

## **APPENDIX B: DOE RESIDENTIAL ENERGY EFFICIENCY EVALUATION: BUILDER SURVEY PHONE SCRIPT**

*Note to DOE: This is a phone survey and will require approximately 30 minutes.*

*Note to DOE: We will send respondents a clean version of the survey ahead of time to allow them to review the questions; this clean version will not include all prompts and answer options.*

For “check all that apply questions” with many possible responses, the survey administrator will not read all of the options. Instead, the administrator will ask the participant for an unprompted answer and follow up as necessary to ensure that the participant has provided all relevant responses.

Yellow highlight = questions for BA builders only

Green highlight = questions non-BA builders only

Blue highlight = questions for public companies only

Pink highlight = questions for private companies only

Gray highlight = questions for California builders only

### **OPENING STATEMENT TO BE READ BY SURVEY ADMINISTRATOR TO PARTICIPANT**

The U.S. Department of Energy contracted with Industrial Economics, Incorporated (IEc) to conduct an evaluation of the Building Technologies Office’s (BTO’s) investments in new residential efficiency program activities. A key focus is assessing the Building America program’s influence on the market for new residential construction. This survey of builders is important for us to gauge the program’s market impact, both for builders who participated in the program as well as those who did not. Thank you for taking the time to answer the following questions, which will provide important insights for our evaluation.

As we ask you the following questions, please provide the responses as best you can. Please ask us to repeat any question if necessary.

Your responses and the fact that you took this survey will be kept confidential. IEc will report survey findings in aggregate; your comments will not be attributed to you as an individual or to your organization in IEc’s discussions with DOE or in the evaluation report.

This survey will take approximately 30 minutes.

### **BUILDER HISTORY**

First, we will start with some questions about your company.

Q1. How many years has your company been in business?

# IEc

1. Record response: \_\_\_\_\_
2. Don't know

Q2. How many years has your company worked in the new residential construction industry?

1. Record response: \_\_\_\_\_
2. Don't know

Q3. Does your company conduct home renovations in addition to building new homes?

1. Yes
2. No
3. Don't know

Q4. [If yes to Q3] What percent of your company's revenue comes from home renovations?

1. Record response: \_\_\_\_\_
2. Don't know

Q5. Our data show that your company works in [XX regions]. Is this correct?

1. Yes
2. No → we also work in these additional regions: \_\_\_\_\_
3. No → we do not work in these regions: \_\_\_\_\_
4. Don't know

Q6. Are there specific states where your company constructs most of its homes?

1. Yes → specific states: \_\_\_\_\_
2. No
3. Don't know

Q7. Does your company build Energy Star homes?

1. If yes, what year did your company start to build Energy Star homes? \_\_\_\_\_

Q8. We understand that your company builds, on average, about XX percent of its homes in California. Is that right?

1. [If No] Can you tell me what percentage of the homes your company builds are in California?

## **BUILDING AMERICA INVOLVEMENT**

Q9. During which years did your company work with the Department of Energy's Building America program? (check all that apply)

1. 1995
2. 1996
3. 1997
4. 1998
5. 1999
6. 2000
7. 2001
8. 2002
9. 2003
10. 2004
11. 2005
12. 2006
13. 2007
14. 2008
15. 2009
16. 2010
17. 2011
18. 2012
19. 2013
20. 2014
21. 2015

Q10. Which Building America team(s) did/does your company work with? (check all that apply)

*Interviewer: ask "any other teams?" before moving onto next question.*

1. ARBI / Alliance for Residential Building Innovation (Davis Energy Group, DEG)
2. ARIES / Advanced Residential Integrated Energy Solutions (The Levy Partnership, Inc.)
3. BA-PIRC / Building America Partnership for Improved Residential Construction (Florida Solar Energy Center, FSEC, University of Central Florida) formerly Building America Industrialized Housing Partnership (BAIHP)
4. BARA / Building America Retrofit Alliance (Building Media Inc, BMI)
5. BEEHA / Building Energy Efficient Homes for America (U of Nebraska)
6. BIRA / Building Industry Research Alliance (ConSol)
7. BSC / Building Science Corporation
8. CARB / Consortium for Advanced Residential Buildings (Steven Winter Associates)
9. CSE / Fraunhofer Center for Sustainable Energy Systems
10. Dow / Habitat Cost Effective Energy Retrofit Program Team (Dow Chemical)
11. Gas Technology Institute
12. Hickory Consortium
13. Home Innovation Research Labs
14. IBACOS / Integrated Buildings and Construction Solutions Consortium
15. NELC / National Energy Leadership Corps (Penn St)
16. NREL / National Renewable Energy Laboratory
17. N-STAR / NorthernSTAR Energy Efficient Housing Research Partnership Team (University of Minnesota)
18. ORNL / Oak Ridge National Laboratory
19. PARR / Partnership for Advanced Residential Retrofit (Gas Technology Institute)
20. PHI / Partnership for Home Innovation (formerly National Association of Home Builders Research Center, NAHBRC-IP)
21. Other: \_\_\_\_\_
22. Don't know

