while the homes were still under construction.

Five of the six builders say the new process for determining the HERS index required for Version 3 qualification was clearly explained to them. The sixth builder knew what HERS index her project had to achieve, but was not aware of how the Version 3 target HERS index was determined.

Five builders say they were "very satisfied" and one says he was "satisfied" with their ICF account manager and any other ICF staff they worked with or had contact with because of participating in the Pilot. The builder responding he was "satisfied" is a production builder whose Pilot project was a duplex; he noted that the ICF staff did not have much involvement in his project.

All six builders say they were "very satisfied" with their HERS raters. The production builder whose Pilot project was a single-family detached home says he has worked with several HERS raters and that he likes the HERS rater he is working with now because he takes time to explain things in contractor language and has group meetings on site with subs and crews.

Five of the six builders who participated in the Pilot responded that they were "very satisfied" when asked: "Overall, how satisfied were you with your experience participating in the Pilot?" One builder, a production builder, says that, overall, he was "satisfied." He commented:

"The more you do it the easier it gets. It was a little rough in the beginning. We were getting involved in ENERGY STAR and NAHB Green Programs at the same time. It was easier to reach my HERS rater than NAHB."

2.1.6 If You Had It to Do Over Again

Builders were asked, *"If you had it to do over again, what, if anything, would you do differently?"* One production builder says he would not do anything different. The other production builder says:

"I would probably get designers that were better at getting ENERGY STAR requirements down on paper than what I had. I had a mechanical engineering company doing a lot of my design work and they had the ENERGY STAR-qualification requirements, but the requirements didn't make their way into the design documents. I want the information incorporated better."

The architect of one of the custom homes says:

> *"We didn't do as well on air sealing as usual; would have liked to do better. It would be nice if ENERGY STAR or the Program provided specifications you could give the builder to understand exactly what is required—provide something with drawings so discrepancies get caught in the field."*

What these builders are looking for may very well be met by the field guides available for the Version 3 mandatory checklists. These field guides can be downloaded from the EPA website; the guides explain the rationale behind each item and provide examples (pictures and drawings) of successful and unsuccessful details.[10]

The builder of another custom home says he would not change much. He says that there were some issues, but with the Program involved it worked out pretty well.

The remaining two builders focused on what they hoped to improve in their next projects. The owner/builder of a custom home says she wants each home to be better. She would pay more attention to the HVAC data required. She thinks her HVAC contractor did a good job and she monitored their work, but wants them to be more responsive providing information. The builder of the affordable housing home says she would not change anything, but is going to try to do even more next time.

2.2 HERS Raters

HERS raters who worked with the builders in the Pilot were asked if they thought they had the training they needed and felt prepared to explain Version 3 requirements to the builders they worked with and help them meet those requirements. One felt prepared; he trained himself using on-line resources and felt capable of communicating the information. The other HERS rater would have liked more training on Version 3 HVAC requirements so he could have provided more guidance to the HVAC contractor.

2.2.1 Working with Pilot Builders

The HERS rater who worked with five builders says they did not try that hard to meet Version 3 requirements. He says they changed a few things and learned about what would be expected in the future, but basically they did what they normally do. In one case he worked with a construction manager who did not have the authority to try out some things. Of the five homes he worked on, two passed and three failed to meet all Version 3 requirements. He added that the standard practices of two of the builders he worked with are very close to meeting Version 3 requirements.

[10] Guide books can be downloaded from:
http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_v3_training_req#che

The HERS rater who worked with one builder (architect) says she tried hard, but not really hard, to meet Version 3 requirements. Although the home fell short of meeting all Version 3 requirements he says that of all the builders he works with she is the most willing to "*plug in anything and go the extra mile*."

Both HERS raters say builders needed the most help with, and found it hardest to meet, Version 3 HVAC and TEC checklists. None of the four homes with ducted HVAC systems met all HVAC checklist requirements. Meeting TEC requirements for Grade I insulation installation, reducing thermal bridging and sealing sheetrock to the top late at all attic/wall interfaces[11] were challenging for the builders. It is virtually impossible to achieve a Grade I insulation installation using fiberglass batts to insulate basement ceilings. Both HERS raters say that the homes they worked with that did not meet Version 3 requirements failed to meet Grade I insulation installation and the HVAC checklist and QIV requirements.

Both HERS raters say they spent much more time working with the Pilot homes than they do with a typical Version 2 home. One HERS rater says the amount of time he spent working with the Pilot home is probably pretty typical of what will be required working with other builders building their first Version 3 home. The other HERS rater says it may take less time working with builders who have had Version 3 training, but it is hard to predict and will vary from job to job because some builders will get it right the first time and others will not, and have to make changes.

2.2.2 HERS Rater Satisfaction with the Pilot Process

The HERS raters working with the Pilot homes were asked if they got the training and support they wanted from the ICF staff implementing the Pilot and if they thought the Pilot was well thought out, organized and implemented efficiently. One HERS rater says he did not get the training and support he would have liked from ICF staff and the other says, *"I didn't get much, but I didn't expect much."* Looking ahead, they would like to see ICF train HVAC, insulation and framing subcontractors. They both stressed that it is important to use trainers who have extensive hands-on experience. They say builder training sessions can be useful, but not one-to-one training with builders who are already working closely with a HERS rater; different people explain things differently and if things aren't explained exactly the same way builders get confused. Also, one HERS rater commented that HVAC training is sometimes targeted at advanced HVAC engineers and that this training may be too advanced and technical for most builders.

With respect to the Pilot being well thought out, organized and implemented efficiently, one HERS rater says, *"It was important to do and they did a fairly good job. It was a hard thing to tackle as early as they did."* The other HERS rater says, *"I can't give it two thumbs up. It was a little rushed and I never saw much of the results. I didn't learn that much from ICF."*

[11] TEC checklist requirement: Sheetrock sealed to top plate at all attic/wall interfaces using silicone caulk, latex foam, or equivalent material. Construction adhesive shall not be used.

Both HERS raters cited things they would have liked to have seen done differently in the Pilot.

- *"More effort to get projects in the planning stage, not projects underway; that limited what builders were willing to try. Some changes have to happen at the planning stage and we got to some homes too late."*
- *"ICF observed rather than pushed participants to achieve Version 3 compliance; would have liked to see them push more."*
- Hold a sit-down, kick-off meeting with all the participating raters and builders to explain the goals of the Pilot, any concerns people had, and the increased incentives for Pilot participants.
- Hold a debriefing meeting at the end of the Pilot with ICF staff, the builders and the HERS raters to provide cross pollination of ideas and experiences.

2.3 HVAC Contractors

Neither of the two interviewed HVAC contractors who worked on Pilot homes knew that the homes were participating in the Pilot and neither say the purpose of the Pilot was explained to them. The contractor working on the Pilot home that is in a large development knew that the home was going to be an ENERGY STAR home, but did not realize that there was anything different about the Pilot home.

When asked if the builder, or someone else, explained the requirements of the Version 3 HVAC System Quality Installation Contractor checklist and the HVAC System Quality Installation Rater checklist to them and asked them to complete the contractor checklist, both said no. They also say there was nothing in their contracts with the builders about passing the Version 3 checklists. The HVAC contractor who worked on the development home says the builder asked him to meet checklist requirements, but not the Version 3 checklist specifically. (This contractor wanted to see the HVAC contractor checklist; the interviewer emailed him a copy and then discussed it in more detail after giving the contractor a chance to review it.) After seeing the checklist, this contractor said he did not think he filled it out. He does remember a HERS rater testing the house. He also says:

> *"As far as leakage and airtight quality, the builder asked us to step it up a lot. The way we usually do it, we didn't have to do too much stepping up. We made it, we attempted to make it very, very tight as far as that goes. We stepped up to R-8 insulation a little sooner than we had to. I don't think we jumped the SEER or anything like that because of cost."*

The other HVAC contractor, who participates in the Cool Smart Program and worked on a custom home in the Pilot, says:

> *"I don't remember* [anyone explaining the Pilot or asking me to complete a checklist], *but it may have been, but I don't think it was. The builder never mentioned ENERGY STAR or anything like that. I think he said, 'We're doing a tight house.' There's a lot of that now*

with the builders; not that they're building ENERGY STAR homes, but that they are building a tight house."

Both HVAC contractors say they did not have any contact with, or support from, anyone else involved in implementing the Pilot about meeting the HVAC System Quality Installation Contractor checklist and the HVAC System Quality Installation Rater checklist requirements.

Neither HVAC contractor was aware that the Pilot homes they worked on failed to meet some of the requirements of the HVAC checklists. The HVAC contractor who worked on the development home says, *"I thought we'd pass all of them."* The HVAC contractor who worked on the custom home said, "*I didn't even know it was being rated till now*."

After describing what parts of the checklist their homes failed, these HVAC contractors were asked if these were things they could address if they worked on other ENERGY STAR homes striving to meet Version 3 requirements and, if so, how much it would cost.

The Pilot home in a development failed to pass the HVAC System Quality Contractor checklist because the home builder was too busy and did not attempt to get a Manual D or meet the system commissioning requirements. A Manual J was completed and the home met the requirements of the Whole-Building Mechanical Ventilation Design.[12] The HVAC contractor who worked on this house says, "*Oh yes, of course. We could design that, we could show that. It's just a matter of measuring*." He estimated the additional cost would be $200.

For the custom home, the builder had a hard time getting the Manual J load calculations and the Manual S calculations for equipment selection, and was unable to get the Manual D and system commissioning information required for Version 3 Quality Installation Verification. A large duct leakage problem was found in an enclosed wall cavity during a preliminary duct test and was corrected.[13] The HVAC contractor who worked on this house says for a 2,000 square foot home with a $15,000 HVAC installation it would cost an additional $300 to $500 dollars.

[12]ICF International. *Massachusetts New Homes with ENERGY STAR 2011 ENERGY STAR® Version 3 Evaluation Pilot*, submitted to Joint Management Committee, December 2010. (p 11)

[13]ICF International. *Massachusetts New Homes with ENERGY STAR 2011 ENERGY STAR® Version 3 Evaluation Pilot*, submitted to Joint Management Committee, December 2010. (p 9)

3 Builder Interviews

3.1 Version 3 Training

All 17 interviewed builders were asked what additional training they would like, or think they will need, to ensure they will be able to meet Version 3 requirement.

3.1.1 Satisfaction with Version 3 Training Sessions

The 11 interviewed builders who did not participate in the Pilot, but who attended a Version 3 training session or had access to the training presentation materials from someone else in their company who attended, were asked how satisfied they were with the training. Figure 3- shows that builders gave mixed responses. The majority of builders (8 of 11 builders) were either "very satisfied" or "satisfied" with the training. One builder who was "very satisfied" commented: *"Back in the day we were building homes so fast we didn't pay attention to this stuff, but the incentives force you to pay attention."* The builder who responded "neither satisfied nor dissatisfied" says he found the training a little confusing.

The builder who responded that he was "somewhat dissatisfied" builds single-family detached and attached homes. He says he has completed 10 to 15 ENERGY STAR-qualified homes and currently has all his homes ENERGY STAR qualified. He described why he was somewhat dissatisfied with the training as follows:

> *"It is not clear—ENERGY STAR versus Massachusetts ENERGY STAR—it's confusing. Version 2, Version 2.5, Version 3, Massachusetts New Homes with ENERGY STAR—it's a bunch of terminology. It is very checklisty and very confusing. I'm not a dumb guy."*

Figure 3-: Satisfaction with Version 3 Training

Three builders who attended training sessions say they think they have the knowledge and training they will need to meet Version 2.5 requirements for ENERGY STAR qualification in 2011 and Version 3 requirements in 2012. The other builders who attended a training session, or have access to the training materials, say they may need assistance meeting Version 3 requirements. The reasons these builders give for saying they think they may need assistance focus on confusion about not only Version 3, but with the many changes going on with new building codes, stretch code requirements, and other energy efficiency building programs.

3.1.2 Additional Version 3 Training Needs

All 17 interviewed builders were asked what additional training they would like to have to be sure they could meet Version 3 requirements in 2012. The following are specific topics interviewed builders say they would like more training on:

- Final Version 3 requirements
- Air sealing
- Reducing thermal bridging
- Mechanical and HVAC systems—the mechanics
- HVAC QIV and checklists
- A seminar on heating and cooling loads—they were always based on rule of thumb
- Building envelope
- Thermal barriers—given the unique shapes of some buildings
- Air barriers
- Treating the whole house as a system

Some builders will rely on their HERS raters for training. One builder says the most important thing for her is getting hands-on, on-site training and support from her HERS rater; once she knows what to do, training will not be an issue. Another builder says:

> *"The one-to-one meetings we have with our HERS rater are so specific to our particular needs and limitations and concerns that it just makes it easy. So, I am not looking for any generalized training on a topic. What works for us is that in the planning process and throughout construction our HERS rater is there as a resource."*

3.1.3 Training for Builders Who Did Not Participate in the Pilot or Training Sessions

All 17 interviewed builders were also asked what training they think builders who did not participate in the Pilot or attend Version 3 training will need to be able to meet Version 3 requirements. In addition to the topics listed in the previous section, they suggested that builders who have not had any Version 3 training will need the following training:

- Training sessions similar to those already conducted, but in more detail
- Training on all the steps, including all the forms and paperwork

- Duct sealing training
- A fundamental update on building science
- Ventilation—understanding the thermodynamics and making sure houses can breathe
- Materials—the variety of materials that can be chosen; VOCs (Volitile Organic Compounds) for open- and closed-cell foam insulation
- How to properly install foam insulation
- Specific how-to training: *"I've seen guys using Thermax with clear tape when you're supposed to use the other tape. Windows over foam: there are kits that you have to buy for that (flash kit for over the window), they are part of the system but almost nobody uses them."*

Builders also say that HVAC and insulation contractors will need training to meet Version 3 requirements. Builders say that for Version 3 to be successful, HVAC and insulation subs need to know what they will be required to do and builders need to know that their subs are capable of doing what is required.

Several builders pointed out that the training that other builders will need will vary depending on how aware they are of what will be required. Examples of what these builders said are:

- *"If you've been paying attention, which I assume the people building ENERGY STAR homes have, the Version 3 stuff is not that big a step. Version 3 is not significantly different from what we have been trying to do. We might have to try just a little bit harder, but we have our builders trained well enough that the minor additional stuff will not be that hard to do. But, if you haven't been keeping up with ENERGY STAR and green building in general, then it's going to be a shock to you."*
- *"They will need a lot more training than I will. I don't think any of these guys understand what's involved. I pay attention to what is going on. I can follow what's going on a little bit, and if I'm getting confused they are going to be confused."*
- *"Other builders will probably need more than I do because I have been doing this for a while and this is a smaller step for me. If the raters are well trained they should be able to help us. Other builders will probably need the same training that I do, but maybe a bit more of it."*

In addition, builders new to the Program will likely need more training. As one builder said, *"You can't give them a two hour introduction to Version 3 and expect them to be up-to-speed on the requirements."*

3.1.4 Should Training Include Information on Costs?

All builders were asked if they would like training to include information on the cost of using different building materials, mechanical equipment, etc. The majority of interviewed builders (14 of 17 builders) say they would like training to include cost information. One of these builders says people with experience with the materials should address cost—builders who could answer

questions on materials they have worked with. These builders say they would like training to include cost information for the following:

- Smart framing
- Structural Insulated Panels (SIPS)
- Integrated insulated foundation systems
- Insulation products:
  - Icynene
  - Comparison of blown-in cellulose versus foam
- Building envelope components, including windows and doors
- Air sealing products: foam, mastic, etc.
- Mechanical equipment
  - Heating systems
  - Boilers
  - Ventilation systems
  - Where to buy high-efficiency equipment in small sizes
- Energy-efficient designer lighting without using fluorescent bulbs[14]

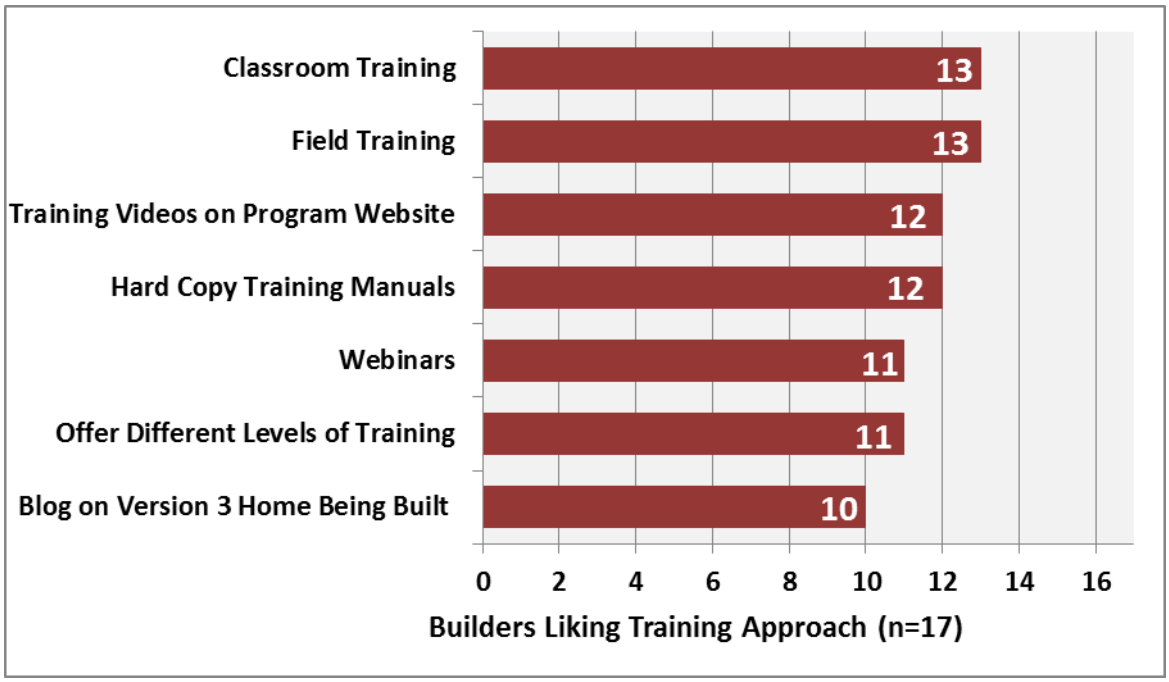
One builder thinks training could include something about the relative costs of different products, but that actual costs are going to vary a lot from situation to situation and region to region. Two builders say they would not want costs addressed in training: one says it is not necessary because the cost of building materials change so rapidly and the other thinks it could be too much like a commercial for certain products.

