Market Progress Evaluation Report

Architecture + Energy Program, Final Report

prepared by

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Final Report

MARKET PROGRESS EVALUATION REPORT
ARCHITECTURE + ENERGY PROGRAM

Funded By:

Submitted To:

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EXECUTIVE SUMMARY

The Northwest Energy Efficiency Alliance is a non-profit group of electric utilities, state governments, public interest groups and industry representatives committed to bringing affordable, energy-efficient products and services to the marketplace. This report is the Third Market Progress Evaluation Report (MPER) for the Architecture + Energy: Building Excellence in the Northwest (A+E) Program sponsored by the American Institute of Architects-Portland Chapter (AIA/Portland) and funded since 1998 by the Northwest Energy Efficiency Alliance (the Alliance).[1]

The goal of the A+E program is to encourage design professionals to use "energy-efficient/sustainable building practices" from inception to completion of their commercial building projects. To accomplish this goal, the A+E program has offered annual awards recognizing design excellence for energy-efficient nonresidential buildings and conducted workshops, both in conjunction with the awards and at other times and locations.

Since 1993, the Architecture + Energy program has educated over 600 people, nearly 400 of whom are practicing architects in the region. These architects have come from 164 firms. Two or more architects have participated from nearly 30% of these firms. Architects from 54% of the largest firms in the region—those employing 50 or more people—have participated in A+E; 20% of all firms with more than five employees have had one or more architects participate in the program.

Based on a survey of 43 participants and 50 nonparticipants that asked architects detailed questions about their design practices, we conclude that the projects of participants more frequently incorporate energy-efficient design practices than do the projects of nonparticipants. This finding was statistically significant. In addition, qualitative data strongly suggests that participants compared with nonparticipants use a greater number and variety of energy-efficient features in their designs that have any such features.

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1 Peters, Jane S. and Marjorie McRae. (1999) *First Market Progress Evaluation Report Architecture + Energy Program*. (E99-034) Northwest Energy Efficiency Alliance. www.nwalliance.org. Peters, Jane S. and Marjorie McRae. (1999) *Second Market Progress Evaluation Report Architecture + Energy Program*. Northwest Energy Efficiency Alliance.

Participants themselves credited their energy-efficient design practices to the influence of the A+E program. That is not to say that the program was the sole influence. Nonetheless, 86% of the participants most frequently engaging in energy-efficient practices said that they suggest these ideas to their clients more frequently since attending an A+E event. Fifty-two percent of this participant group said that their clients accept these ideas more frequently since they attended an event, which they attribute at least in part to their increase in knowledge and enthusiasm.

More than half of the sampled nonparticipants had heard of the Architecture + Energy Awards.

During conversations with the A+E program manager (on the AIA/Portland staff) during the weeks that this report was being written, the manager said that the Alliance has no plans to continue its funding of the program in its current form. Components of the A+E program are expected to be included in some way in the Alliance's future Commercial Buildings Initiative. In addition, the manager said that AIA/Portland intends to continue the awards program, opening it to national participation, but does not intend to continue the workshops until the awards component of their program is re-established.

This report offers a number of specific recommendations. In summary:

- Architecture + Energy is an effective, successful brand name for energy-efficient design recognition and education that appeals to the region's architects. Architects are aware of A+E, and they are aware of other regional resources, including other Alliance-funded efforts. The Alliance could develop a long-term perspective and commitment that continues and builds on these valuable assets.

- The A+E program will always be most effective in reaching architects, as its name implies. However, the awards program provides examples that can be elaborated on in a separate outreach campaign for the client and consultant community. In addition, a separate effort could be pursued to provide architects with what they say they need most—"the numbers." The Alliance could take steps both to reach other players in the new construction market and to increase the availability of what all the players need: reliable data that is easy to access and understand.

- The A+E awards and workshop programs should continue, but the A+E program can't address all the players in the new construction market nor give even architects all of the technical information that they need. The Alliance could carefully build the missing pieces for transforming the

market, being sure to tie the pieces together to continue and expand the A+E message.

1. INTRODUCTION

The Northwest Energy Efficiency Alliance is a non-profit group of electric utilities, state governments, public interest groups and industry representatives committed to bringing affordable, energy-efficient products and services to the marketplace. This report is the Third Market Progress Evaluation Report (MPER) for the Architecture + Energy: Building Excellence in the Northwest (A+E) Program, sponsored by the American Institute of Architects-Portland Chapter (AIA/Portland) and funded since 1998 by the Northwest Energy Efficiency Alliance (the Alliance).[2] This introduction presents a brief description of the A+E program through 2000.