Q11. Why did your company decide to work with the Building America program? (check all that apply)

1. Potential construction cost savings
2. Learn about whole home approaches to energy efficiency
3. Looking to better manage moisture in homes constructed
4. Looking to address quality issues other than moisture management

5. Assistance to obtain Energy Star certification
6. Other: \_\_\_\_\_
7. Other: \_\_\_\_\_
8. Don't know

Q12. In your opinion, what were the main benefits your company received from working with the Building America program?

1. Construction cost savings
2. Learned about whole home approaches to energy efficiency
3. Better managed moisture in homes constructed
4. Addressed quality issues other than moisture management
5. Obtained Energy Star certification
6. Other: \_\_\_\_\_
7. Other: \_\_\_\_\_
8. Don't know

Q13. Did your company ever have an opportunity to work with the Building America program (for example, was your company invited to participate on a team)?

1. Yes
2. No
3. Don't know

Q14. [If yes to Q13] Why did your company decide not to work with the Building America program? Interview prompt "anything else?" before moving to next question.

1. Record response: \_\_\_\_\_
2. Don't know

## **ENERGY EFFICIENCY TECHNOLOGY/PRACTICE ADOPTION**

For the next set of questions, I need to provide some more information on Building America first. Building America is a market diffusion program for technologies/practices and whole house design approaches. While the focus of the program is on the house as a system and overall energy reductions with a group of technologies/practices, some energy efficiency technologies/practices demonstrated by Building America have been particularly successful in penetrating the new residential construction market. These are:

# IEc

- Air leakage and infiltration requirements including requiring a specific performance level and whole-building pressurization testing (i.e., blower door testing), or may require prescriptive measures such as specific requirements for air sealing and/or thermal bypass air barriers. BA-influenced requirements for air leakage and infiltration were initially reflected in Energy Star for Homes version 2.0 (2006) and 2009 IECC, as well as subsequent versions of the programs and codes.
- Duct leakage requirements including requiring a specific performance level (e.g., less than 4 cubic feet per meter per 100 square feet), requiring duct pressure testing, requiring that ducts be moved to a conditioned space, or requiring that ducts have a certain level of insulation (e.g., R-6). BA-influenced requirements for duct leakage were initially reflected in Energy Star for Homes version 2.0 (2006), and 2009 IECC, as well as subsequent versions of the programs and codes.
- Thermal bridging requirements including requiring specific placement of insulation or requiring continuous insulation. Thermal bridging requirements were initially reflected in Energy Star for Homes version 3 (2012), and 2012 IECC, as well as subsequent versions of the programs and codes.
- Increased insulation as initially reflected in 2006 IECC (and Energy Star for Homes refers to codes), as well as subsequent versions of the programs and codes.

For this next set of questions, please provide answers that apply to your company in general, across your company's divisions.

Q15. Does your company use these technologies/practices only where they are required by code?  
(Yes/No/Don't know)

1. Air leakage and infiltration requirements in 2009 IECC
2. Thermal bridging requirements of IECC 2012
3. Duct leakage requirements in 2009 IECC
4. Increased insulation requirements of IECC 2006

Q16. Does your company include these technologies/practices in non-Building America projects?

(Yes/No/Don't know)

1. Air leakage and infiltration requirements in 2009 IECC
2. Duct leakage requirements in 2009 IECC
3. Thermal bridging requirements in IECC 2012
4. Increased insulation requirements of IECC 2006

Q17. [If yes to Q16] In what year did your company start including these technologies/practices in non-Building America projects?