3.1.5 Best Training Approaches

All builders were asked what they think are the best approaches for providing builders the training they will need to meet Version 3 requirements. Interviewers listed a number of training approaches and builders indicated whether or not they thought it was a good training approach. Figure 3- shows how many builders liked each training approach. Clearly, different builders prefer different training approaches; some say they learn best from classroom training and others prefer on-site training or demonstrations. Therefore, to effectively meet builders' training needs a variety of training approaches will likely be needed.

[14] The builder who suggested this said custom-home clients would like this; they love spending money on stuff they can't see, like insulation, but when you put in a compact fluorescent light bulb they get a little offended.

Figure 3-: Builder Training Approaches



Builders say there are pros and cons associated with any type of training. Classroom training is good, but it is time consuming and may require traveling some distance. Builders like field training, seeing things done on site, but say field training typically focuses on only one stage of the building process—you don't get the full picture. Some builders don't think hard copy manuals are useful in the field, while others like to have manuals with pictures on site to show subs what they expect them to do. Builders say webinars are good because they are flexible and you can participate from anywhere, but it is too easy to be distracted and you may not pay close attention. One builder commented that it would be good to offer webinars outside business hours because it is hard to find time for training during the day. Some builders like the idea of web-based training, blogs and reference sites—others tend to be overwhelmed by the internet. Builders like the idea of offering different training to builders with different levels of experience building ENERGY STAR homes, but say, in the end, everyone has to learn how to meet all the Program requirements.

Three builders suggested other training approaches they think would be useful. One suggested some type of mentoring program, where a builder with a project underway could show a new builder how to do things. Another suggested experienced ENERGY STAR builders could serve as consultants and answer questions on things for other builders. When this builder was asked if he thought this approach could create problems in terms of competition, he said he might be concerned with that if he had a big company with a lot of employees. However, he works for himself and would like to see everyone do a better job and help the industry improve. A third builder suggested that Program staff need to attend builder meetings and seminars and go to

HBA (Home Builder Association) meetings to meet with builders on their turf and remind them of what they need to do.

3.2 Building ENERGY STAR-Qualified Housing

All 17 interviewed builders were asked how long they have been building ENERGY STAR-qualified homes, how many ENERGY STAR-qualified homes they have built, and if they are currently having all their homes ENERGY STAR qualified. Table 3- shows that interviewed builders have from one to 13 years' experience building ENERGY STAR homes; the average is 5 years and the median 3 years. Individually they have built from one to 600 ENERGY STAR homes; the average is 56 and the median is 13 homes. Most interviewed builders (14 of 17) say they currently have all their homes ENERGY STAR qualified. The three builders who do not have all their homes ENERGY STAR qualified say:

- *"I would like to, but we don't build homes for resale. Everything is pretty client driven so if the client is not willing, we can't do it."*
- *"One Habitat home is not ENERGY STAR. One last year had open duct work on the third floor; the owners did it themselves and it did not pass."*
- *"It depends on the geographical area. On some of the sites we are using oil as opposed to gas. Quite honestly, it comes down to a simple cost analysis in terms of whether it is cost effective or not. In some cases it is; in some cases it is not."*

Table 3-: ENERGY STAR Building Experience

ENERGY STAR Building Experience	V3 Pilot Builders (n=6)	Other Builders (n=11)	All Builders (n=17)
How long have you been building ENERGY STAR homes? (Years)			
Minimum	1	2	1
Maximum	7	13	13
Average	3	6	5
Median	3	6	3
About how many ENERGY STAR-qualified homes have you built?			
Minimum	1	1	1
Maximum	28	600	600
Average	10	82	56
Median	5	13	13
Do you currently have all your homes ENERGY STAR qualified?			
Yes	5	9	14
No	1	2	3

Figure 3- and Figure 3- show the number of interviewed builders falling into various categories of ENERGY STAR-building experience and number of ENERGY STAR-qualified homes built, respectively. As shown, although the sample size is relatively small, there are multiple builders in every years of experience category. Furthermore, the sample includes 4 builders who have built only 1 or 2 ENERGY STAR-qualified homes, 4 who have built 8 or 9 ENERGY STAR homes, 4 who have built 13 to 20 ENERGY STAR homes, 2 who have built 25 or 28 homes and 3 who have built 75 to 600 ENERGY STAR homes.

Figure 3-: Years Building ENERGY STAR Homes

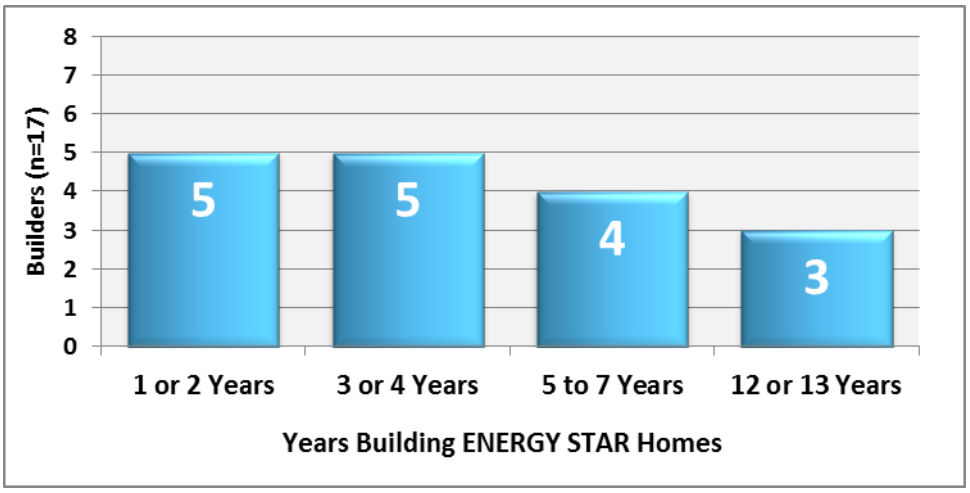
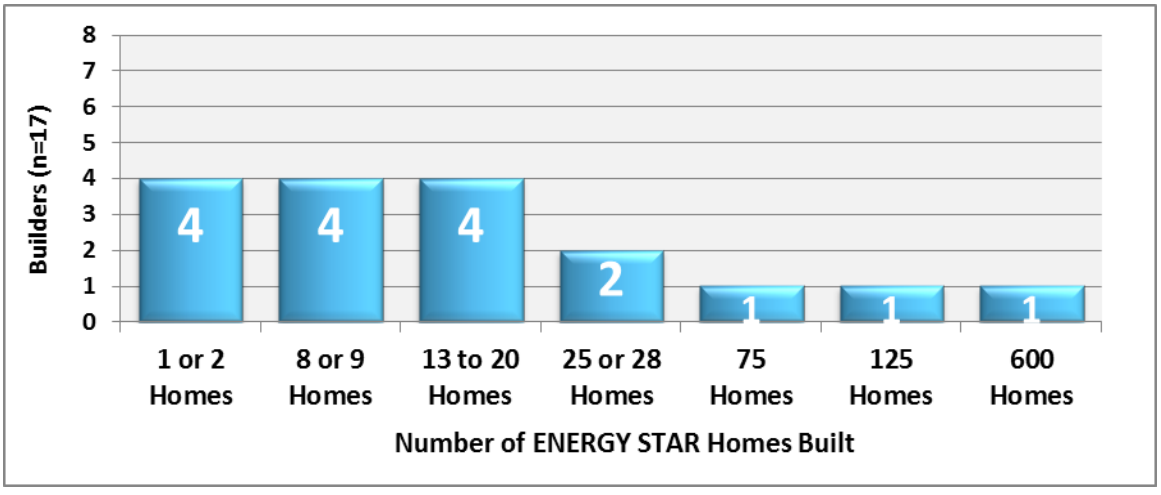


Figure 3-: Number of ENERGY STAR Homes Built



3.2.1 Value of the ENERGY STAR Label

All 17 interviewed builders were asked how important, or valuable, is it for them to build ENERGY STAR homes and be able to market them as ENERGY STAR-qualified homes in the current housing market. Figure 3- shows that the majority of interviewed builders (10 of 17 builders) say that being able to market their homes as ENERGY STAR qualified is very valuable. Figure 3- shows that 11 of the 17 interviewed builders think being ENERGY STAR qualified increases the marketability of their homes.

Figure 3-: Value of ENERGY STAR Label

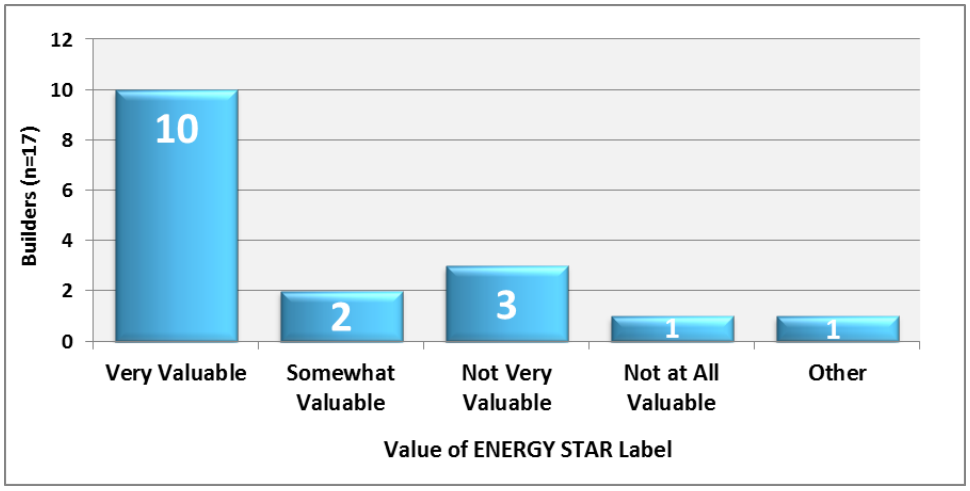
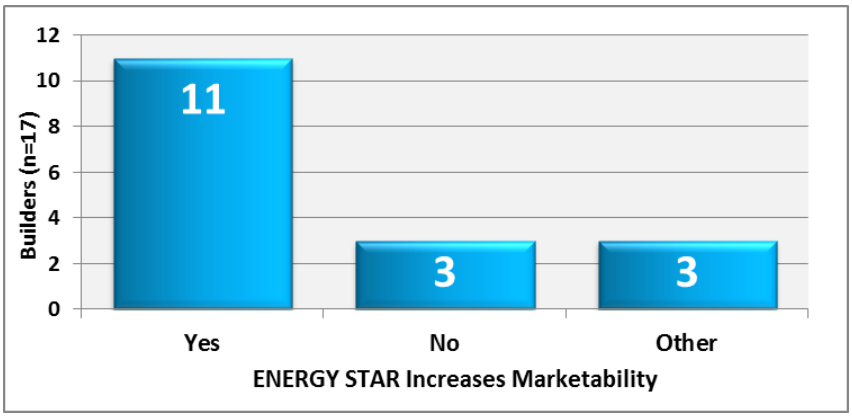


Figure 3-: ENERGY STAR Increases Marketability



Builders who find being able to market their homes as ENERGY STAR-qualified homes very valuable say:

- *"When we score well, our marketing people have the certificate and use it in marketing. People are impressed. Our competitors are also ENERGY STAR so our low scores help."* (Production Builder)

- *"Our jobs are always custom homes, so the label itself is not that valuable in marketing. But, being able to tell clients we are an ENERGY STAR builder is helpful—it helps us market our services."* (Custom-home Builder)
- *"It is valuable because I know how to use that information to market my homes."*(Custom-home Builder)
- *"I have to maintain building ENERGY STAR because our advertising describes us as doing that and that is one of our biggest selling features. It has helped us sell homes. Without it I don't think we could have done it the way the economy is. We are running a commercial now advertising our ENERGY STAR homes and that is huge. I have seen more and more builders doing well on the Program. I am finding more homeowners, younger ones, getting more involved and they understand the Program better. They come into one of our houses and you start talking about ENERGY STAR and they know about it and have been doing research."* (Production Builder)
- *"I love it. I like using it. I try to sell it as no extra cost—you recoup costs in incentives."* (Custom-home Builder)
- *"I got way more foot traffic once I switched to ENERGY STAR. People started coming. Everyone is thinking green and the mindset is people go into the store and they want to buy something with the ENERGY STAR sticker, even if they don't understand what it is."*(Builder of affordable homes and market rate spec homes)
- *"It's one of our bigger selling tools. We market ENERGY STAR. We explain that by building to ENERGY STAR they are going to save money. It is appreciated, but not as much as it should be. We explain that it is worth spending another $15,000 to $20,000 for one of our homes, rather than working with someone who is not as concerned with the efficiency of the house. All those little things add to the value, but it is a little more challenging for us to be competitive."*(Production Builder)

Three builders say that being able to market their homes as ENERGY STAR-qualified homes is not very valuable, or not at all valuable:

- *"I have never gotten a job because I am an ENERGY STAR builder."* (Builder of spec and custom homes)
- *"We don't really have people asking about it. It boils down to basic supply and demand. Ours is a lifestyle change—people are downsizing. It is one thing that sets us apart a little bit. They like it, but are not going to pay extra for it. It depends on the price of crude oil over the next year or two; if costs go up then people might get more energy conscious and they'll start asking*." (Builder of spec-built home development)
- *"People don't know what it is. People come to me and I say, 'Hey, by the way, I'm doing ENERGY STAR.' and they say, 'Hey, what the heck is that?' The only benefit they see is financially, but I'm not drawing customers in because of it."*(Builder of spec and custom homes)

The builder giving the "other" response builds affordable housing. She says:

> *"It is extremely important to us to build ENERGY STAR homes because of the type of program we are; low income family opportunities are so limited. We educate buyers about energy efficiency and the ENERGY STAR components of our homes. It is not for marketing our homes. We market ENERGY STAR, but that is not the draw."*

Builders were also asked if building to higher tiers makes their homes more marketable; only four builders say it does. In general, builders say buyers do not understand the tier levels. Builders tend to market the HERS indices of their homes and talk with buyers or custom-home clients about what a lower HERS index means in terms of savings. A production builder says:

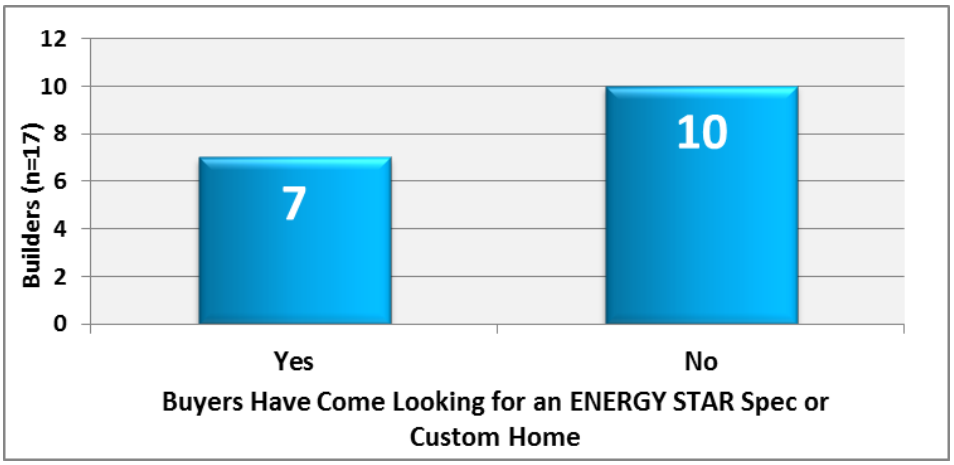
> *"When buyers understand what the rating is all about, and if they are on the fence, this rating, if even half true, shows I have a high energy-efficient product and it is certified by an independent party. This is a key part of our marketing. We display the HERS certificate in a frame and we use signs. People look at the certificate and ask questions."*

Although only four builders say building to higher tiers makes their homes more marketable, six say they use lower HERS indices to distinguish their homes from other ENERGY STAR homes.