PROGRAM DESCRIPTION

Program Goal, Objectives, and Premise

The goal of the A+E program is to encourage design professionals to use "energy-efficient/sustainable building practices"[3] from inception to completion of their commercial building projects. Key objectives are:

- To increase awareness of architects and their clients about energy efficiency as a design criterion; and
- To encourage the design community to look beyond energy code requirements for further improvements in energy-efficient design in the context of resource efficiency.

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2 Peters, Jane S. and Marjorie McRae. (1999) *First Market Progress Evaluation Report Architecture + Energy Program*. (E99-034) Northwest Energy Efficiency Alliance. www.nwalliance.org.Peters, Jane S. and Marjorie McRae. (1999) *Second Market Progress Evaluation Report Architecture + Energy Program*. Northwest Energy Efficiency Alliance.

3 *Architecture + Energy: Building Excellence in the Northwest*. Proposal to the Northwest Energy Efficiency Alliance, July 1997. Page 1. Energy efficient refers to reduced energy use as the result of design and construction practices. Sustainable refers to the use of material and building practices and designs that have the lowest impact on the environment, both at the time of construction and during long-term operation of the facility.

To accomplish these goals and objectives, the A+E program has had four primary components:

- An annual award program recognizing design excellence for energy-efficient nonresidential buildings throughout the Pacific Northwest region;
- An interactive workshop held with the awards jury in conjunction with the awards program;
- Regional educational workshops for architects and engineers on the integration of architecture and energy in building design; and
- Interactive educational visits to architectural firms.

The premise of A+E is that a barrier to the practice of energy-efficient and sustainable design occurs because architects and engineers are not fully aware and knowledgeable of the value and benefits of energy-efficient and sustainable building design practices. They lack awareness of the importance of incorporating these practices into the earliest stages of the project. With this lack of knowledge and awareness, and little impetus from clients, full integration of energy-efficient, sustainable design principles is not a priority consideration.

The A+E program provides a demonstration to architects and engineers that energy-efficient design can be aesthetically and functionally effective. In addition to the awards and award-day workshop, the regional workshops transfer the experience of the winning projects and design practices to architects and engineers in locations other than Seattle and Portland. A key component of the A+E program is the interactive, interdisciplinary teaching that occurs in these workshops.

The A+E program rests on two key assumptions about how knowledge and awareness of energy-efficient design practices can be effectively transferred to architects and engineers:

- Architects and engineers are most effectively persuaded to embrace and champion energy-efficient and sustainable building practices through professional recognition and acknowledgment by peers, such as occurs in the A+E design awards process; and
- Architects and engineers are receptive to and learn well in an interdisciplinary, interactive educational workshop format.

History and Funding

The concept of a regional award program for energy-efficient design excellence was proposed in 1991, and the first awards were given in 1993. The award program ran through 1999, the seventh awards ceremony.

Funding for the program initially came from the Bonneville Power Administration, with supplemental support from Portland General Electric. In October 1997, the Alliance funded the A+E program as a venture, with a maximum of $500,000 for the effort in 1998 and 1999.

In 2000, the Alliance funded the program as infrastructure and provided $225,000 to AIA/Portland to offer regional A+E workshops and firm visits, and to maintain a market presence for Architecture + Energy. The latter activity included maintaining awareness of the awards component to support its successful implementation in the future, should the awards receive Alliance funding through a new or different project. At the request of AIA/Portland, the contract expiration date was extended into 2001, with no additional funding.

PREVIOUS EVALUATION FINDINGS

The first and second MPERs demonstrated that architects participating in the A+E program thought it was highly effective. Architects reported that the program influenced their design practice and facilitated learning about energy-efficient/ sustainable design.

Participants reported a high level of satisfaction with the content and delivery of the events they attended and a strong willingness to attend A+E events in the future. Forty percent of workshop participants also reported that the program had a significant influence on their design practice, in two cases leading to immediate design changes.

Along with their praise of the A+E program events, participants offered suggestions for improvement. Key among these were requests to expand the presentations to include the point of view of developers, engineers, and occupants, and to provide cost and benefit information—"the numbers"—for the advocated design practices.