1. Air leakage and infiltration requirements in 2009 IECC \_\_\_\_\_
2. Duct leakage requirements in 2009 IECC \_\_\_\_\_
3. Thermal bridging requirements in IECC 2012 \_\_\_\_\_

4. Increased insulation requirements of IECC 2006 \_\_\_\_\_
- Q18. [If no to Q15 and as applicable yes to Q16] Does your company use these technologies/practices as standard practice for new construction? (Yes/No/Don't Know)
1. Air leakage and infiltration requirements in 2009 IECC
  2. Duct leakage requirements in 2009 IECC
  3. Thermal bridging requirements in IECC 2012
  4. Increased insulation requirements of IECC 2006
- Q19. [If yes to Q16] In what year did your company start to use the technologies/practices as standard practice?
1. Air leakage and infiltration requirements in 2009 IECC \_\_\_\_\_
  2. Duct leakage requirements in 2009 IECC \_\_\_\_\_
  3. Thermal bridging requirements in IECC 2012 \_\_\_\_\_
  4. Increased insulation requirements of IECC 2006 \_\_\_\_\_
- Q20. [If yes to Q16 and no longer working with BA] Did your company continue to use these technologies/practices after working with the Building America program where they are not required by code? (Yes/No/Don't Know)
1. Air leakage and infiltration requirements in 2009 IECC
  2. Duct leakage requirements in 2009 IECC
  3. Thermal bridging requirements in IECC 2012
  4. Increased insulation requirements of IECC 2006
- Q21. [If yes to Q16] How have these technologies/practices changed net residential building costs over time, if at all?
1. Air leakage and infiltration requirements in 2009 IECC
  2. Duct leakage requirements in 2009 IECC
  3. Thermal bridging requirements in IECC 2012
  4. Increased insulation requirements of IECC 2006
- Q22. [If yes to Q16] Have you found that by adopting these practices, you have been able to save money on HVAC equipment (e.g., by sizing a smaller systems, or reducing the number of air handlers)? (Yes/No/Don't Know)
1. Air leakage and infiltration requirements in 2009 IECC
    - i. If yes, why?
  2. Duct leakage requirements in 2009 IECC
    - i. If yes, why?

3. Thermal bridging requirements in IECC 2012
  - i. If yes, why?
4. Increased insulation requirements of IECC 2006
  - i. If yes, why?

Q23. Regarding HVAC, what is the typical square foot/ton that you are sizing today? \_\_\_\_\_

What was the square foot/ton that you were sizing in 2006? \_\_\_\_\_

For the next set of questions, please provide answers only for the homes your company builds in California.

Q24. What resources, if any, do you rely on to ensure your homes comply with CA Title 24 and/or CA ES Homes requirements?

Q25. Did you rely on any of the following Building America resources when designing homes to comply with CA Title 24 and/or CA ES Homes Requirements? [Yes/No/Don't Know]

1. EE construction approaches demonstrated by Building America projects
2. Guidance or resources developed by Building America or its teams
3. Case studies or other documentation on lessons learned from Building America demonstration projects

Q26. [If Yes to at least one item in Q25] Did you realize any cost savings in complying with CA Title 24 and/or CA ES Homes by utilizing the [Building America resource]?

1. If yes, can you estimate the design cost savings (in \$ per house) realized? Can you estimate the construction cost savings (in \$ per square foot)?

| BUILDING AMERICA RESOURCE   | USED?<br>(YES/NO) | AVERAGE \$/HOUSE<br>SAVINGS (DESIGN<br>COSTS) | AVERAGE \$/SQUARE<br>FOOT (CONSTRUCTION<br>COSTS) |
|---|-------------------|---|---|
| EE construction approaches demonstrated by Building America projects                                |                   |   |   |
| Guidance or resources developed by Building America or its teams                                    |                   |   |   |
| Case studies or other documentation of lessons learned from Building America demonstration projects |                   |   |   |

Q27. [If yes to at least one item in Q25] Did [the Building America resource] help you comply with CA Title 24 or CA ES homes Requirements in other ways?

1. If yes, please elaborate.

Q28. Did information gleaned from Building America resources and/or projects advance the uptake of the following energy efficiency practices your other divisions outside of California?