Builders were asked if any buyers had come to them looking for an ENERGY STAR spec-built home or asked them to build an ENERGY STAR custom home. Figure 3- shows that fewer than half of the interviewed builders (7 of 17 builders) say buyers or custom-home clients have come to them looking for an ENERGY STAR-qualified home. These seven builders include two production builders, two builders of both spec and custom homes, two builders of only custom single-family homes, and one builder of only affordable housing. The builders of spec housing say it is rare that a buyer comes looking for an ENERGY STAR home, but it does happen. Two of the builders of custom homes are currently working with clients who asked them to build an ENERGY STAR home; one of these builders says:

> *"It happens, all the time. Some of them know more about it [ENERGY STAR homes] than I do. Some are just like, 'I want that ENERGY STAR thing.'"*

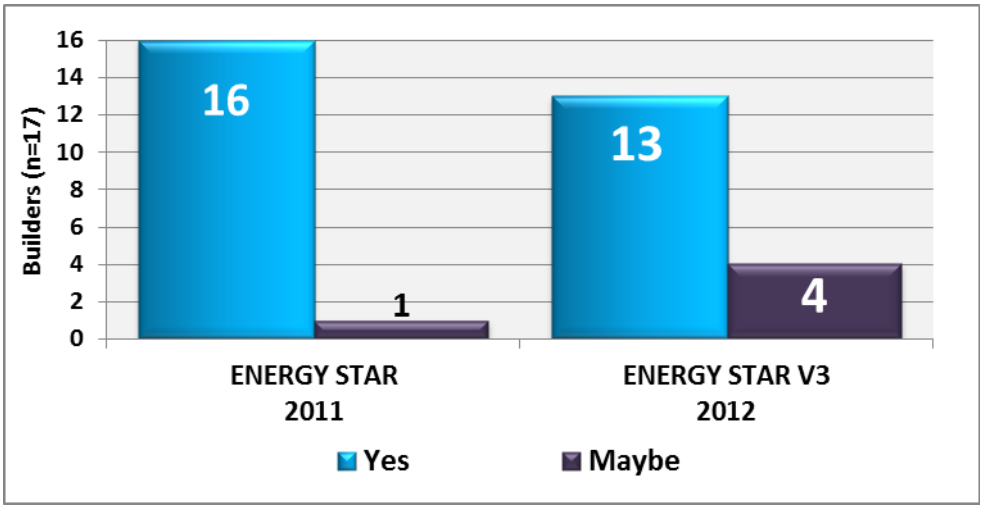
Figure 3-: Buyers Looking for ENERGY STAR Homes



3.2.2 Plans Going Forward

Builders were asked if they plan on having the homes they build in 2011 be ENERGY STAR qualified and if they plan on meeting Version 3 requirements in 2012. Figure 3- shows that 16 of the 17 interviewed builders plan on having all the homes they build in 2011 be ENERGY STAR qualified. One builder is not sure, he says, *"I am going through it to figure out what it is costing me.*" A large majority of the builders (13 of 17) say they plan to have the homes they build in 2012 meet the new Version 3 ENERGY STAR requirements. All six builders who participated in the Pilot say they plan to have all their 2012 homes meet Version 3 requirements. Of the four builders who are not sure if they will try to meet Version 3 requirements in 2012, two say they need to look more closely at the cost of meeting Version 3 requirements, one says he needs more information about what will be required, and one is a custom-home builder who says he can only do it if his clients are willing to incorporate all the Version 3 requirements.

Figure 3-: Plans for Meeting New Requirements



Most interviewed builders (10 of 17) were not aware that all builders of Version 3 ENERGY STAR homes are required to complete on-line, web-based training on Version 3. However, after being told about this requirement, all 17 builders said they planned to take the training.

Builders were also asked if they thought the HVAC contractors they currently work with will be able, and willing, to meet the Version 3 requirements for ENERGY STAR qualification. Most builders (12 of 17) say they think their HVAC contractors could meet Version 3 requirements, but only three were **confident** that their HVAC contractors would be both able and willing to meet Version 3 requirements. The nine builders who think their HVAC contractors would be able to meet the requirements, but might not be willing to meet them, say they would consider hiring a different HVAC contractor who was trained on the Version 3 requirements and would guarantee meeting Version 3 requirements.

Four builders are unsure if the HVAC contractors they currently work with will be able to meet Version 3 requirements and one builder does not think his HVAC contractor will be able to meet Version 3 requirements. Four of these five builders say they would consider hiring a different HVAC contractor who was trained on the Version 3 requirements and would guarantee meeting them; the fifth builder says he might consider hiring someone else.

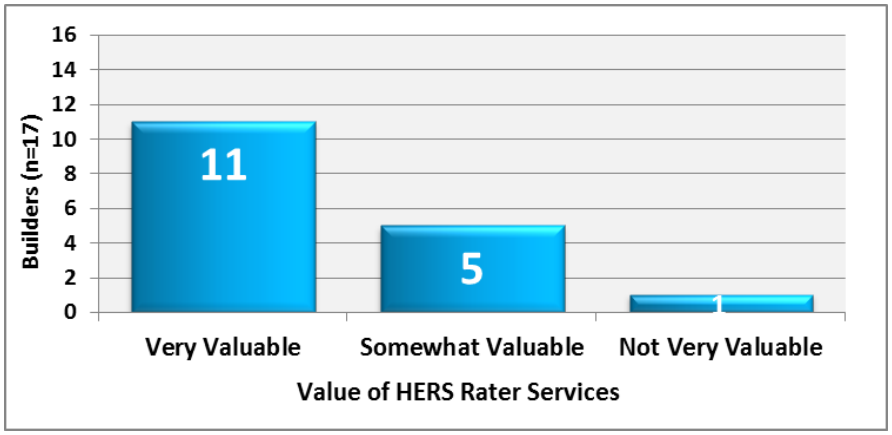
Builders' estimates varied widely when asked how much they think meeting Version 3 requirements will add to the cost of building a typical single-family detached home. Builders were told they could provide dollar or percentage estimates of additional cost. Five builders gave percentage estimates ranging from 2% to 10%. Seven builders gave dollar estimates ranging from a few hundred dollars to $15,000. Two builders who participated in the Pilot say there would be no, or very little, additional cost because they are building to Version 3 requirements now. Two builders say they have no idea of what the added cost would be. One custom-home builder says it will depend on the house—it could be almost nothing or a lot.

Only 6 of the 17 interviewed builders are now building in Stretch Code communities. The remaining 11 builders do not have any current plans for building in Stretch Code communities; three of these builders, all who participated in the Pilot, commented that they would not hesitate to build in a Stretch Code community.

3.2.3 Value of HERS Rater Services

Almost all interviewed builders find the services provided by the HERS raters they work with on homes they have ENERGY STAR qualified through the Program valuable. Figure 3- shows that 11 builders find their HERS raters' services very valuable, 5 somewhat valuable and 1 not very valuable. All six builders who participated in the Pilot find their HERS raters' services very valuable. One builder says his HERS rater's services become less valuable as he builds more homes and learns more about the Program, but as the Program changes his rater's services become more valuable. The one builder who finds his rater's services not very valuable says, "*I like my HERS rater, but you don't get a lot of the paperwork that they tell you you're getting. You really don't.*"

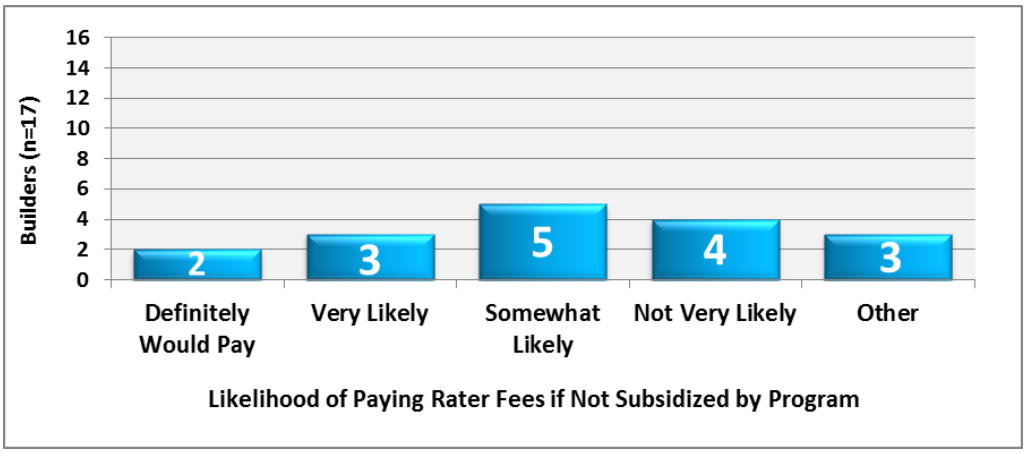
Figure 3-: Value of HERS Rater Services



3.2.4 Paying Rater Fees if Not Subsidized by Program

The Massachusetts Program currently subsidizes at least a portion of the HERS raters' fees. Builders were asked how likely they would be to pay the HERS rater's fees and continue to have their homes ENERGY STAR qualified if the Program no longer subsidized HERS rater fees. Figure 3- shows that builders' responses to this question varied widely.

Figure 3-: Likelihood of Paying HERS Rater Fees



Only two builders say they would definitely be willing to pay HERS raters fees; both build affordable housing. Three builders say they would be very likely to pay: one production builder, one builder of custom homes and one builder of both spec and custom homes. Five builders say it is somewhat likely that they would pay: three builders of custom homes, one builder of spec homes, and one builder of both custom and spec homes. Four builders say it is not very likely that they would pay: three who build both custom and spec homes and one production builder. The three builders in the "other" category are:

- An affordable housing builder with a limited budget who says it would depend on the cost.
- The construction manager for a production builder who says it would not be his decision; but that he would definitely fight for paying the fees. (To date all the HERS rater fees for this builder have been covered by the Program.)
- A builder of custom homes who says she would be hesitant to pay.

4 HERS Rater Interviews

All 11 HERS raters who certified ENERGY STAR homes in the 2010 Program were interviewed. Two of these HERS raters worked with the Pilot homes.

4.1 Training

As described earlier, one of the HERS raters who worked with Pilot homes says that he felt prepared to explain Version 3 requirements to the builders he worked with in the Pilot; he trained himself using on-line resources and felt capable of communicating the information. The other HERS rater who worked with a builder in the Pilot would have liked more training on Version 3 HVAC requirements so he could have provided more guidance to HVAC contractors.

Seven of the nine interviewed HERS raters who did not work with Pilot homes say they have participated in Version 3 training. They mention training provided by ICF, webinars, presentations made by Sam Rashkin and on-line training. Four of the seven HERS raters who say they have participated in Version 3 training are satisfied with the training they have received; three say they are neither satisfied nor dissatisfied. One of the HERS raters who was neither satisfied nor dissatisfied found the presentation he attended too general—more like a sales presentation to builders. The other HERS rater says he is still somewhat confused because the MA Program will not require builders participating in the Program to meet Version 3 requirements and says, "*This is the first time that we have had to split up our business approach.*"

At the time of the interviews, only three of the nine interviewed HERS raters who did not work with Pilot homes said they felt adequately trained/prepared to explain the Version 3 requirements to the builders they work with and to help them meet those requirements; these HERS raters had not yet attended the training that will be required of all raters certifying Version 3 homes. One HERS rater commented, "*I am nervous as heck. I am giving professional advice so I need to be right."* All 11 interviewed HERS raters are aware that all HERS raters certifying Version 3 ENERGY STAR homes in 2012 will be required to attend a two-day Version 3 training session and they all plan on taking this training.[15] Two of the interviewed HERS raters are training providers.

When asked what they think are the best approaches for providing HERS raters the training and information needed to help builders meet Version 3 requirements, interviewed HERS raters say

[15]Verification partners, including HERS raters and Field Inspectors, must complete ENERGY STAR Version 3 Rater Training through an Accredited Training Provider. Effective January 1, 2012, new raters must take this training to become partners. Raters who join prior to 2012 must complete the training by December 31, 2011 to remain ENERGY STAR partners.
Source: http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_v3_training_req

they like in-person training with other HERS raters. In addition, one HERS rater suggested the following:

> *"A website on Version 3 for raters, a place where raters can pose questions, would be good. In a building with two duct systems, can we trade off superior performance on one system with sub performance on another to have the house pass? (Does 3% leakage on one and 7% on the other qualify for 6% or below overall?) It would be nice to have somewhere to post this kind of question to get an opinion from Sam and his guys. My HERS provider is in New York and is good, but you don't always get consistent answers."*

4.2 Going Forward—Working with Builders

All 11 raters interviewed were asked how difficult they think it will be for most of the builders they currently work with in the Program to be able to incorporate the Version 3 requirements by 2012. Figure 4- shows that most interviewed HERS raters (7 of 11) think it will be somewhat or very difficult for the builders they work with to incorporate Version 3 requirements by 2012. The two HERS raters who think it will be very easy, or relatively easy, for their builders to incorporate Version 3 requirements work with only a few builders; each had four projects with certified homes in the 2010 Program.

Figure 4-: How Difficult for Builders to Incorporate Version 3 Requirements

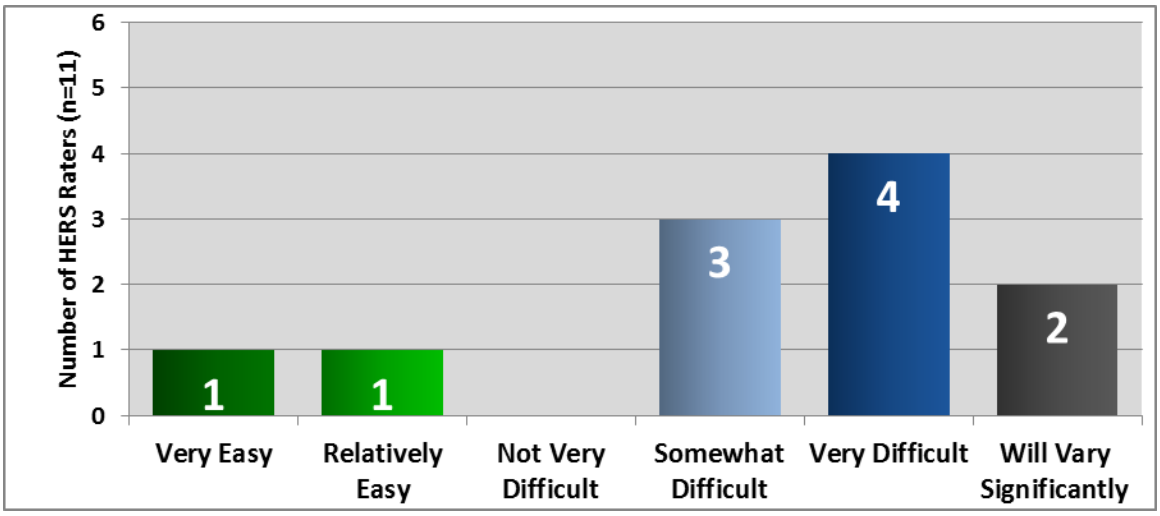
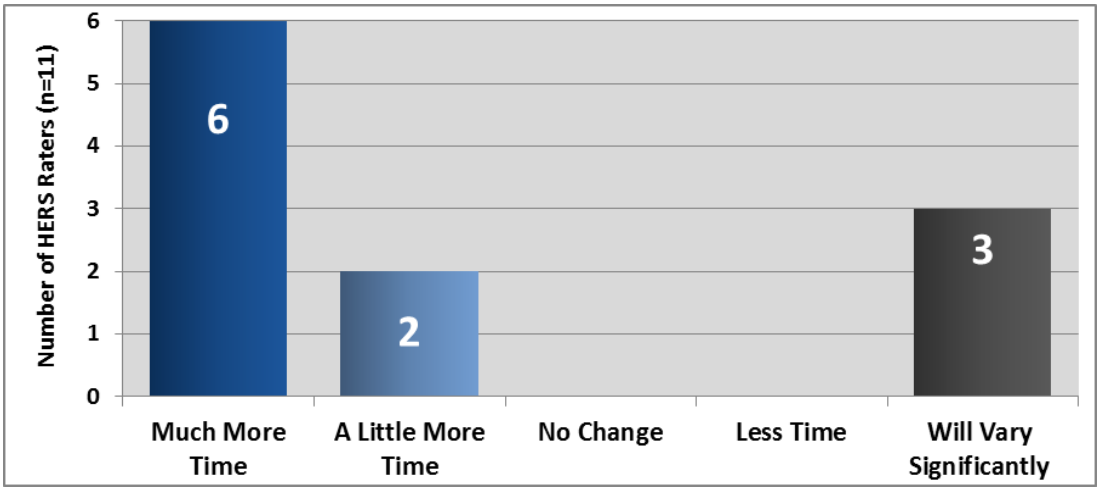


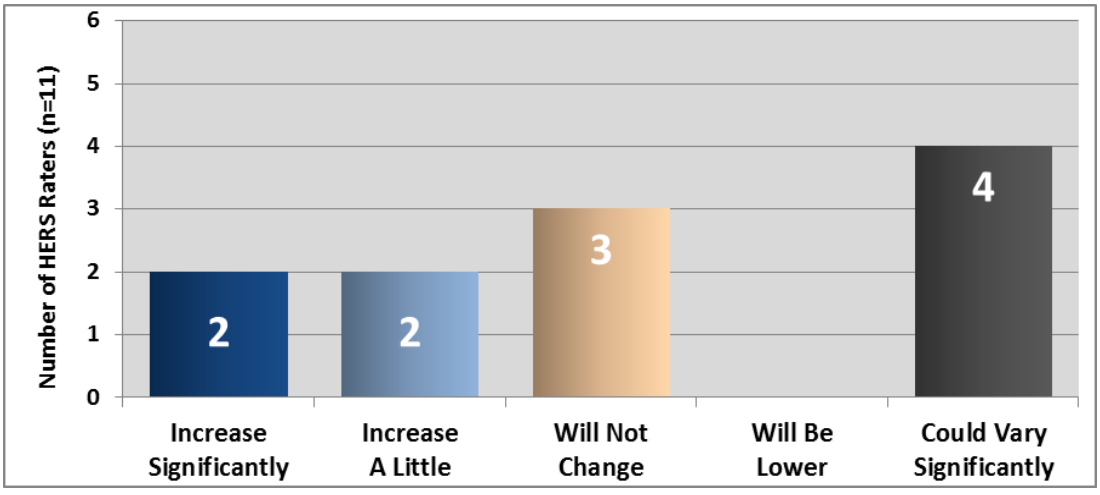
Figure 4- shows that six HERS raters expect it will take much more time for inspections and support for a Version 3 home compared to a Version 2 home; two think it will take a little more time; and three think it will vary significantly from builder to builder. When asked to estimate how much more time they expect to have to spend on Version 3 homes, HERS raters provided estimates of from 30% to 60%. HERS raters say it will take more time to deal with the HVAC and insulation subcontractors; with HVAC subcontractors they will need to make sure that systems are sized and balanced correctly.