Past recommendations included:

- Reassessing the philosophy behind the designation of an "award-worthy" project, perhaps creating several types of awards and publicizing their rationale;

- Expanding the program targets to address other participants in the commercial building design market who are viewed by architects as critical in bringing about energy-efficient and sustainable practice; and

- Providing architects with "the numbers" and other information characterizing energy and non-energy costs, benefits and performance relative to standard practice, so that they can better persuade clients to consider and select energy-efficient designs.

AIA/Portland acted upon a number of the recommendations made in the first and second MPERs. For example, they:

- Increased their marketing efforts to engineering and related firms;

- Increased their activities outside of the Portland and Seattle metropolitan areas;

- Offered assistance to firms in applying energy-efficient design principles (which the program did through firm visits);

- Focused on stand-alone workshops rather than seminars offered as one of a menu of activities at a conference; and

- Improved program participation data.

OUTLINE OF THE REPORT

The report is organized to provide the Alliance and other interested parties with information for decision-making. Following this introductory chapter, the second chapter presents the A+E program events and accomplishments from 1993 through 2000. Chapter 3 describes the evaluation method and sample. Chapter 4 presents findings from the quantitative analysis of architects' responses. We give our conclusions and recommendations for the A+E program in Chapter 5.

Appendix A presents the architects' open-ended comments made during the interviews. Appendix B describes the commercial building design market. It provides a market assessment and describes the barriers to energy-efficient design practices. Appendix C presents characteristics of two groups of A+E participants, elaborating on an analysis of participants given in Chapter 4. Appendix D includes the two survey instruments used in the research: the interview guide for participating and nonparticipating architects and the instrument used to screen

contractor and development firms to find staff architects engaged in commercial new construction design.

1. Introduction

2. PROGRAM EVENTS AND ACCOMPLISHMENTS

Through the seventh award program in 1999, A+E has been consistently well received by participants. Judges in the award competition rate the A+E program as one of the top award programs in the United States and note that it is unique in its comprehensive focus on energy and design.

PROGRAM EVENTS

The Architecture + Energy events, since the program's inception through March 2001, are given in Table 1.

Table 1

A+E EVENTS

EVENT	LOCATION	DATE	VENUE/ PRESENTER
Awards Presentation and Workshops	Portland, OR	6/93	National Electric Lighting Professional Association (NELPA) Conference
Workshop/ Infomercial	Missoula and Billings, MT	1993	Dynamic Design Conferences/ Montana Department of Natural Resources
Awards Presentation and Workshops	Portland, OR	6/94	Stand-alone event
Awards Presentation and Workshops	Portland, OR	6/95	Stand-alone event
Awards Presentation and Workshops	Seattle, WA	6/96	Stand-alone event
Awards Presentation and Workshops	Seattle, WA	6/97	Stand-alone event held at Battell Northwest
Awards Presentation and Workshops	Portland, OR	6/98	Stand-alone event
Workshop	Boise, ID	10/24/98	AIA Idaho State Conference

Continued

2. Program Events and Accomplishments

EVENT	LOCATION	DATE	VENUE/ PRESENTER
Brown Bag Presentations (4)	Portland, OR	4-5/99	Individual firms
Brown Bag Presentations (8)	Seattle, WA	4/12/99	Individual firms
Workshop	Spokane, WA	4/28/99	Stand-alone event hosted by Washington State University and AIA Spokane Chapter/ Steve Ternoey, AIA
Workshop	Portland, OR	5/3/99	7th National Conference on Building Commissioning
Awards Presentation and Workshop	Portland, OR	6/25/99	Stand-alone event
Workshop	Portland, OR	10/99	AIA Portland's Architecture Week/ Dr. Ray Cole and Kath Williams
Firm Visits (3)	Portland, OR	4/28/00	Individual firms/ Steve Ternoey, AIA
Workshop/ Building Tours	Eugene, OR	2000	Stand-alone event
Workshop	Spokane, WA	8/00	Stand-alone event hosted by Washington State University and AIA Spokane Chapter/ Gail Lindsey, AIA
Workshop	Bozeman, MT	9/9/00	Montana State University School of Architecture's 75th Anniversary Celebration/ Steven Ternoey, AIA
Workshop	Sun Valley, ID	9/21/00	AIA/Western International Summit 2000/ Robert Berkebile, FAIA
Firm Consultations	Portland, OR	10/16/00	AIA Portland's Architecture Week
Firm Visit	Tacoma, WA	11/28/00	Individual firm/ Kevin Hydes, PE
Firm Visit	Everett, WA	3/7/01	Individual firm/ Kevin R. Hydes, PE
Firm Visit	Seattle, WA	3/28/01	Individual firm/ Kevin R. Hydes, PE
Workshop	Portland, OR	4/6/01	Stand-alone event/ Gail Lindsey, FAIA and Greg Franta, FAIA

Note: In addition to any sponsor indicated, AIA/Portland has sponsored all events and the Alliance has co-sponsored events from 1998-2001.