1. Air leakage and infiltration requirements including requiring a specific performance level and whole-building pressurization testing (i.e., blower door testing), or may require prescriptive measures such as specific requirements for air sealing and/or thermal bypass air barriers. BA-influenced requirements for air leakage and infiltration were initially reflected in Energy Star for Homes version 2.0 (2006) and 2009 IECC, as well as subsequent versions of the programs and codes.
  - i. Yes → please elaborate.
  - ii. No
  - iii. Don't know
2. Duct leakage requirements including requiring a specific performance level (e.g., less than 4 cubic feet per meter per 100 square feet), requiring duct pressure testing, requiring that ducts be moved to a conditioned space, or requiring that ducts have a certain level of insulation (e.g., R-6). BA-influenced requirements for duct leakage were initially reflected in Energy Star for Homes version 2.0 (2006), and 2009 IECC, as well as subsequent versions of the programs and codes.
  - i. Yes → please elaborate.
  - ii. No
  - iii. Don't know
3. Thermal bridging requirements including requiring specific placement of insulation or requiring continuous insulation. Thermal bridging requirements were initially reflected in Energy Star for Homes version 3 (2012), and 2012 IECC, as well as subsequent versions of the programs and codes.
  - i. Yes → please elaborate.
  - ii. No
  - iii. Don't know
4. Increased insulation as initially reflected in 2006 IECC (and Energy Star for Homes refers to codes), as well as subsequent versions of the programs and codes.
  - i. Yes → please elaborate.
  - ii. No
  - iii. Don't know

## CHANGE IN WARRANTY CALLBACKS AND OTHER POTENTIAL AREAS OF COST SAVINGS

Now we would like to ask you some questions about warranty callbacks and other potential areas of cost savings. Note that our questions are confined to the post-closure period of a residential construction project.

Q29. What resources do you typically use to determine the best method(s) to prevent water intrusion, mold and mildew or proper air sealing, and duct design/installation? *Record all reported*

From publicly available information, we constructed a graph of your company's callback trend since 2002 and emailed it to you. *Note to DOE: IEc will email this graph to participants as part of the interview request.*

[insert firm-specific graph of rolling average of warranty payments per house]

Q30. Can you provide us with these data prior to 2002? We can provide a template. *(Note to DOE: draft template provided after the survey script)*

1. Yes
2. No
3. Don't know / need to follow up.

Q31. Do you think that your firm's average callback payment per house has:

1. Increased in the last 5 years
2. Decreased in the last 5 years
3. Up and down in the last 5 years
4. Don't know

Q32. Can you provide us with callback payment data? We can provide a template. Please include both billable and non-billable callbacks. *(Note to DOE: draft template provided after the survey script)*

1. Yes
2. No
3. Don't know/ need to follow up.

Q33. What factors influence increases and decreases in callbacks? (prompts from choices below if needed and ask them to elaborate; choose all that apply)

1. Economic conditions
  - i. Increase
    1. Please elaborate \_\_\_\_\_
  - ii. Decrease
    1. Please elaborate \_\_\_\_\_

- iii. Don't know
- 2. Recession/housing crash
  - i. Increase
    - 1. Please elaborate\_\_\_\_\_
  - ii. Decrease
    - 1. Please elaborate\_\_\_\_\_
  - iii. Don't know
- 3. Changes in moisture management practices in homes (changes in barrier materials to promote drying, moisture managed foundations, ventilation, vapor retarders)
  - i. Increase
    - 1. Please elaborate\_\_\_\_\_
  - ii. Decrease
    - 1. Please elaborate\_\_\_\_\_
  - iii. Don't know
- 4. Change in the way we handle callbacks
  - i. Increase
    - 1. Please elaborate\_\_\_\_\_
  - ii. Decrease
    - 1. Please elaborate\_\_\_\_\_
  - iii. Don't know
- 5. Other: \_\_\_\_\_
  - i. Increase
    - 1. Please elaborate\_\_\_\_\_
  - ii. Decrease
    - 1. Please elaborate\_\_\_\_\_
  - iii. Don't know
- 6. Other: \_\_\_\_\_
  - i. Increase
    - 1. Please elaborate\_\_\_\_\_
  - ii. Decrease
    - 1. Please elaborate\_\_\_\_\_
  - iii. Don't know

Q34. [If yes to Q35, choice 3] If your firm had *not* implemented the moisture management technologies/practices, would your trend in callbacks be different?

1. Yes
2. No
3. Don't know

*If yes, please use the template provided to estimate the percent difference in each year.*

Q35. [If yes to Q36] How would your callback trends differ over time if you had not implemented moisture management practices? (check all that apply)

1. We would have had more callbacks overall
2. We would have had fewer callbacks overall
3. We would have had more callbacks for quality issues
4. We would have had fewer callbacks for quality issues
5. We would have had more callbacks on aesthetic issues
6. We would have had fewer callbacks on aesthetic issues
7. Don't know/not sure

Q36. Did the moisture management technologies/practices discussed previously lead to changes in your 10-year Builder's Warranty (also called 2-10 HBW or 1-2-10 Warranty) insurance terms (for example, cheaper premiums, more expansive coverage)?