Figure 4-: Additional Time to Work with Version 3 Homes



Interviewed HERS raters were asked how their basic fee for working with a Version 3 home will compare to what they currently charge for working with a Version 2 home. Figure 4- shows that two HERS raters say their basic fee will increase significantly and two say only a little; three say their basic fee will not change and four say fee changes could vary significantly from builder to builder.

Figure 4-: How Basic Fees Will Change



One of the two HERS raters who says his company's basic fee will likely increase significantly says this will happen if a third inspection is required; if a third inspection is not required the basic fee will likely not change; the other expects his basic fee to increase by about 30%.

One of the two HERS raters who say their basic fee will increase a little says the fee increase will not cover the increased time he expects to have to spend with a Version 3 home; the other says:

> *"Our fee is usually based on hours. So once we have a couple under our belt we can go back. The modeling is the same, so that will take the same amount of time. There is going to be a lot of hand holding, trying to explain to the builder what is different about the Program, making sure that all of the checklists get done. The learning curve is going to take a little extra time as well as extra time with the checklist. Once we get a handle on that, we can start setting our new fee schedule."*

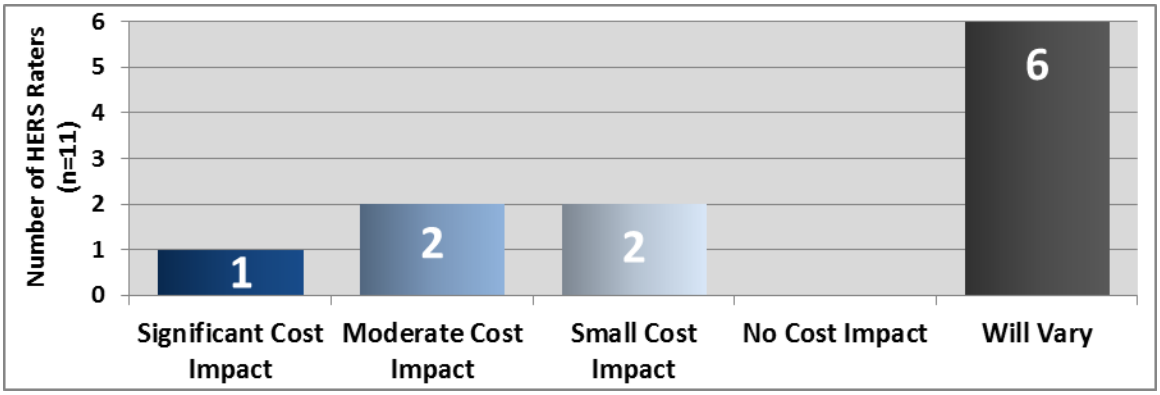
Of the three HERS raters who say their basic fees will not change, one does not think the market will bear an increase in fees; one will not increase fees for existing clients, and already charges more for additional work; and one works predominantly with passive and zero energy homes.

HERS raters who say fee increases could vary significantly from builder to builder say it will depend on how much experience a builder has building ENERGY STAR homes and could vary from development to development. One HERS rater explained that it will depend on how closely the builder listens to what the new requirements are and incorporates them; if they don't get it right the first time that means they will require an additional inspection, which increases the cost.

4.3 Version 3 Impact on Cost of Homes

Interviewed HERS raters were asked how they think incorporating Version 3 requirements will affect the cost of homes. Figure 4- shows that all HERS raters think there will be at least some impact on the cost of building homes.

Figure 4-: Impact of Version 3 on Cost of Homes



The Version 3 requirements that HERS raters think will have the biggest impact on building costs are:

- Meeting TEC requirements:
  - Achieving Grade I insulation installation, especially if builders make the change from fiberglass batts to foam insulation
  - Reducing thermal bridging
  - Sealing sheetrock to the top late at all attic/wall interfaces
- Meeting HVAC checklist requirements:
  - Hiring an HVAC contractor who is willing and able to meet HVAC checklist requirements
  - HVAC contractors will probably be charging quite a bit more because they will have to do calculations that they haven't had to do previously.
  - When HVAC contractors hear "ENERGY STAR" their prices go up; there is uncertainty and they don't know what they will be required to do so they pad their margins.
- Air Quality: installing an HRV (Heat Recovery Ventilation) system
- The extra time required to learn about Version 3 requirements, incorporate them correctly and make sure subcontractors do everything required.

4.4 Likelihood of Builders Making Changes

All interviewed HERS raters were asked how likely they think builders will be willing to make each of the following seven specific changes that could help them meet Version 3 requirements:

- Using something other than fiberglass batts to insulate floors
- Using 24 inch on-center stud spacing
- Using Structural Insulated Panels (SIPS)
- Using a different HVAC contractor on homes with ducted HVAC systems if their current contractor is not willing, or able, to commit to meeting Version 3 HVAC requirements
- Using continuous rigid insulation sheathing
- Using advanced framing techniques
- Using double-framed walls

Figure 4- through Figure 4- show that in every category some HERS raters say the likelihood of builders making the change will vary from builder to builder. No HERS raters say builders will be likely to use double-framed walls. Only one or two HERS raters think builders will be at least somewhat likely to use something other than fiberglass batts to insulate floors, use 24 inch on-center study spacing or consider using SIPS. Three HERS raters think builders will be at least somewhat likely to use continuous rigid insulation sheathing. Five HERS raters think builders will be at least somewhat likely to use advanced framing techniques or use a different HVAC

contractor if the one they currently work with is not willing or able to meet Version 3 requirements.

Figure 4-: Builder Willingness to Not Use Fiberglass Batts

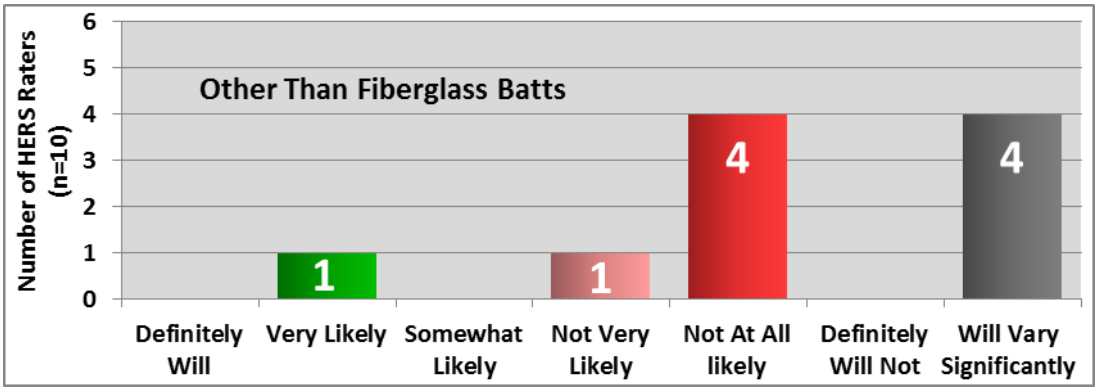


Figure 4-: Builder Willingness to Use 24 Inch On-Center Stud Spacing

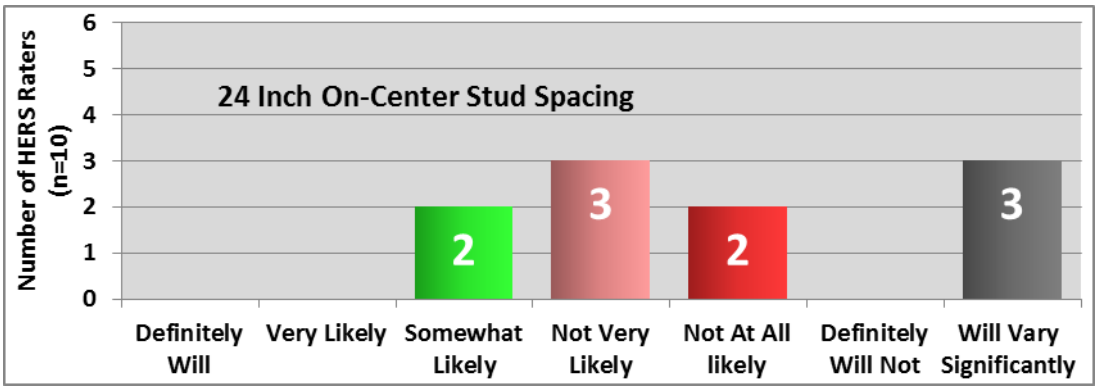


Figure 4-: Builder Willingness to Consider SIPS

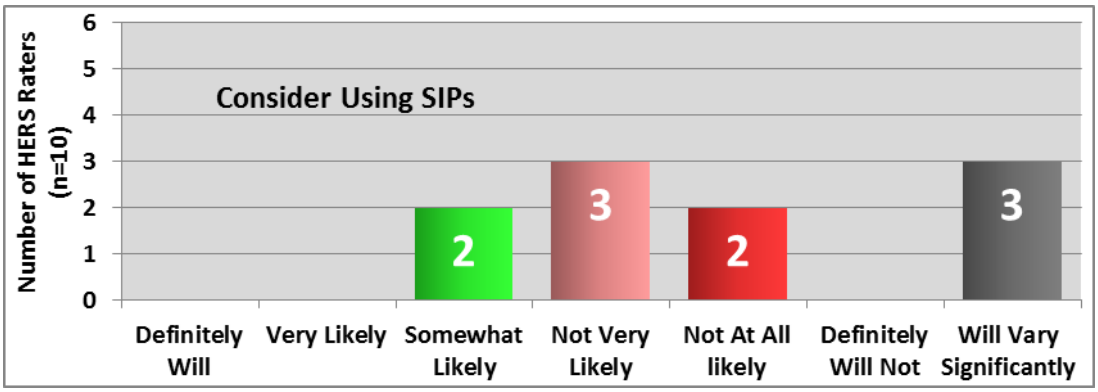


Figure 4-: Builder Willingness to Change HVAC Contractors

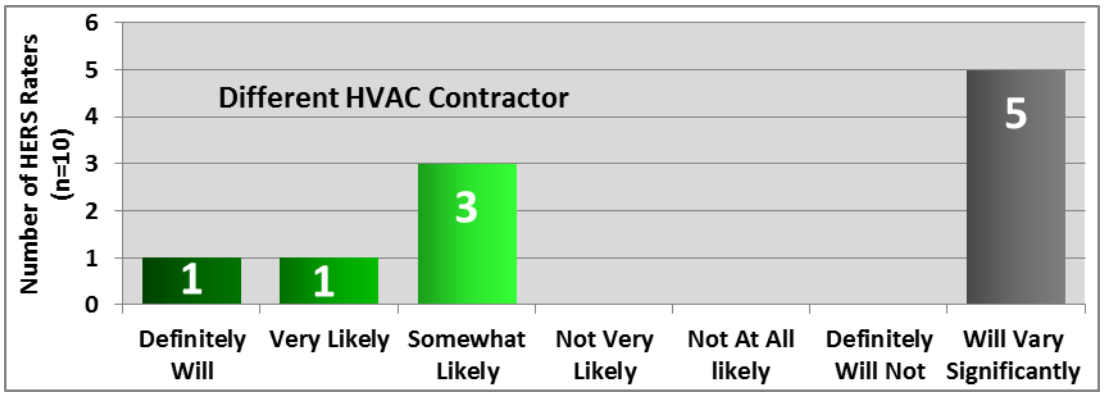


Figure 4-: Builder Willingness to Use Continuous Rigid Insulation Sheathing

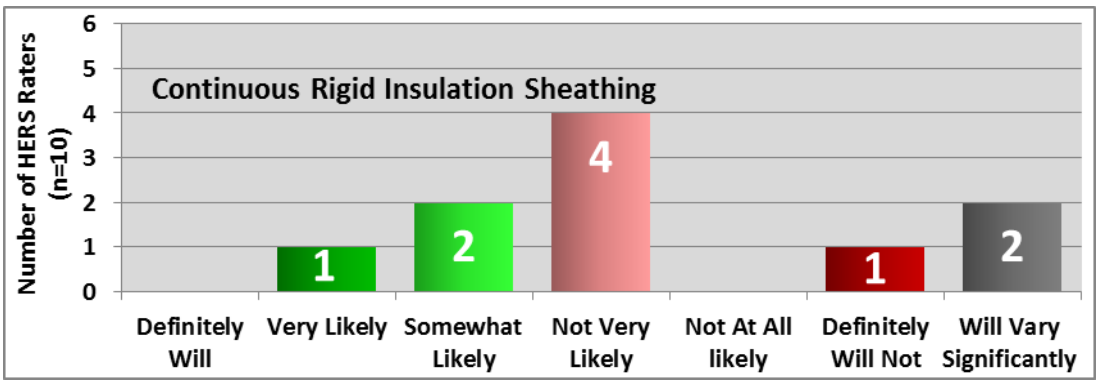


Figure 4-: Builder Willingness to Use Advanced Framing Techniques

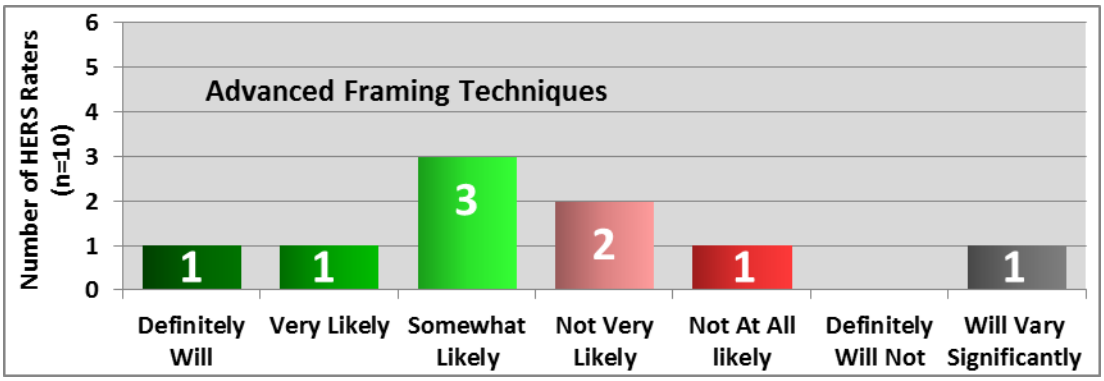
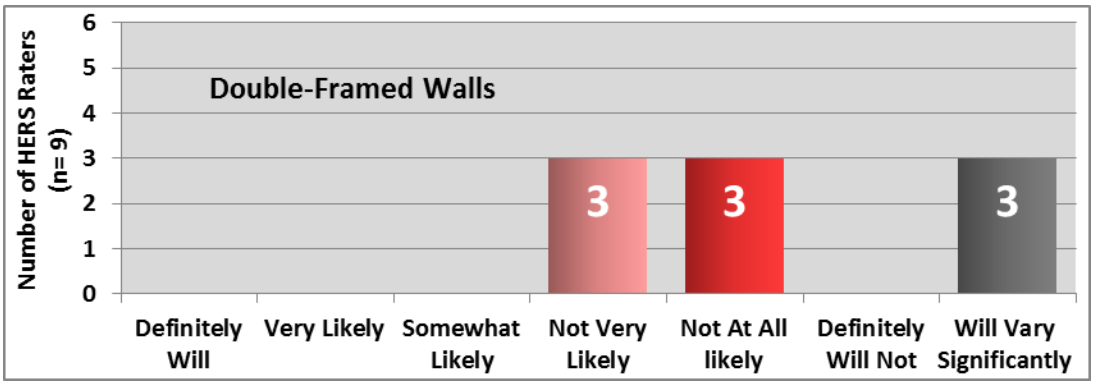


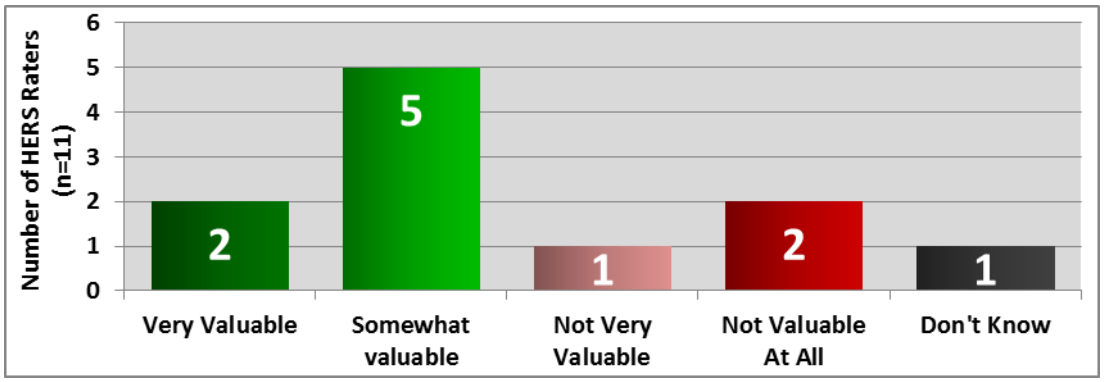
Figure 4-: Builder Willingness to use Double-Framed Walls



4.5 Importance of Building to ENERGY STAR Standards

All interviewed HERS raters were asked how important or valuable they think it is to the builders they currently work with in the Program to have their homes ENERGY STAR qualified. Figure 4- shows that most (7 of 11) HERS raters think the builders they work with think having their homes certified is at least somewhat valuable.

Figure 4-: Value of Having Homes ENERGY STAR Qualified



HERS raters say that what builders find most valuable about having their homes certified are:

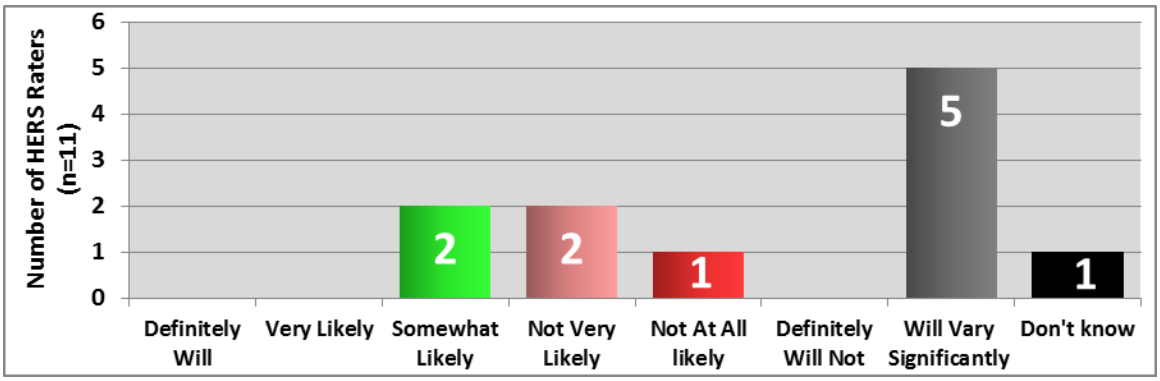
- Marketing benefits:
  - Homes sell faster
  - Branding differentiates their homes
- The technical support and advice provided by HERS raters.
  - Supplying insulation specs
  - Help with mechanical decisions and review of proposals
  - QC over subcontractors

- Free compact fluorescent bulbs (CFLs)
- Incentives/rebates
- Good preparation for performance testing in stretch code communities

HERS raters were also asked how likely they think the builders they currently work with in the Program will choose to incorporate the Version 3 requirements and continue to have their homes ENERGY STAR certified. Figure 4- shows that only two HERS raters say the builders they work with will be at least somewhat likely to incorporate Version 3 requirements; three think it is not very likely, or not at all likely. The most common response (5 HERS raters) is that the likelihood of incorporating Version 3 changes will vary significantly from builder to builder. The HERS rater who doesn't know if the builders he works with will incorporate Version 3 requirements says:

> *"I honestly don't know and it keeps me up at night and scares the heck out of me. Energy conservation can be tied to benefits to customers. Tying some of the expanded (not necessarily energy saving) requirements in Version 3 to benefits will be difficult."*

Figure 4-: How Likely Builders Will Be to Incorporate Version 3 Requirements



HERS raters were also asked which requirements they think it will be most difficult to convince builders who are "on the fence" about meeting Version 3 requirement to incorporate. They cited:

- Meeting TEC requirements:
  - Grade I insulation installation
  - Reduced thermal bridging
  - Advance framing techniques
- Meeting HVAC checklist requirements:
  - Load calculations for heating and cooling

Cost will clearly be an issue. As one HERS rater says:

> *"In selling it is location, location, location. In building it is cost, cost, cost. There is a fundamental disconnect between who has to make the investment and who gains the*

benefit. I don't know which specific requirements it will be most difficult to convince builders to adopt, but anything that inflates their cost, or directly relates to cost, will be a barrier."

The time required to learn the new requirements and make sure they are all met will also be an issue. As one HERS rater says:

"Builders want to get in, get done and not have carrying costs. They have a way of doing things, and any change that disrupts their pattern affects their construction schedule."

4.6 New Technologies and Increased Saving Opportunities

HERS raters were asked the following three questions addressing new technologies and how to increase savings:

- Do you see builders using any new technologies that you think are generating gas or electric savings that are not addressed in the REM/Rate software and, therefore, not showing up as savings?
- Are you aware of any new technologies that could produce savings that you think the Program should look into and consider promoting?
- Do you have any general suggestions for how to increase savings per home?

4.6.1 New Technologies

HERS raters mentioned several technologies, many of which are already being seen in homes participating in the Program, that they would like to see promoted more aggressively. Some of the technologies would be applicable to a very small percentage of homes and others have much wider applicability. LED lighting is one of the most commonly mentioned technologies. Other technologies mentioned are:

- Ductless mini-split heat pumps
- Air source heat pumps
- Solar hot water
- Heat pump water heaters
- Spray foam insulation
- Triple pane windows
- Rigid exterior insulation
- 24 inch on-center framing
- Optimal Value Engineering (OVE) framing
- Metal roofing, rigid foam insulation and an unvented roof: With an unvented roof you have no cold air being brought in.

HERS raters also suggested several new technologies, not all of which would necessarily increase savings. These new technologies include:

- Feedback monitors
  - Feedback monitors showing instantaneous electric use. The thinking is that if you can demonstrate on average how feedback monitors affect how people operate their homes, then you should be able to account for savings. One HERS rater says the monitors now cost $150 or less.
  - Feedback monitors for Gas or Heating Energy Use
- Ventilation systems with higher CFM/Watt
- Motor controlled ventilation based on pollutants rather than time
  - One rater says that the time approach, ventilation fans running a fixed number of hours per day, bothers people. He suggests using a system that monitors the buildup of moisture, carbon dioxide and other pollutants. If no one is in the house it would run less, which would save energy and make owners happy.
- HVAC technologies
  - Inverter Driven Heat Pumps: Investigate the technology for both split-ductless and ducted systems, figure out a proper rating system, work with AHRI (Air-Conditioning, Heating, and Refrigeration Institute) to make sure that it will happen and then get the information out there so that trade contractors understand what they are looking at. (The rater making this suggestion says he is not referring to the older American (Trane, Carrier and Lennox) systems; he is referring to the newer Mitsubishi and Sanyo systems.)
  - Dual Fuel Cold Climate Heat Pumps: The HERS rater who suggests promoting these rather than ones with electric resistance heat backup says that cold-climate heat pumps are effective at much lower temperatures than standard heat pumps.
- Water heating
  - Dehumidifier water heaters: They have a very high Energy Factor.[16]
- Air Sealing Systems: EnergyComplete™ from Owens Corning is an example. It is a spray on gasket. The real attraction is that it can be used at the top plate and if it is put on thick enough it should work when you put sheet rock up. The timing for using this product is good because it can be done at the same time the sheet rock is put up, but the problem is that the cost is high. (This system was used on a test home by one of the builders who participated in the Pilot.)

[16] For a description see: http://www.ornl.gov/adm/partnerships/factsheets/10-G01075_ID1096.pdf
Water heating dehumidifier

- Thermostatically controlled blinds: One HERS rater had a project with quad-paned windows and thermostatically controlled blinds outside the high solar gain windows. This is a new Hunter Douglas company product. This HERS rater commented, "*This is out there a little bit and you need to have a home designed for passive solar heat gain*."

4.6.2 REM/Rate Modeling Issues

More than half of the interviewed HERS raters mentioned problems they have encountered modeling homes or specific measures in REM/Rate.

- REM/Rate is ill suited for good passive designs because it does not properly address the physical aspects of windows used in passive solar gain homes or thermal bridging as it applies to super insulated buildings. REM/Rate does not accurately account for shading or super insulated envelopes, which can have large impacts on energy use.[17]
- It is not clear how to account for the thermal mass of a wall made of insulated concrete forms.
- "*The way air source heat pumps are modeled does not accurately reflect their actual efficiency. Heat pumps that are variable speed and have an output based on temperature and load can be much more efficient at a higher outdoor temperature. Over the course of a season they can be 250% efficient, but REM/Rate shows them at their worst performance and you do not capture the savings. We've measured this ourselves and REM/Rate does not accurately model variable speed air source heat pumps."*
- "*REM/Rate calls an LED a CFL. This needs to be addressed if there is a substantial reduction in energy usage going from CFLs to LEDs."*
- Occupancy sensors for lighting and ventilation are not addressed in REM/Rate.

4.7 INCREASING SAVINGS

Several builders commented on how to increase savings. Their comments are listed below:

- *"I think execution and envelope are what they should focus on, since those are the things that can't be fixed easily or cheaply later on. Improving equipment is easy in ten years; improving insulation is not."*
- Build efficient envelopes and install better mechanicals.
- Reward homes that have a lower envelope area because they inherently use less energy. (Example: An 8x8x8 cube compared to a 4x16x8 rectangular shape will have 17% less area from which to lose heat for the same volume and floor area.)
- Get away from stick framing or reduce the framing factor.
- Incentivize LED lighting.

[17] In earlier interviews, the HERS raters who worked on the Zero Energy Challenge Homes also identified limitations using REM/Rate for very low energy homes.

- More efficient lighting options: Mid- to high-end homes have huge chandeliers that usually do not accept energy-efficient bulbs, making it impossible for the home to meet the CFL percentage requirements. Find acceptable efficient lighting technologies that will enable these homes to meet ENERGY STAR requirements.
- *"Ensure that raters are doing their job."*
- "*As you encourage passive homes etc. there are no cold surfaces and the home is comfortable at a lower set point. Communicate this to people as you build tighter homes. The set point is controlled in REM/Rate (fixed) but there are also comfort levels related to thermal bridging and the indoor temperature can be lower."*
- "*Create an ENERGY STAR compliant library for builders. If builders incorporated all ENERGY STAR requirements in the planning stage they would avoid having to make changes during construction. We say to builders that we will not charge a penny extra to work with their architect, but it isn't happening.*"[18]
- One HERS rater says the answer to how to increase savings is not to focus on individual components but on the relationships between components—getting the system to work better together. He says that the houses being built today are so tight and the equipment in them is so efficient that there is not much more you can do that is cost effective, so you need to look to other places and types of programs. He thinks two of the biggest cost and savings drivers are promoting green framing (offering OVE framing certification) and subsidizing LED lighting.

[18]One builder of a Version 3 Pilot home supports this idea. When asked if he was to do it again [try to meet Version 3 requirements] what, if anything, he would do differently, he said: " I would probably get designers that are better at getting ENERGY STAR requirements down on paper than what I had. I had a mechanical engineering company doing a lot of my design work and they had the ENERGY STAR requirements, but those requirements didn't make their way into the design documents. I want the information incorporated better."

5 HVAC Contractor Interviews

5.1 Checklist Requirements and Standard Practices

Five of the eight interviewed HVAC contractors who did not work on a Pilot home say they are aware of the Version 3 checklists. All ten interviewed HVAC contractors were asked if meeting the following list of Version 3 requirements is their standard practice in homes with ducted heating and/or air conditioning systems and, if not, how often they meet the requirement:

- Manual J: system sizing
- Manual S or original equipment manufacturer (OEM) recommended: equipment selection
- Manual D: duct system design
- Equipment selection: matched components and sensible heat ratio
- Generate AHRI reference # from the AHRI online database
- Measure air flow across coil
- Measure room-by-room air flow
- Measure static pressure
- Measure refrigerant charge
- Seal ducts with mastic product
- Insulate ducts
- Pressure balance ducts

The interviewed HVAC contractors work primarily in the retrofit market, not new construction. In many cases they say they meet the Version 3 requirements on Cool Smart and new construction jobs, but not other jobs.

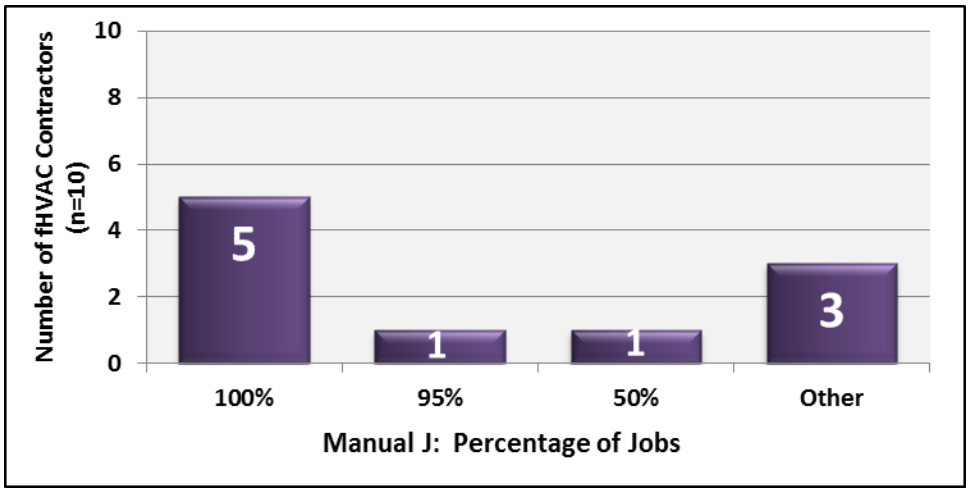
Manual J: Eight HVAC contractors say fulfilling the Manual J requirement is their standard practice. One of the contractors who says it is not his standard practice says he does it for probably more than 80% of air conditioning installations, but not for a very small home where he is replacing a one-half ton unit. He installs Weissman modulating gas boilers and says the smallest boiler they offer is 91,000 Btu, which he knows is oversized for some of the homes he works in. If a house is medium-sized or larger, that is when he starts doing the Manual J on heating installations. He also does the Manual J for homes installing heating systems for customers participating in the Mass Save Heat Loan Program. The other contractor says, "*If it's Cool Smart Program, I'll do it 100%, basically, on the air conditioning side. Honestly, on the heating side, I don't do it.*"

Figure 5- shows how often (on what percentage of jobs) HVAC contractors complete the Manual J. As shown, one-half (5 of 10 contractors) say they always do, one says 95% of jobs and one says 50% of jobs. In the "other" category, one does the Manual J for all new installations and 80% of retrofit installations; one for all new installations and 90% of installations in existing

homes; and one for more than 80% of air conditioning installations and 60% of heating installations.

Nine of the ten HVAC contractors say they always use software to perform the Manual J; one says some of his employees prefer to use software and some prefer to do the calculations manually. Eight contractors use Wrightsoft, one uses Elite, one uses both Wrightsoft and Elite, and one does not know what software is used because his supply house does the Manual J.

Figure 5-: Manual J Done



Manual S or OEM Recommended: Seven of the ten interviewed HVAC contractors say they always either use Manual S to select and size residential cooling equipment, furnaces and heat pumps or use OEM recommended equipment. One contractor does not use Manual S, but uses OEM recommended equipment on 80% of jobs. One contractor uses Manual S on 25% of jobs and one on 40% of jobs: neither of these contractors said how often they used OEM recommended equipment.

Manual D: Three HVAC contractors say they use Manual D for installations in new construction. One always uses Manual D; it is his standard practice for new duct systems and for the comparison of the equipment size to a replacement piece of equipment. Four contractors use a ductulator. Two use Wrightsoft; these contractors explained that Manual D is incorporated in Wrightsoft when doing the Manual J.

Equipment Selection—Matched Components and Sensible Heat Ratio: Nine of the ten interviewed HVAC contractors say it is their standard practice to select matched components and choose equipment based on its sensible heat ratio. Six of these contractors say they do it for all jobs; one does it 80% of the time; one does it for all ESQI jobs, which account for 25% of his jobs; and one says he probably does not do it for all of his jobs. One contractor says it is not his standard practice; he uses matched components for 50% of his jobs.

Generate AHRI Reference Number from AHRI Online Database: Nine of the ten interviewed HVAC contractors say it is their standard practice to generate the AHRI reference number from the AHRI online database. Six of these contractors say they do this for all jobs. One contractor does it for all new installations or replacements, never for anything else; one does it for all jobs with refrigerant systems; one does it for all jobs where a rebate is involved, which he says are 70% of his jobs. The HVAC contractor who says it is not his standard practice says he is not sure what the AHRI reference number is, but might have used it a couple of times for homeowner rebates.

Measure Air Flow across the Coil: Five of the interviewed HVAC contractors say measuring air flow across the coil is standard practice; four of these contractors say they do it on all jobs and one says he does it on 90% of jobs. Of the five who say it is not their standard practice to measure air flow across the coil, three say they do it only on Cool Smart installations; 10% to 20% of jobs for one of these contractors, 20% for one contractor, and 60% for one contractor. One contractor measures air flow across the coil on 33% of jobs, but always looks at static pressures and fan curves. One HVAC contractor, the only interviewed contractor who is not a Cool Smart contractor, says he does not measure air flow across the coil.

Measure Room-by-Room Air Flow: Measuring room-by-room air flow is not standard practice for any of the ten interviewed HVAC contractors. One says it depends on the situation, but he probably does it on no more than one-half of jobs. One does room-by-room load analysis with Wrightsoft and uses a flow hood on about a third of jobs to actually measure the flow. One says he probably measures room-by-room air flow about 30% of the time; he works with homes that are 10 years to 200 years old with existing ductwork and tries to make something better for the owner, but says owners are seldom willing to pay for making major changes in duct work. One contractor says he measures room-by-room air flow about 20% of the time, usually for balancing noise. One does it for whole new duct work systems (heating and air conditioning), which account for 10% of his jobs, but not for a furnace, boiler or air conditioning replacement. One says he does this only if he sees a problem—about 10% of jobs. One says that if he knows what the overall CFM needs to be and has the right duct to do it, and the right duct design, he is going to have the right flow. One contractor says he would do it if he worked on new construction jobs and two say they never measure room-by-room air flow.