1. Yes → which terms: \_\_\_\_\_
2. No
3. We don't provide 10 Year Warranty to Homeowners
4. Don't know

Q37. [If yes to Q38] Were these changes:

5. Positive → Please explain
6. Negative → Please explain

Q38. [If yes to Q38] Please provide name of insurance company and contact info.

1. Explanation: \_\_\_\_\_
2. Name of insurance company: \_\_\_\_\_
3. Contact name: \_\_\_\_\_
4. Contact email: \_\_\_\_\_
5. Contact phone: \_\_\_\_\_

Q39. Did the moisture management technologies/practices discussed previously lead to changes in your litigation risk?

1. Yes → please explain, including litigation on which issue: \_\_\_\_\_
2. No
3. Don't know

Q40. [If yes to Q41] Were these changes:

1. Positive → Please explain
2. Negative → Please explain

## **BUILDING AMERICA INFLUENCE ON INDUSTRY**

Q41. Do you use any of the following Building America resources more than once per year? (check all that apply) (*Note to DOE: for this question, IEC will read all selections.*)

1. Case studies
2. Building America Solution Center
3. Best Practice Guides
4. Top innovation profiles
5. Window Replacement, Rehabilitation, and Repair Guide
6. Quality management System Guidelines
7. EEBA Builder's Guides
8. EEBA Water Management Guide
9. Attic Air Sealing Guidelines
10. National Residential Efficiency Measures Database
11. Building America House Simulation Protocol (HSP)
12. Building Energy Optimization Analysis Method (BEopt)
13. Domestic Hot Water Event Schedule Generator
14. Other resources developed by Building America building science experts
15. Other: \_\_\_\_\_
16. Other: \_\_\_\_\_
17. None

Q42. Are there other, non-Building America resources you typically use to gather information to help you decide which energy efficiency technologies and practices to use in your buildings? For example, other DOE resources or Custom Builder's Magazines. *Record all reported.*

1. [For each resource reported] Do you use this resource more than once a year?

- Q43. How would you rate the strength of the Building America program’s influence on the new residential construction industry on a scale of one to 10, where one means the program has no influence, and 10 means the program is very influential?
- Q44. How would you rate the value of the Building America program to the new residential construction industry on a scale of one to 10, where one means the program has no value, and 10 means the program has significant value?
- Q45. How would you rate the importance of the BEopt modeling tool for facilitating increased energy efficiency in new homes on a scale of one to 10, where one means the tool was not at all important, and 10 means the tool was very important?
- Q46. How would you rate the importance of the DOE climate maps for facilitating increased energy efficiency in new homes on a scale of one to 10, where one means the maps were not at all important, and 10 means the maps were very important?
- Q47. How would you rate the importance of the vapor retarder classification system for facilitating better moisture management in new homes on a scale of one to 10, where one means the system was not at all important, and 10 means the system was very important?
- Q48. In your opinion, have the technologies/practices advanced by the Building America program spilled over into the renovation market? (Yes/No/Don’t Know)
1. Air leakage and infiltration requirements in 2009 IECC
  2. Duct leakage requirements in 2009 IECC
  3. Thermal bridging requirements in IECC 2012
  4. Increased insulation requirements of IECC 2006
  5. Moisture management practices

If yes, are they commonly, sometimes, or rarely used in renovation market? (Interviewer use table below)

| <b>TECHNOLOGY/PRACTICE</b>                             | <b>COMMON PRACTICE IN RENOVATION MARKET</b> | <b>USED SOMETIMES IN RENOVATION MARKET</b> | <b>RARELY USED IN RENOVATION MARKET</b> |
|--|---|--|---|
| Air leakage and infiltration requirements in 2009 IECC |   |  |   |
| Duct leakage requirements in 2009 IECC                 |   |  |   |
| Thermal bridging requirements in IECC 2012             |   |  |   |
| Increased insulation requirements of IECC 2006         |   |  |   |
| Moisture management practices                          |   |  |   |

## PUBLIC BUILDERS

|  | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |  |
|--|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|
| Home sale revenues (\$)  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Number of homes closed/delivered (#)   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Warranties issued/put in reserves (\$)   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Warranty settlements/payments made (\$)  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Warranty settlements/payments made (#)   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Percentage change in warranty payments <b>IF</b> moisture management practices did not exist |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |

## PRIVATE BUILDERS

|   | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |  |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|
| Home sale revenues (\$)                 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Number of homes closed/delivered (#)    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Warranties issued/put in reserves (\$)  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Warranty settlements/payments made (\$) |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Warranty settlements/payments made (#)  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Percentage change in warranty payments <b>IF</b> moisture management practices did not exist |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|