Measure Static Pressure: Four of the ten interviewed HVAC contractors say it is their standard practice to measure static pressure; their estimates of how often they measure static pressure range from 80% to 90%. Two contractors say they measure static pressure on Cool Smart jobs: 40% to 50% of jobs for one of these contractors and 60% for the other. One says he does not do it on a regular basis, maybe 50% of the time. One contractor says he measures static pressure only 20% of the time and another contractor 2% of the time. One contractor does not measure static pressure.

Measure Refrigerant Charge: Nine of the ten interviewed HVAC contractors say it is their standard practice to measure refrigerant charge and eight of these contractors say they do it on all

cooling jobs; one did not know the percentage of jobs. The contractor who says it is not his standard practice to measure refrigerant charge says he does it as time and weather conditions allow—45% of service calls and 100% of new installations. Most contractors (6 of 10) use the subcooling and super heat method to measure refrigerant charge. One uses an anemometer, one uses digital gauges, one uses the manual curve, and one says he follows manufacturers' instructions—subcooling, superheat, delta T's, wet bulbs, dry bulbs, "*the whole works*."

Seal Ducts with Mastic Product and Insulate Ducts: All ten interviewed HVAC contractors say they always seal ducts with a mastic product and always insulate ducts.

Pressure Balance Ducts: Pressure balancing ducts is not standard practice for any of the ten interviewed HVAC contractors. Three contractors say they pressure balance ducts from 20% to 30% of the time. Two say they rarely pressure balance ducts—2% to 5% of jobs. Five contractors say they do not pressure balance ducts on residential jobs. Multiple contractors seemed unsure about what pressure balancing is, how it differs from measuring static pressure and room-by-room airflow, or seemed to think this was typically only done in commercial applications.

5.1.1 Additional Cost to Meet Checklist Requirements

All interviewed HVAC contractors were asked how much job costs would increase if meeting all the checklist requirements was included in the job contract. Responses varied widely and were in a variety of formats. The responses, listed from low to high, are:

- $250 for a contractor already meeting minimum standards; $500 for a typical contractor
- $300 to $500
- $500
- $600-$800 per system or 12% increase
- 10%
- $1,000 per system or 5%
- $1,000 or 8% for a contractor already meeting minimum standards; $2,500 or 25% for a typical contractor
- New construction 0%; Retrofit $3,000 to $5,000 or less depending on the customer
- 35% to 40% more than what a builder is typically paying for new construction
- $3,000 for the average size job for a typical contractor

HVAC contractors were also asked how much additional time meeting the checklist would add to their normal design, installation and start-up process. Estimates of the number of additional hours that would be required ranged from zero to ten hours; the average is five hours and the median is four. The contractor who said it would not add any time for him elaborated:

> *"It's been such a part of my life for so long, it doesn't really add any more time for me because we've been doing this stuff. But, to the average person it's going to add, design-wise, about four hours overall to the price of the design. And to the installation, let's talk*

a single system up to five tons, it's going to add anywhere from one to three days to a job project. But, when you take the guy who's been doing hack work, and he puts in an air conditioner or a furnace and he has a plenum on it and he comes off it with 50 feet of flex duct, running to six different outlets around—what we call a spaghetti job—it's going to add a lot, because he's got to now put a whole trunk system in. So it's going to add a lot to the cost of materials, it's going to add a lot to the cost of the labor. So a job that a guy is now doing, or a couple of guys are doing, in three days is going to become a week and a half, or at the very least a week, but probably a week and a half, and his materials cost is going to go up by at least a third."

5.2 HVAC Contractor Training

All interviewed HVAC contractors say they currently have the in-house expertise to fulfill the Version 3 HVAC installation requirements. However, four contractors mentioned areas where they would like additional training. Two contractors would like additional training on Manual D and Manual S; one would like additional training on Manual J. Two contractors would like to learn more about exactly what is required to complete the HVAC checklists, including detailed information on what the HVAC contractor is expected to measure and how. No interviewed contractors mentioned needing training on pressure balancing ducts, but since none do this as standard practice it may be appropriate to offer training on pressure balancing ducts.

Nine of the ten interviewed HVAC contractors say that if ACCA offered a "Quality Assured" Contractor Recognition Program supporting the ENERGY STAR HVAC Contractor checklist that they would be willing to attend a four-hour training session; the tenth contractor says he would consider attending.

Five of the interviewed HVAC contractors say they would send all their crews to training on meeting Version 3 checklist requirements; two would send only lead personnel, who could then train others. Three contractors say how many people they would send to training would depend on how many would likely be working on ESQI jobs and the cost and timing of the training; one of these contractors would make the training mandatory for his employees who would be working on ESQI jobs and optional for his other employees.

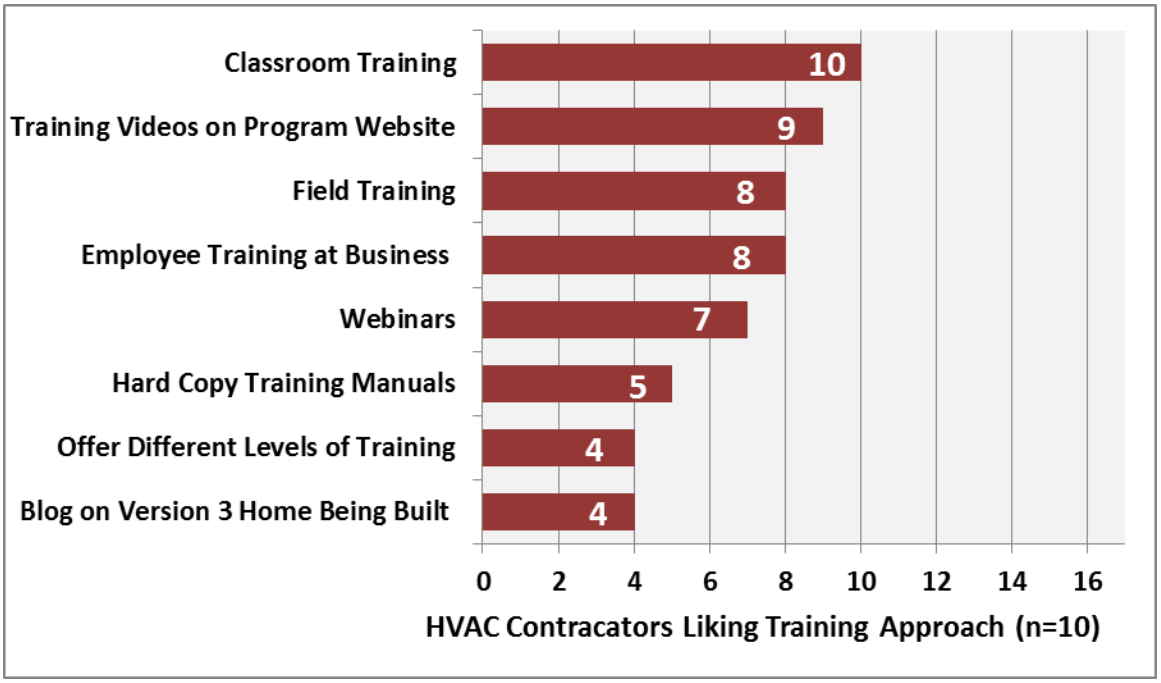
Only two interviewed contractors say their companies currently maintain written policies, procedures and practices stating how to implement best installation practices and meet industry standards. Six of the eight contractors who say their companies do not currently do this say they would be willing to do it. The remaining two contractors say their companies do not have written documentation but that work is closely supervised to make sure it is done correctly.

5.2.1 HVAC Training Approaches

All HVAC contractors were asked what they think are the best approaches for providing the training they will need to meet Version 3 requirements. Interviewers listed a number of training approaches and HVAC contractors indicated whether or not they thought it was a good training

approach. Figure 4- shows how many contractors like each training approach. As with builders, different contractors prefer different training approaches and a mix of training approaches will likely be the most effective way to meet HVAC contractors' training needs.

Figure 5-: HVAC Contractor Training Approaches



All interviewed HVAC contractors like the idea of classroom training. However, in their comments, they point out that it is important that the level of the training match the audience and the presenter be able to fully engage the audience, otherwise people drift off and start daydreaming. Some contractors prefer videos and on-site training because they say their people learn best by seeing how something is done, and if they can touch it that is even better. Several contractors like the idea of field training, but say it is difficult to set up and do well. One contractor commented that hands-on training is particularly important for teaching the more complex practices, saying "*Let's face it, people learn by trial and error, and there's not much trial and error in the classroom.*"

Contractors who like the idea of offering different levels of training say that it is important because they find it frustrating and a waste of time to sit through training that covers what they already know. One contractor noted that Cool Smart, ACCA and supply houses offer different levels of training and he finds that very valuable. He said ACCA offers webinars once a month and has past webinars available on their website; you can go back over two or three years of webinars and select the one you want when it is convenient and useful to you.

One contractor would like to see HVAC contractor training include information on HERS raters and their role in qualifying ENERGY STAR homes; air pressures, air changes, heat loss, heat

gain, etc. He says the problem is that when he sends out a crew to try to solve a problem for a customer they know just a small piece of the pie, and if they are not able to solve the problem the customer is left frustrated and not knowing where to turn for help. He would like a better understanding of how the whole house operates.

5.3 Value of Being Able to Meet Version 3 HVAC Requirements

All ten HVAC contractors were asked how important or valuable it would be for them to be able to market themselves or their companies as being able to meet ENERGY STAR builders' need to have their homes fulfill all HVAC related requirements for ENERGY STAR certification in 2012. Figure 5- shows that half (5 of 10) of the HVAC contractors say it would be very valuable for them to be able to market themselves as being able to fulfill the HVAC requirements for Version 3 homes. The other five contractors say they do very little new construction work so, for them, marketing being able to fulfill Version 3 HVAC requirements currently has limited value.

Figure 5-: Value of Marketing Ability to Meet Version 3 Requirements

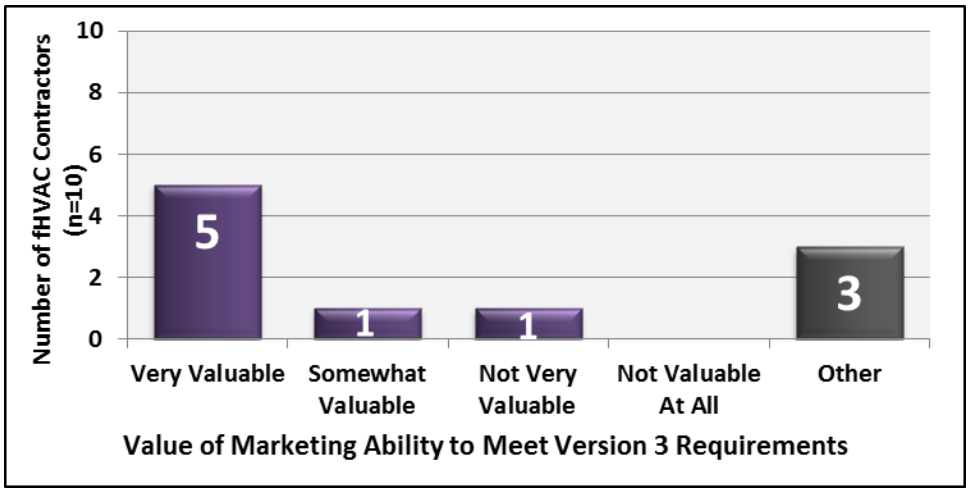
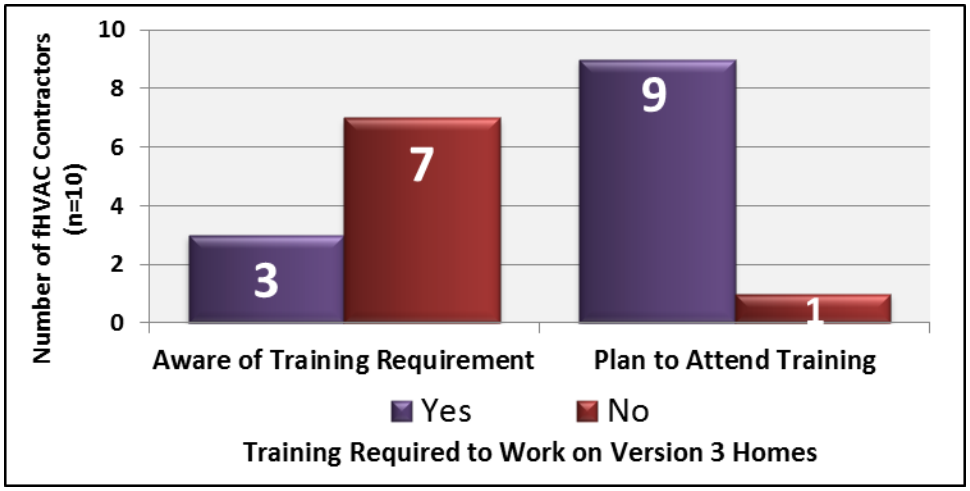


Figure 5- shows that only three of the interviewed HVAC contractors were aware of the training required for HVAC contractors who work on Version 3 ENERGY STAR-qualified homes.[19] However, nine of the ten contractors either plan to attend the training or say they have completed the training.

Figure 5-: HVAC Contractor Version 3 Training Requirement



The one contractor who does not plan on attending training, at least right now, says he does not do much new construction work, but is picking up the same knowledge and standardizing his procedures more on the Version 3 requirements, regardless of whether or not he is working on an ENERGY STAR home.

Nine of the ten interviewed HVAC contractors say they plan on being prepared to guarantee that their work in 2012 will meet all ENERGY STAR Version 3 requirements and that they will commit to this in their contracts with ENERGY STAR builders.

5.4 HVAC Distributor Input

In addition to HVAC contractors, the executive vice president of a full service distributor of heating and cooling equipment was interviewed. ICF provided training on Version 3 of the ENERGY STAR Homes Program last November to roughly 40 attendees at a training sponsored by this distributor. Overall, the distributor's comments addressing HVAC contractors working on new construction projects are consistent with the comments of the Cool Smart HVAC

[19] HVAC contractors who wish to install systems in ENERGY STAR Version 3 homes will be required to be 'credentialed' by an EPA–recognized third–party training and oversight organization (H-QUITO).
Source: http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_hvac_contractors

contractors interviewed. All of the Cool Smart contractors interviewed do mainly retrofit jobs. They are trained to do QIV and three are Premier Contractors trained to do ESQI jobs, but these jobs are a relatively small part of their business and they cannot compete with the low pricing many HVAC contractors offer builders for new construction projects.

Interviewed HVAC contractors agree with the distributor's observation that HVAC contractors want and need to know exactly what they will be expected to do when working on a Version 3 home, or a home in a stretch code community; they want to know the "specific stuff." The distributor says most HVAC contractors are more concerned about what is going to be required in stretch code communities than in Version 3 homes. Overview presentations and general information do not provide what they want to know. Version 3 presentations tend to focus more on what builders are required to do than subcontractors.

For a long time, many distributors have done the Manual J calculations for HVAC contractors. The distributor we talked with says his company is moving away from doing Manual J calculations and pushing the HVAC contractors to do the calculations themselves, using Wrightsoft or other applications; he says that other distributors are doing the same. He says he knows that the typical HVAC contractor is not doing a Manual J for a typical home.[20] He says they all know what a Manual J is and know what they have to do—the problem is getting them to do it. He says it is hard to get HVAC contractors to come to training on something until it affects them directly.

The distributor estimates 20% of the HVAC contractors he works with are aware of Version 3 requirements and 15% to 20% of the contractors he deals with work on ENERGY STAR homes, but they are not necessarily the same contractors. He says builders tell their subcontractors that a job is going to be ENERGY STAR and to "*just get the work done*," assuming that their subcontractors know what they are doing, but many subcontractors do not have a clue. He says half, probably three-quarters, of them do not even know what a HERS rater is. They do not know what stretch code is or Version 3 homes. If they are asked to do more and more in a home, they need to be compensated for it. It is all about money. Builders want to keep costs as low as possible. The subcontractors want to get in and get out, fast. That's how they make money. The distributor estimates meeting Version 3 checklist requirements will likely take an extra day of work per home. (This is consistent with interviewed HVAC contractors' estimates of how much longer it would take for a typical HVAC contractor.)

When asked if he thinks HVAC contractors will shy away from working on Version 3 homes the distributor said, absolutely. He says probably half of the HVAC contractors he works with have the knowledge to meet Version 3 requirements, but they will not do it because it takes too long. Again, it is all about the money. If a builder has three or four HVAC contractors bid for a job and if an HVAC contractor bids low because he needs the work, gets the job and finds out he cannot make any money on it, he will not do it again. The distributor also says HVAC contractors want

[20] This distributor company offers training courses and their course schedule for May and June 2011 includes courses on Manual J, Manual D and EPA certification.

builders to insulate homes so that all the duct work and mechanical equipment is in conditioned space; that makes it easier for them to meet ENERGY STAR requirements because duct leakage is typically not a problem. He has heard that some HVAC contractors have walked away from jobs if the ducts and equipment were not going to be in conditioned space. "*It's just when you get outside the envelope, in an attic or a basement, that's when the trouble begins."*

Appendix A Participant Builder Interview Guide

Questions for Builders Who Participated in the Version 3 Pilot

BASIC DEMOGRAPHIC INFORMATION

1. How long have you been building homes?
2. What type of housing do you build?
3. About how many homes have you built?
4. How many homes have you built in the last two years?
5. What is the average cost of the homes you build? *(Probe for a range of costs, if appropriate.)*
6. How long have you been building ENERGY STAR homes?
7. How many ENERGY STAR-qualified homes have you built?
8. Do you currently have all your homes ENERGY STAR qualified?
   8.1. **If not, ask:** Why not?

PARTICIPATION IN THE PILOT

9. How did you learn about the Pilot?
10. Why did you decide to participate in the Pilot?
11. What stage was the home in when you learned about and enrolled in the pilot?
12. How did you go about choosing a HERS rater to work with?
13. How did your building plan, building process, choice of HVAC equipment, choice of HVAC contractor and budget change because of participation in the Pilot and effort to meet Version 3 requirements?
14. How much additional time was required to meet Version 3 requirements?
15. If a custom home, what role did the homeowner play in making decisions that affected the ability or likelihood that the home would be able to meet Version 3 requirements?
16. What changes required to meet Version 3 requirements did you find it most difficult to meet, or understand, and what changes did you find it relatively easy to meet? *(Note that we will know which requirements they failed to meet and be able to probe for more detail on why they failed to meet these requirements. In particular, we will probe about whether they made a conscious decision to not meet a certain requirement or if they tried and failed.)*
17. If you had it to do over again, what, if anything, would you do differently?

SATISFACTION WITH THE PARTICIPATION PROCESS

18. Did you get the support you wanted or needed to help you meet Version 3 requirements?
19. Was the new process for determining the HERS index that had to be achieved to meet Version 3 clearly explained?

20. Satisfaction with the services provided by the various parties involved:*(Ask for responses on a scale of: very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, or very dissatisfied. If the response is dissatisfied, ask why they were dissatisfied.)*
    - 20.1. How satisfied were you with the ICF account manager and/or any other ICF staff you worked with or had contact with because of participating in the Pilot?
    - 20.2. How satisfied were you with your HERS rater?
21. Overall, how satisfied were you with your experience participating in the Pilot. *(Ask for responses on a scale of: very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, or very dissatisfied. If the response is dissatisfied, ask why they were dissatisfied.)*

GOING FORWARD—TRAINING

22. What kind of training do you think other builders will need to successfully meet Version 2.5 requirements?
23. What additional training on Version 3 requirements, if any, would you like to have to be sure you can meet Version 3 requirements in 2012?
24. Would you like training to include information on the cost of using different building materials, mechanical equipment, etc.? (*Examples are Structured Insulated Panels (SIPS), using something other than fiberglass batt insulation, etc.)*
    - 24.1. If yes, ask: For what specific materials, mechanical equipment, renewable options or subcontractor services would you like to see cost addressed in training?
25. What do you think are the best approaches for providing builders the training they need to meet Version 3 requirements? *(Check all that apply.)*
    - 25.1. Classroom training
    - 25.2. Field training
    - 25.3. Webinars
    - 25.4. Having tapes of training available on the Program's website
    - 25.5. Hard copy training manuals
    - 25.6. Real time blog on the internet of a Version 3 home being built from scratch
    - 25.7. Different levels of training for builders with different levels of experience
    - 25.8. Other

VALUE OF ENERGY STAR LABEL

26. How important, or valuable, is it for you to build ENERGY STAR homes and be able to market them as ENERGY STAR-qualified homes in the current housing market? *(Note: Builders interviewed for the "Streamlining Participation Process" report last year were asked this identical question. Response choices are: very valuable, somewhat valuable, not very valuable, not valuable at all, and other.)*

27. Does being ENERGY STAR qualified increase the marketability of your homes? *(Probe for examples of why or why not they think it increases marketability.)*
    - 27.1. **If yes, ask:** Does building to higher tiers matter–make your homes more marketable–or is the only thing that matters when it comes to selling a home is that it has an ENERGY STAR label?
    - 27.2. If you build a higher-tier ENERGY STAR home, do you do anything in your marketing to distinguish your home from other ENERGY STAR homes?
        - 27.2.1. **If yes, ask:** How do you distinguish your higher-tier homes?
        - 27.2.2. How successful is this approach in helping market your higher-tier ENERGY STAR homes?
28. Have any buyers come to you looking for an ENERGY STAR-qualified spec-built home? *(If yes, probe for examples.)*
29. Have any buyers come to you asking you to build a custom-built ENERGY STAR home?*(If yes, probe for examples.)*

GOING FORWARD—BUILD ENERGY STAR HOMES?

30. Looking ahead, do you plan to have homes you build in 2011 be ENERGY STAR-qualified? *(Note: Per EPA December 1, 2010 update, single family homes that are permitted before April 1, 2011 can continue to be qualified under the current v2 guidelines until July 1, 2011. Condos and apartments in multi-family buildings that are permitted before April 1, 2011 can continue to be qualified under the current v2 guidelines until January 1, 2012. All homes both permitted and completed between April 1, 2011 and December 31, 2011 must be qualified using the new v2.5 guidelines. Version 2.5 is composed of the Version 3 ENERGY STAR Reference Design coupled with the Air Barriers and Air Sealing sections of Thermal Enclosure checklist. Under Version 2.5, the other inspection checklists shall be completed but not enforced.*
    http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_2011_comments)
31. Do you plan on meeting all Version 3 requirements for homes you build in 2012?
    - 31.1. **If not, ask:** Why not?
    - 31.2. How would the Version 3 requirements have to change for you to continue building ENERGY STAR homes?
32. Are you aware that all builders of Version 3 ENERGY STAR homes in 2012 will be required to complete on-line, web-based training on Version 3? *(Note: If builder is not aware of the training, the interviewer can explain that one person from each building firm will be required to take the training. The training will be available in early 2011, will be free, will take about one hour to complete, and will include a test.)*
33. How much do you think meeting Version 3 requirements will add to the cost of building a home? *(Responses could be a percentage increase or the average incremental cost for a typical single family detached home.)*

34. Do you think the HVAC contractor you currently work with will be able, and willing, to meet the Version 3 requirements for ENERGY STAR qualification?
    34.1. If not, ask: Would you be willing to consider hiring a different HVAC contractor who was trained on the Version 3 requirements and would guarantee meeting Version 3 requirements?
35. Do you now, or do you plan to, build in stretch code communities?
    35.1. **If yes, ask:** what effect does this have on your interest in making sure you are prepared to build homes in 2012 that meet Version 3 ENERGY STAR requirements?
36. How valuable do you find the services provided by the HERS rater you work with on homes you have ENERGY STAR qualified through the MA New Homes with ENERGY STAR Program?
37. The MA Program currently subsidizes at least a portion of the HERS raters' fees. If the MA Program no longer subsidized HERS rater fees, how likely would you be to pay the HERS rater's fees and continue to have your homes ENERGY STAR qualified?
    37.1. **If not likely, ask:** Why not?

Closing

38. Those are all the questions I have. Is there anything I haven't asked you about that you would like to add about your participation in the Version 3 Pilot?

THANK YOU FOR YOUR TIME

Appendix B Non-Participant Builder Interview Guide

Questions for Builders Who Attended Version 3 Training

BASIC DEMOGRAPHIC INFORMATION

1. How long have you been building homes?
2. What type of housing do you build?
3. About how many homes have you built?
4. How many homes have you built in the last two years?
5. What is the average cost of the homes you build? *(Probe for a range of costs, if appropriate.)*
6. How long have you been building ENERGY STAR homes?
7. How many ENERGY STAR-qualified homes have you built?
8. Do you currently have all your homes ENERGY STAR qualified?
   8.1. If not, ask: Why not?

VERSION 3 TRAINING

9. Overall, how satisfied were you with the Version 3 training you attended? *(Ask for responses on a scale of: very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, or very dissatisfied. If the response is dissatisfied, ask why they were dissatisfied. Note: we will know what training they attended.)*
10. With the training that you have had, do you think you have all of the knowledge and training you will need to be able to meet Version 2.5 requirements for ENERGY STAR qualification in 2011 and Version 3 requirements in 2012?
    10.1. If not, ask: Why not?
11. What additional training and/or information would you like, or think you will need, to ensure you will be able to meet the new requirements? *(Probe for specific information they would like to have and to identify specific requirements they would like more training on.)*
12. What kind of training do you think other builders will need to successfully meet the new requirements?
13. Would you like training to include information on the cost of using different building materials, mechanical equipment, etc.? *(Examples are Structured Insulated Panels (SIPS), using something other than fiberglass batt insulation, etc.)*
    13.1. **If yes, ask:** For what specific materials, mechanical equipment, renewable options or subcontractor services would you like to see cost addressed in training?
14. What do you think are the best approaches for providing builders the training/information they will need to meet Version 3 requirements? *(Check all that apply.)*
    14.1. Classroom training
    14.2. Field training
    14.3. Webinars
    14.4. Having tapes of training available on the Program's website

14.5. Hard copy training manuals
14.6. Real time blog on the internet of a Version 3 home being built from scratch
14.7. Different levels of training for builders with different levels of experience
14.8. Other

VALUE OF ENERGY STAR LABEL

15. How important, or valuable, is it for you to build ENERGY STAR homes and be able to market them as ENERGY STAR-qualified homes in the current housing market? *(Note: Builders interviewed for the "Streamlining Participation Process" report last year were asked this identical question. Response choices are: very valuable, somewhat valuable, not very valuable, not valuable at all, and other.)*
16. Does being ENERGY STAR qualified increase the marketability of your homes? *(Probe for examples of why or why not they think it increases marketability.)*
    16.1. **If yes, ask:** Does building to higher tiers matter–make your homes more marketable– or is the only thing that matters when it comes to selling a home is that it has an ENERGY STAR label?
    16.2. If you build a higher-tier ENERGY STAR home, do you do anything in your marketing to distinguish your home from other ENERGY STAR homes?
        16.2.1. **If yes, ask:** How do you distinguish your higher-tier homes?
    16.3. How successful is this approach in helping market your higher-tier ENERGY STAR homes?
17. Have any buyers come to you looking for an ENERGY STAR-qualified spec-built home? *(If yes, probe for examples.)*
18. Have any buyers come to you asking you to build a custom-built ENERGY STAR home? *(If yes, probe for examples.)*

GOING FORWARD—BUILD ENERGY STAR HOMES?

19. Looking ahead, do you plan to have homes you build in 2011 be ENERGY STAR-qualified? *(Note: Per EPA December 1, 2010 update, single family homes that are permitted before April 1, 2011 can continue to be qualified under the current v2 guidelines until July 1, 2011. Condos and apartments in multi-family buildings that are permitted before April 1, 2011 can continue to be qualified under the current v2 guidelines until January 1, 2012. All homes both permitted and completed between April 1, 2011 and December 31, 2011 must be qualified using the new v2.5 guidelines. Version 2.5 is composed of the Version 3 ENERGY STAR Reference Design coupled with the Air Barriers and Air Sealing sections of Thermal Enclosure checklist. Under Version 2.5, the other inspection checklists shall be completed but not enforced.*
    http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_2011_comments)
20. Do you plan on meeting all Version 3 requirements for homes you build in 2012?
    20.1. **If not, ask:** Why not?

20.2. How would the Version 3 requirements have to change for you to continue building ENERGY STAR homes?

21. Are you aware that all builders of Version 3 ENERGY STAR homes in 2012 will be required to complete on-line, web-based training on Version 3? *(Note: If builder is not aware of the training, the interviewer can explain that one person from each building firm will be required to take the training. The training will be available in early 2011, will be free, will take about one hour to complete, and will include a test.)*
22. Do you think the HVAC contractor you currently work with will be able, and willing, to meet the Version 3 requirements for ENERGY STAR qualification?
    22.1. **If not, ask:** Would you be willing to consider hiring a different HVAC contractor who was trained on the Version 3 requirements and would guarantee meeting Version 3 requirements?
23. How much do you think meeting Version 3 requirements will add to the cost of building a home? *(Responses could be a percentage increase or the average incremental cost for a typical single family detached home.)*
24. Do you now, or do you plan to, build in stretch code communities?
    24.1. If yes, what effect does this have on your interest in making sure you are prepared to build homes in 2012 that meet Version 3 ENERGY STAR requirements?
25. How valuable do you find the services provided by the HERS rater you work with on homes you have ENERGY STAR qualified through the MA New Homes with ENERGY STAR Program?
26. The MA Program currently subsidizes at least a portion of the HERS raters' fees. If the MA Program no longer subsidized HERS rater fees, how likely would you be to pay the HERS rater's fees and continue to have your homes ENERGY STAR qualified?

Closing

27. Those are all the questions I have. Is there anything I haven't asked you about that you would like to add about Version 3 requirements?

THANK YOU FOR YOUR TIME

Appendix C Participant HERS Rater Interview Guide

Questions for HERS Raters Who Worked with Version 3 Pilot Homes

BASIC DEMOGRAPHIC INFORMATION

1. How many years have you been a HERS rater?
2. How long have you been certifying homes participating in the Massachusetts ENERGY STAR Homes Program?
3. About how many ENERGY STAR homes have you certified?
   - 3.1. How many builders are you currently working with in the MA Program?
   - 3.2. About how many homes (housing units) are you currently working with in the MA Program?

PARTICIPATION IN THE PILOT

4. How many of the Pilot homes did you work with?
5. Did you feel fully trained/prepared to explain the Version 3 requirements to the builders you worked with and to help them meet those requirements?
   - 5.1. If not, what additional training would you have liked?
6. How hard do you think builders tried to meet the Version 3 requirements? *(Probe if this varied from builder to builder if the HERS rater worked with more than one Pilot home and if builders' commitment varied, why do they think some builders were more committed than others.)*
7. How many of the homes you worked with met all Version 3 requirements and how many failed to meet Version 3 requirements?
8. How much training/support did builders need to incorporate the Version 3 requirements into their building process?
9. For which Version 3 requirements did builders need the most training/support?
10. For which Version 3 requirements did builders need the least training/support?
11. Which Version 3 requirements did builders find it hardest to meet and why?
12. Which Version 3 requirements did builders find it easiest to meet and why?
13. What requirements did homes fail to meet and why? *(Note: we will know what requirements each home failed to meet, which will enable us to probe why each home failed specific requirements.)*
14. How much more time did you spend working with the Pilot homes than you spend working on a Version 2 ENERGY STAR home?

SATISFACTION WITH THE PARTICIPATION PROCESS

15. Did you get the training/support you wanted/needed from the ICF staff implementing the Pilot?
16. Do you think the Pilot was well thought out, organized and implemented efficiently?
17. Is there anything you would have liked to have seen done differently?
18. Overall, how satisfied are you with your experience participating in the Pilot. *(Ask for responses on a scale of: very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, or very dissatisfied. If the response is dissatisfied, ask to explain why they were dissatisfied.)*

GOING FORWARD

19. What additional training on Version 3 would you like, or feel you need, to provide the support builders will need to meet Version 3 requirements?
20. What training do you think HERS raters who did not work with a Pilot home will need to be able to explain the Version 3 requirements to builders and provide the support builders will want/need to meet Version 3 requirements by 2012?
21. Are you aware that all HERS raters certifying Version 3 ENERGY STAR homes in 2012 will be required to attend Version 3 training by January 1, 2012? (Note: If HERS rater is not aware of the training, the interviewer can explain that the training will be available via RESNET training providers, not EPA. Each rater must be certified and working under accredited providership.)
    21.1. If yes, ask: Do you plan on completing the training?
    21.2. If not, ask: Why not?
22. How difficult do you think it will be for most of the builders you currently work with in the Program to be able to incorporate the Version 3 requirements by 2012?
23. How do you expect the amount of time required for inspections and support for a Version 3 home will compare to a Version 2 home?
24. How much will your basic fee for working with a Version 3 home compare to what you currently charge for working with a Version 2 home?
25. How do you think incorporating the Version 3 requirements will affect the cost of homes?
26. How important do you think it is to the builders you currently work with who are participating in the Program to have their homes ENERGY STAR qualified?
27. How likely do you think the builders you currently work with who are participating in the Program will choose to incorporate the Version 3 requirements and continue to have their homes ENERGY STAR certified?
28. For builders who are “on the fence” about incorporating Version 3 requirements, which requirements will be the most difficult to convince them to incorporate?
29. How likely do you think builders will be willing to make specific changes that could help them meet Version 3 requirements? Examples are:
    29.1. Using something other than fiberglass batts to insulate floors

29.2. Using 24 inch on-center stud spacing
29.3. Consider using Structural Insulated Panels (SIPS)
29.4. Using a different HVAC contractor on homes with ducted HVAC systems if their current contractor is not willing, or able, to commit to meeting Version 3 HVAC requirements
29.5. Continuous rigid insulation sheathing
29.6. Advanced framing techniques
29.7. Double-framed walls

NEW TECHNOLOGIES AND SAVINGS

30. Do you see builders using any new technologies that you think are generating gas or electric savings that are not addressed in the Rem/RATE software and, therefore, not showing up as savings?
    30.1. If so, what technologies?
31. Are you aware of any new technologies that could produce savings that you think the Program should look into and consider promoting?
    31.1. If so, what technologies?
32. Do you have any general suggestions for how to increase savings per home?

CLOSING

33. Those are all the questions I have. Is there anything I haven't asked you about that you would like to add about your participation in the Version 3 Pilot?

THANK YOU FOR YOUR TIME

Appendix D Non-Participant HERS Rater Interview Guide

Questions for HERS Raters Who Did Not Work with Version 3 Pilot Homes

BASIC DEMOGRAPHIC INFORMATION

1. How many years have you been a HERS rater?
2. How long have you been certifying homes participating in the Massachusetts ENERGY STAR Homes Program?
3. About how many ENERGY STAR homes have you certified?
   - 3.1. How many builders are you currently working with in the MA Program?
   - 3.2. About how many homes (housing units) are you currently working with in the MA Program?