## **BUILDING AMERICA INFLUENCE ON INDUSTRY**

Q49. Do you use any of the following Building America resources more than once per year? (check all that apply) *(Note to DOE: for this question, IEc will read all selections.)*

18. Case studies
19. Building America Solution Center
20. Best Practice Guides
21. Top innovation profiles
22. Window Replacement, Rehabilitation, and Repair Guide
23. Quality management System Guidelines
24. EEBA Builder's Guides
25. EEBA Water Management Guide
26. Attic Air Sealing Guidelines
27. National Residential Efficiency Measures Database
28. Building America House Simulation Protocol (HSP)
29. Building Energy Optimization Analysis Method (BEopt)
30. Domestic Hot Water Event Schedule Generator
31. Other resources developed by Building America building science experts
32. Other: \_\_\_\_\_
33. Other: \_\_\_\_\_
34. None

Q50. Please rate the extent to which you agree with the following statement on a scale from 1 to 5, where 1 is strongly disagree and 5 is strongly agree: The Building America program has a strong influence on the new residential construction industry.

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

Q51. Please rate the extent to which you agree with the following statement on a scale from 1 to 5, where 1 is strongly disagree and 5 is strongly agree: The Building America program has significant value to the new residential construction industry.

1. Strongly disagree

2. Disagree
3. Neutral
4. Agree
5. Strongly agree

Q52. Please rate the extent to which you agree with the following statement on a scale from 1 to 5, where 1 is strongly agree and 5 is strongly disagree: The development of the BEopt modeling tool was important for facilitating increased energy efficiency in new homes.

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

Q53. Please rate the extent to which you agree with the following statement on a scale from 1 to 5, where 1 is strongly disagree and 5 is strongly agree: The DOE climate maps were important for facilitating increased energy efficiency in new homes.

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

Q54. Please rate the extent to which you agree with the following statement on a scale from 1 to 5, where 1 is strongly disagree and 5 is strongly agree: The vapor retarder classification system was important for facilitating better moisture management in new homes.

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

Q55. Have the technologies/practices advanced by the Building America program spilled over into the renovation market? (Yes/No/Don't Know)

1. Air leakage and infiltration requirements in 2009 IECC
2. Duct leakage requirements in 2009 IECC
3. Thermal bridging requirements in IECC 2012

4. Increased insulation requirements of IECC 2006
5. Moisture management practices

If yes, are they commonly, sometimes, or rarely used in renovation market? (Interviewer use table below)

| <b>TECHNOLOGY/PRACTICE</b>                             | <b>COMMON PRACTICE IN RENOVATION MARKET</b> | <b>USED SOMETIMES IN RENOVATION MARKET</b> | <b>RARELY USED IN RENOVATION MARKET</b> |
|--|---|--|---|
| Air leakage and infiltration requirements in 2009 IECC |   |  |   |
| Duct leakage requirements in 2009 IECC                 |   |  |   |
| Thermal bridging requirements in IECC 2012             |   |  |   |
| Increased insulation requirements of IECC 2006         |   |  |   |
| Moisture management practices                          |   |  |   |

## PUBLIC BUILDERS

|  | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |  |
|--|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|
| Home sale revenues (\$)  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Number of homes closed/delivered (#)   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Warranties issued/put in reserves (\$)   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Warranty settlements/payments made (\$)  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Warranty settlements/payments made (#)   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Percentage change in warranty payments <b>IF</b> moisture management practices did not exist |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |

## PRIVATE BUILDERS

|   | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |  |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|
| Home sale revenues (\$)                 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Number of homes closed/delivered (#)    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Warranties issued/put in reserves (\$)  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Warranty settlements/payments made (\$) |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |
| Warranty settlements/payments made (#)  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |

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| Percentage change in warranty payments <b>IF</b> moisture management practices did not exist |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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## APPENDIX C: BA PROGRAM EXPERT INTERVIEW GUIDE

### INTERVIEW GUIDE FOR BUILDING EXPERTS

The U.S. Department of Energy contracted with Industrial Economics, Incorporated (IEc) to conduct an evaluation of the Building Technologies Office (BTO)'s investments in new residential efficiency program activities. A key focus is assessing the Building America program's influence on the market for new residential construction. Thank you for taking the time to answer the following questions, which will provide important insights for our evaluation.

Your responses will be kept confidential. IEc will report interview findings in aggregate; your comments will not be attributed to you as an individual or to your organization in IEc's discussions with DOE or in the evaluation report.

### QUESTIONS ABOUT THE BUILDING AMERICA PROGRAM

1. What is your or your firm's relationship with Building America? If you were on a Building America team, which team(s) and during which years?
2. Please provide a brief description of your building science research, including how (if at all) this research has been affected (directly or indirectly) by the Building America program.
3. Please refer to the Building America Logic Model (Attachment A). IEc will walk through the diagram over the phone and requests feedback on the following questions based on your knowledge of the Building America program and the new residential construction market (answers can be provided after the interview if the interviewee would like more time to review the diagram):
  - a. Do you think the boxes in the logic model accurately reflect the program's inputs, activities, outputs, and outcomes?
  - b. Are the boxes shown in the right order?
  - c. Are the connections between boxes shown correctly? Are there potentially other feedback loops?
  - d. For which outputs and outcomes in the logic model do you think Building America has had the greatest influence?
  - e. Are there areas shown in the logic model where Building America had less of an influence? If yes, please explain.

### QUESTIONS ABOUT INDUSTRY-WIDE TRENDS IN RESIDENTIAL EFFICIENCY

4. With the exception of plug loads, energy use intensity (EUI) in new homes has been declining over the last 20 years. What factors are driving the decline in EUI in new homes?
  - a. For each factor that you identified: To what extent, if any, did Building America influence it?

- b. Other than Building America, what were the other influences on each factor that you identified?
  - c. For each factor that you identified:
    - i. Do you think this would have happened at all without Building America?
    - ii. If yes, do you think this would have happened *earlier*, *later*, or *at the same time* without Building America? For “earlier” or “later,” can you estimate *how much* earlier or later?
5. Are you familiar with Building America’s role in supporting the cost-effectiveness (or reducing the cost) of home energy efficiency measures? If yes:
- a. Are you aware of work that Building America has conducted to reduce the cost of home energy efficiency measures? If yes, please describe.
  - b. Do you think trends in the cost of home energy efficiency measures over the last 20 years can be attributed to Building America? If yes, to what extent?
6. Are you familiar with Building American’s role in supporting the development and adoption of the RESNET and the HERS rating system? If yes:
- a. What do you understand that relationship to be?
  - b. Do you think the Home Energy Score data and trends can be attributed to Building America? If yes, to what extent?

#### **QUESTIONS ABOUT BUILDING AMERICA’S ADVANCEMENT OF SPECIFIC TECHNOLOGIES AND PRACTICES**

7. Please refer to the list of technologies and practices below. To the best of your knowledge, in which of these technologies/practices did Building America play a role in demonstrating and advancing in the marketplace? Which Building America team(s) worked on them and when?
- a. Air leakage and infiltration levels
    - i. Thermal bypass air barriers/air sealing (Energy Star for Homes Thermal Bypass Checklist)
  - b. Duct leakage
    - i. Unvented, conditioned crawlspaces
    - ii. Unvented, conditioned attics
    - iii. Ducts in conditioned space
  - c. Enclosure requirements (insulation, fenestration U-factor and SHGC)
  - d. Removal of option to trade high-efficiency HVAC equipment for reductions in other requirements in the code
  - e. Efficient framing/advanced framing
    - i. Thermal bridging

- f. Requirement that framing cavities may not be used as supply ducts or plenums
  - g. Moisture management
    - i. Continuous insulation ratio
    - ii. Ventilation
    - iii. Vapor retarder classification system
  - h. Building science-based climate maps
  - i. Mechanical innovations:
    - i. Hot water heating and distribution
    - ii. Water heating/space heating combined systems
8. Are there other technologies/practices, not on this list that Building America helped to advance in the marketplace?
9. What other actors (outside of Building America) played a role in developing, demonstrating, and increasing the market adoption of these technologies/practices?
10. Which technologies/practices do you think Building America played the biggest role in mainstreaming into new residential construction?
11. Which technologies/practices do you think Building America played less of a role in mainstreaming into new residential construction?
12. Over the last 20 years, have you found in warmer climates that you can satisfy space heating with a water heater and eliminate a furnace?
- a. If yes, what (if any) was Building America's role?
13. To what extent have these technologies/practices influenced the housing retrofit market? Please explain.
14. Do you think that practices developed by Building America addressing moisture management led to decreases in mold problems in new homes over the last 20 years? Why or why not?
- If yes, please explain:
- a. Which practices?
  - b. Which Building America team(s) worked on them and when?
  - c. How often is a moisture problem bad enough to cause mold in new homes?
  - d. Do you know of any way to estimate the percent of new homes where mold growth was avoided due to Building America?
15. Can you point us to any literature on cost reduction of callbacks from moisture management changes that Building America/BSC pioneered?
16. Can you point us to any literature on reduced litigation after moisture management changes?