VERSION 3 TRAINING

4. Have you participated in any training on Version 3 requirements?
   - 4.1. If yes, ask: What training have you had?
5. Overall, how satisfied are you with the training you received? *(Ask, for each training, for responses on a scale of: very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, or very dissatisfied. If the response is dissatisfied, ask to explain why they were dissatisfied.)*
6. Do you feel adequately trained/prepared to explain the Version 3 requirements to the builders you work with and to help them meet those requirements?
   - 6.1. If not, ask: What additional training would you like? (Probe for what specific Version 3 requirements they would like more training on.)
   - 6.2. What do you think are the best approaches for providing HERS raters the training/information needed to help builders meet Version 3 requirements?
7. Are you aware that all HERS raters certifying Version 3 ENERGY STAR homes in 2012 will be required to attend Version 3 training by January 1, 2012? *(Note: If HERS rater is not aware of the training, the interviewer can explain that the training will be available via RESNET training providers, not EPA. Each rater must be certified and working under accredited providership.)*
   - 7.1. If yes, ask: Do you plan on completing the training?
   - 7.2. If not, ask: Why not?

GOING FORWARD

8. How difficult do you think it will be for most of the builders you currently work with through the Program to be able to incorporate the Version 3 requirements by 2012?
9. How do you expect the amount of time required for inspections and support for a Version 3 home will compare to a Version 2 home?

10. How much will your basic fee for working with a Version 3 home compare to what you currently charge for working with a Version 2 home?
11. How do you think incorporating the Version 3 requirements will affect the cost of homes?
    11.1. What requirements will have the biggest impact on costs?
12. How important do you think it is to the builders you currently work with who are participating in the Program to have their homes ENERGY STAR qualified?
13. How likely do you think the builders you currently work with who are participating in the Program will choose to incorporate the Version 3 requirements and continue to have their homes ENERGY STAR certified?
14. For builders who are "on the fence" about incorporating Version 3 requirements, which requirements do you think will be the most difficult to convince them to incorporate?
15. How likely do you think builders will be willing to make specific changes that could help them meet Version 3 requirements? Examples are: *(Note: Based on the interviews with builders and HERS raters who participated in the Pilot, this list can be expanded to include any additional changes that builders who participated in the Pilot said they are not willing to make and HERS raters who worked with the Pilot homes identified as changes builders are least likely to make.)*
    15.1. Using something other than fiberglass batts to insulate floors
    15.2. Using 24 inch on-center stud spacing
    15.3. Consider using Structural Insulated Panels (SIPS)
    15.4. Using a different HVAC contractor on homes with ducted HVAC systems if their current contractor is not willing, or able, to commit to meeting Version 3 HVAC requirements
    15.5. Continuous rigid insulation sheathing
    15.6. Advanced framing techniques
    15.7. Double-framed walls

NEW TECHNOLOGIES AND SAVINGS

16. Do you see builders using any new technologies that you think are generating gas or electric savings that are not addressed in the Rem/RATE software and, therefore, not showing up as savings?
    16.1. If so, what technologies?
17. Are you aware of any new technologies that could produce savings that you think the Program should look into and consider promoting?
    17.1. If so, what technologies?
18. Do you have any general suggestions for how to increase savings per home?

CLOSING

19. Those are all the questions I have. Is there anything I haven't asked you about that you would like to add about Version 3 requirements?

THANK YOU FOR YOUR TIME

Appendix E Participant HVAC Contractor Interview Guide

Questions for HVAC Contractors Who Worked on Homes with Ducted HVAC Systems in the Version 3 Pilot

BASIC DEMOGRAPHIC INFORMATION

1. How many years have you been an HVAC contractor?
2. How many years have you installed HVAC systems in ENERGY STAR homes?
   2.1. About how many ENERGY STAR-qualified homes have you worked on?
3. Have you participated in any Program-sponsored training for HVAC contractors?
4. Do you install boilers (wet work including piping) or just furnaces and A/C (air).
5. Do you design and fabricate the duct systems or contract the work out?
6. How large is your company (number of field crews)?
7. Do you hold any industry certifications such as NATE?
   7.1. **If yes,** please describe.
8. Do you belong to any particular trade organization or attend conferences and meetings?
   8.1. **If yes,** please describe.
9. Do you currently do any work with the MA COOL SMART Program?
   9.1. **If yes,** please describe.
10. Have you attended any COOL SMART trainings on ENERGY STAR Quality Installation Specifications or QIV?
11. Have you participated in any other types of training such as manufacture, ACCA (Air Conditioning Contractors of America), supply house training etc.
    11.1. **If yes,** please describe.

PARTICIPATION IN THE PILOT

12. Did you know that the home was participating in the Version 3 Pilot?
    12.1. If yes, ask: When did you learn the home was part of the Version 3 Pilot?
13. Was the purpose of the Pilot clearly explained to you?
14. Did the builder (or someone else) explain the requirements of the Version 3 HVAC System Quality Installation Contractor checklist and the HVAC System Quality Installation Rater checklist to you? *(If yes, probe for who told them about the requirements.)*
    14.1. **If yes, ask:** Was this before or after you were hired?
15. Were you asked to complete the HVAC System Quality Installation Contractor checklist? *(Note: For Version 2.5 HVAC contractors will be required to complete the checklist, but not meet the requirements.)*
    15.1. **If not, ask:** Have you seen the HVAC System Quality Installation Contractor checklist and the HVAC System Quality Installation Rater checklist?

16. Did the builder ask you to try to do work that would meet the requirements of the HVAC System Quality Installation Contractor checklist and the HVAC System Quality Installation Rater checklist?
    16.1. **If yes, ask:** Was passing the Version 3 checklists included as a requirement in your contract with the builder?
17. Did you have any contact with or support from anyone else involved in implementing the Pilot about meeting the HVAC System Quality Installation Contractor checklist and the HVAC System Quality Installation Rater checklist?
    17.1. **If yes, ask:** Who did you have contact with (HERS rater, ICF personnel, etc.) and was the information/support you received helpful?
18. How satisfied are you with the information/support you received? *(Ask for responses on a scale of: very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, or very dissatisfied. If the response is dissatisfied, ask why they were dissatisfied.)*
19. Are you aware that the home failed to meet at least some of the requirements of the HVAC System Quality Installation Contractor checklist and the HVAC System Quality Installation Rater checklist?
    19.1. **If yes, ask**: Can you explain why the home failed specific requirements? *(Note: We will have information from the Pilot on exactly what requirements each home failed to meet and will be able to probe for information on why the HVAC contractor was unable to, or intentionally decided not to, meet those requirements.)*
    19.2. Are these factors things that you think you could address if you worked on other ENERGY STAR homes striving to meet Version 3 requirements?
    19.3. **If yes, ask:** How much extra would it cost?

CHECKLIST REQUIREMENTS AND STANDARD PRACTICE QUESTIONS

20. I have a list of HVAC checklist requirements and would like you to tell me if meeting each one is standard practice for you in homes with ducted heating and/or air conditioning systems and, if not, how often you meet the requirement (percentage of jobs)?
    20.1. Manual J? *(System Sizing, Manual J, "Residential Load Calculation," published by the Air Conditioning Contractors of America (ACCA), is the recommended method for use in the United States.)*
        20.1.1. Performed manually or with software?
            20.1.1.1. If software, which Program?
    20.2. Manual S or OEM recommended? *(Equipment Selection, Manual S, published by ACCA, addresses the procedures that should be used to select and size residential cooling equipment, furnaces and heat pumps.)*
    20.3. Manual D? *(System Design,(Manual D, published by ACCA, is the nationally-recognized standard for designing residential HVAC duct systems.)*

20.3.1. Do you use other duct design methods – Duct Size Calculator or ductulator[21] etc.?

20.4. Equipment selection: matched components and sensible heat ratio

20.5. Generate AHRI reference # from the AHRI online database?[22]

20.6. Measure flow across coil?

20.7. Measure room-by-room air flow?

20.8. Measure static pressure?

20.9. Measure refrigerant charge?

20.9.1. **If yes, ask:** What measurement method do you use: flow grid, fan curve, pressure matching, anemometer, temperature rise, other?

20.10. Seal ducts with mastic product?

20.11. Insulate ducts?

20.12. Pressure balance ducts?

21. How much would the costs for a job increase if meeting all the checklist requirements was included in the job contract?

22. How much additional time would meeting the checklist add to your normal design, installation and start-up process?

23. How much additional material would meeting the checklist add to your normal design, installation and start-up process?

24. What is your hourly installation rate per worker?

TRAINING

25. Do you currently have the in-house expertise to fulfill the Version 3 HVAC installation requirements?

25.1. **If not,** what, specifically, would you want or need training on to be sure you could properly complete the HVAC System Quality Installation Contractor checklist in 2011 and successfully meet all HVAC related Version 3 requirements in 2012?

26. If ACCA offered a "Quality Assured" Contractor Recognition Program supporting the ENERGY STAR HVAC Contractor checklist, would you attend a 4-hour session?

26.1. Does your company currently maintain written policies, procedures and practices stating how you implement best installation practices and industry standards?

26.2. **If not,** would you be willing to develop a company policy for QI standards?

27. Do you have multiple crews?

27.1. **If yes, ask:** Would you train all crews to meet Version 3 requirements?

28. What do you think are the best approaches for providing the training you want/need?

28.1. Classroom training

[21] "A ductulator is basically a duct calculator. It is used by HVAC professionals to perform duct sizing processes. It is normally available as computer software available on laptops, and pocket pc's. They were specially designed by professional engineers to replace hand held ductulators. .http://www.reference.com/motif/Home/free-ductulator

[22] The AHRI Certified Reference Number is your system's unique identifier in the directory and can be entered to pull up your system's certified efficiency ratings. The certificate provides a hard copy of the AHRI Certified Reference Number and the system's certified efficiency ratings, which can be used to obtain utility rebates and tax credits. http://www.ahrinet.org/Content/WhybuyARIPerformanceCertifiedsystems_300.aspx

28.2. Field training
28.3. Hard copy training manuals
28.4. Employee training at their business location
28.5. Webinars
28.6. Having tapes of training available on the Program's website
28.7. Real time blog on the internet of a Version 3 home being built from scratch
28.8. Different levels of training for HVAC contractors with different levels of experience
28.9. Other

VALUE OF BEING ABLE TO MEET ENERGY STAR REQUIREMENTS

29. How important, or valuable, is it for you to be able to market yourself or your company as being able to meet ENERGY STAR builders' need to have their homes fulfill all HVAC related requirements for ENERGY STAR certification in 2012?
30. Are you aware that all HVAC contractors working on Version 3 ENERGY STAR homes in 2012 will be required to complete Version 3 training? *(Note: If HVAC contractor is not aware of the training, the interviewer can explain that one person from each HVAC firm will be required to complete the training. The training will be available through Air Conditioning Contractors of America (ACCA). EPA will provide lists of credentialed HVAC contractors.)*
    30.1. **If yes, ask:** Do you plan on completing the training?
    30.2. **If not, ask:** Why not?
31. Do you plan on being prepared to guarantee that your work in 2012 will meet all ENERGY STAR Version 3 requirements?
32. Will you commit to this in your contracts with ENERGY STAR builders?

Closing

33. Those are all the questions I have. Is there anything I haven't asked you about that you would like to add about your participation in the Version 3 Pilot?

THANK YOU FOR YOUR TIME

Appendix F Non-Participant HVAC Contractor Interview Guide

Questions for HVAC Contractors Who Attended Training but Did Not Work on Version 3 Pilot Homes

BASIC DEMOGRAPHIC INFORMATION

1. How many years have you been an HVAC contractor?
2. Have you installed HVAC systems in ENERGY STAR homes?
   - 2.1. **If yes, ask:** How many years have you installed HVAC systems in ENERGY STAR homes?
   - 2.2. About how many ENERGY STAR-qualified homes have you worked on?
3. What Program-sponsored training for HVAC contractors have you participated in? *(Note: We should have lists from ICF that will tell us what training they attended.)*
4. Do you install boilers (wet work including piping) or just furnaces and A/C (air)?
5. Do you design and fabricate the duct systems or contract the work out?
6. How large is your company (number of field crews)?
7. Do you hold any industry certifications such as NATE?
   - 7.1. **If yes**, please describe.
8. Do you belong to any particular trade organization or attend conferences and meetings?
   - 8.1. **If yes**, please describe.
9. Do you currently do any work with the MA COOL SMART Program?
   - 9.1. **If yes,** please describe.
10. Have you attended any COOL SMART trainings on ENERGY STAR Quality Installation Specifications or QIV?
11. Have you participated in any other types of training such as manufacture, ACCA (Air Conditioning Contractors of America), supply house training etc.?
    - 11.1. **If yes,** please describe.

CHECKLIST REQUIREMENTS AND STANDARD PRACTICE QUESTIONS

12. Are you familiar with the Version 3 HVAC System Quality Installation Contractor checklist and the HVAC System Quality Installation Rater checklist? *(Note: They should be if they attended training and everyone we will be interviewing will have attended training.)*
13. I have a list of HVAC checklist requirements and would like you to tell me if meeting each one is standard practice for you in homes with ducted heating and/or air conditioning systems and, if not, how often you meet the requirement (percentage of jobs)?
    - 13.1. Manual J? *(System Sizing, Manual J, "Residential Load Calculation," published by the Air Conditioning Contractors of America (ACCA), is the recommended method for use in the United States.)*

13.1.1. Performed manually or with software?

13.1.1.1. If software, which Program?

13.2. Manual S or OEM recommended? *(Equipment Selection, Manual S, published by ACCA, addresses the procedures that should be used to select and size residential cooling equipment, furnaces and heat pumps.)*

13.3. Manual D? *(System Design,(Manual D, published by ACCA, is the nationally-recognized standard for designing residential HVAC duct systems.)*

13.3.1. Do you use other duct design methods – Duct Size Calculator or ductulator[23] etc.?

13.4. Equipment selection: matched components and sensible heat ratio

13.5. Generate AHRI reference # from the AHRI online database?[24]

13.6. Measure flow across coil?

13.7. Measure room-by-room air flow?

13.8. Measure static pressure?

13.9. Measure refrigerant charge?

13.9.1. **If yes, ask:** What measurement method do you use: flow grid, fan curve, pressure matching, anemometer, temperature rise, other?

13.10. Seal ducts with mastic product?

13.11. Insulate ducts?

13.12. Pressure balance ducts?

14. How much would the costs for a job increase if meeting all the checklist requirements was included in the job contract?
15. How much additional time would meeting the checklist add to your normal design, installation and start-up process?
16. How much additional material would meeting the checklist add to your normal design, installation and star-up process?
17. What is your hourly installation rate per worker?

[23] "A ductulator is basically a duct calculator. It is used by HVAC professionals to perform duct sizing processes. It is normally available as computer software available on laptops, and pocket pc's. They were specially designed by professional engineers to replace hand held ductulators. http://www.reference.com/motif/Home/free-ductulator

[24] The AHRI Certified Reference Number is your system's unique identifier in the directory and can be entered to pull up your system's certified efficiency ratings. The certificate provides a hard copy of the AHRI Certified Reference Number and the system's certified efficiency ratings, which can be used to obtain utility rebates and tax credits. http://www.ahrinet.org/Content/WhybuyARIPerformanceCertifiedsystems_300.aspx

TRAINING

18. Do you currently have the in-house expertise to fulfill the Version 3 HVAC installation requirements?
    18.1. **If not,** what, specifically, would you want or need training on to be sure you could properly complete the HVAC System Quality Installation Contractor checklist in 2011 and successfully meet all HVAC related Version 3 requirements in 2012?
19. If ACCA offered a "Quality Assured" Contractor Recognition Program supporting the ENERGY STAR HVAC Contractor checklist, would you attend a four-hour session?
    19.1. Does your company currently maintain written policies, procedures and practices stating how you implement best installation practices and industry standards?
    19.2. **If not,** would you be willing to develop a company policy for QI standards?
20. Do you have multiple crews?
    20.1. **If yes, ask:** Would you train all crews to meet Version 3 requirements?
21. What do you think are the best approaches for providing the training you want/need?
    21.1. Classroom training
    21.2. Field training
    21.3. Hard copy training manuals
    21.4. Employee training at their business location
    21.5. Webinars
    21.6. Having tapes of training available on the Program's website
    21.7. Real time blog on the internet of a Version 3 home being built from scratch
    21.8. Different levels of training for HVAC contractors with different levels of experience
    21.9. Other

VALUE OF BEING ABLE TO MEET ENERGY STAR REQUIREMENTS

22. How important, or valuable, is it for you to be able to market yourself or your company as being able to meet ENERGY STAR builders' need to have their homes fulfill all HVAC related requirements for ENERGY STAR certification in 2012?
23. Are you aware that all HVAC contractors working on Version 3 ENERGY STAR homes in 2012 will be required to complete Version 3 training? (Note: If HVAC contractor is not aware of the training, the interviewer can explain that one person from each HVAC firm will be required to complete the training. The training will be available through Air Conditioning Contractors of America (ACCA). EPA will provide lists of credentialed HVAC contractors.)
    23.1. **If yes, ask:** Do you plan on completing the training?
    23.2. **If not, ask**: Why not?
24. Do you plan on being prepared to guarantee that your work in 2012 will meet all ENERGY STAR Version 3 requirements?
25. Will you commit to this in your contracts with ENERGY STAR builders?

Closing

26. Those are all the questions I have. Is there anything I haven't asked you about that you would like to add about meeting Version 3 requirements?

THANK YOU FOR YOUR TIME