17. Do you think that builder and homeowner insurance premiums were affected by the work that Building America did to manage moisture? If yes, please explain and point us to any relevant literature.
18. Are you familiar with Building America's role in supporting the development and adoption of the ASHRAE Standard 62.2: Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings? If yes:
  - a. What do you understand that relationship to be?
  - b. Do you think ASHRAE Standard 62.2 and improvements in home ventilation can be attributed to Building America? If yes, to what extent?

## **FINAL THOUGHTS**

19. Who else should we be posing these questions to?
20. Are there any other thoughts or observations that you would like to share with us?

## **INTERVIEW GUIDE FOR BUILDING EXPERTS NOT PARTICIPATING IN BA**

The U.S. Department of Energy contracted with Industrial Economics, Incorporated (IEc) to conduct an evaluation of the Building Technologies Office (BTO)'s investments in new residential efficiency program activities. A key focus is assessing the Building America program's influence on the market for new residential construction. Thank you for taking the time to answer the following questions, which will provide important insights for our evaluation.

Your responses will be kept confidential. IEc will report interview findings in aggregate; your comments will not be attributed to you as an individual or to your organization in IEc's discussions with DOE or in the evaluation report.

### **GENERAL QUESTIONS**

1. Please provide a brief description of your building science research, in terms of the key topics or challenges you worked on.
  - a. Has your work been affected (directly or indirectly) by the Building America program?
2. With the exception of plug loads, energy use intensity (EUI) in new homes has been declining over the last 20 years. What factors are driving the decline in EUI in new homes?
  - a. For each factor that you identified: To what extent, if any, did Building America influence it?
  - b. Other than Building America, what were the other influences on each factor that you identified?
  - c. For each factor that you identified:
    - i. Do you think this would have happened at all without Building America?
    - ii. If yes, do you think this would have happened *earlier*, *later*, or *at the same time* without Building America? For "earlier" or "later," can you estimate *how much* earlier or later?
3. Are you familiar with Building America's role in supporting the cost-effectiveness (or reducing the cost) of home energy efficiency measures? If yes:
  - a. Are you aware of work that Building America has conducted to reduce the cost of home energy efficiency measures? If yes, please describe.
  - b. Do you think trends in the cost of home energy efficiency measures over the last 20 years can be attributed to Building America? If yes, to what extent?

### **QUESTIONS ABOUT BUILDING AMERICA'S ADVANCEMENT OF SPECIFIC TECHNOLOGIES AND PRACTICES**

4. Please refer to the list of technologies and practices attached to this guide (Attachment B).

To the best of your knowledge, in which of these technologies/practices did Building America play a role in demonstrating and advancing in the marketplace? Which Building America team(s) worked on them and when?

- a. Air leakage and infiltration levels



## Thermal bypass air barriers/air sealing (Energy Star for Homes Thermal Bypass Checklist)

- b. Duct leakage –
    - i. Unvented, conditioned crawlspaces
    - ii. Unvented, conditioned attic
    - iii. Ducts in conditioned space
    - iv. Requirement that framing cavities may not be used as supply ducts or plenums
  - c. Enclosure requirements (insulation, fenestration U-factor and SHGC)
  - d. Efficient framing/advanced framing
    - i. Thermal bridging
  - e. Moisture management
    - i. Continuous insulation ratio
    - ii. Ventilation
    - iii. Vapor retarder classification system
  - f. Building science-based climate maps
  - g. Mechanical innovations:
    - i. Hot water heating and distribution
    - ii. Water heating/space heating combined systems
  - h. Are there other technologies/practices, not on this list that Building America helped to advance in the marketplace?
  - i. What other actors (outside of Building America) played a role in developing, demonstrating, and increasing the market adoption of these technologies/practices?
  - j. To what extent have these technologies/practices influenced the housing retrofit market? Please explain.
5. Do you think that practices diffused by Building America reduced callbacks from moisture management problems in new construction?
- a. If yes, please explain.

### **FINAL THOUGHTS**

- 6. Who else should we be posing these questions to?
- 7. Are there any other thoughts or observations that you would like to share with us?