PROGRAM ACCOMPLISHMENTS

The Alliance's progress and success indicators for the program in 2000-2001 have been met: to conduct a minimum of four workshops and six firm visits, and to continue market presence activities.

As shown in Table 2, nearly 600 people have attended A+E events since 1993.

Table 2

A+E PARTICIPANTS, 1993-2000

TYPES OF PARTICIPANTS	NUMBER OF UNIQUE PARTICIPANTS
Practicing Architects	376
University Staff	12
Students and Participants Listing Home Phone and No Affiliation	46
Architectural Services Firm Staff	5
Engineering Firm Staff	14
Developers and Builders	6
Institutional Customers	6
Financial Firm Staff	1
Utility and Energy Agency Staff and Energy Professionals	17
Manufacturing Firm Staff	3
Professionals From Outside the PNW	51
AIA Staff, Juror, or Steering Committee Members	29
No Affiliation and No Current Phone Number	28
Total	**594**

Notes: Practicing architects includes brown bag participants in 1999 (n=98). For 1993-1995, participants comprise only those who submitted projects for award consideration; no workshop attendance data were available. Table does not include participants in the 1993 workshop/infomercial in Montana, the 10/99 workshop in Portland, or the 2000 workshop/building tours in Eugene, for which participant data were made available subsequent to the analysis.

In fact, total participation exceeds 600 because data were not available on those who attended the workshops from 1993-1995. For those years, records include only the people who submitted proposals.

Tables 3 through 6 elaborate on the 376 practicing architects listed in Table 2. Table 3 shows the states in which the architects reside, by year of program attendance. About half of all architects participating in the workshops and firm visits reside in Oregon; about one-third come from Washington; 13% come from Idaho; and 5% come from Montana. Most of the architects from Idaho and Montana participated in the workshops held in 2000.[4]

Table 3

PRACTICING ARCHITECTS BY YEAR AND STATE

YEAR PARTICIPATED	STATE				TOTAL ATTENDANCE
	IDAHO	MONTANA	OREGON	WASHINGTON	
Workshops & Firm Visits					
1993-1995	1	1	16	11	29
1996	3	0	13	19	35
1997	1	1	12	11	25
1998	0	0	33	3	36
1999	6	1	34	21	62
2000	30	12	47	43	132
Total Workshops & Firm Visits	***41***	***15***	***156***	***109***	***319***
1999 Brown Bags	0	0	24	74	98
Total	**41**	**15**	**180**	**183**	**417**

Notes: Total of 417 attendees includes 33 architects who attended workshops twice, 4 architects who attended workshops three times, and 339 architects who attended one workshop, consistent with the 376 unique architects given in Table 2. For 1993-1995, participants comprise only those who submitted projects for award consideration; no workshop attendance data were available.

[4] The First MPER found very little recall among participants in the A+E workshop held in October 1998 as part of the AIA Boise Chapter annual meeting. Consequently, those participants are not tallied in Table1 nor included in any subsequent analyses.

Architects from a total of 164 firms have participated in the program since 1993, as shown in Table 4. Of the firms represented, nearly 30% have had two or more architects participate.

Table 4

UNIQUE FIRMS PARTICIPATING IN 1993-2000 WORKSHOPS, BY NUMBER OF PARTICIPANTS FROM FIRM

FIRMS WITH...	NUMBER OF UNIQUE FIRMS	TOTAL UNIQUE PARTICIPANTS
1 Architect Attending	116	116
2 Architects Attending	22	44
3 Architects Attending	14	42
4 Architects Attending	4	16
5 Architects Attending	2	10
6 Architects Attending	1	6
7 Architects Attending	1	7
9 Architects Attending	3	27
10 Architects Attending	1	10
Total	**164**	**278**

Notes: Firms with 1 architect attending include at least 13 self-employed architects. For 1993-1995, participants comprise only those who submitted projects for award consideration; no workshop attendance data were available.

In 1999, the program staff conducted a number of brown bags at individual firms to discuss the awards program, explain its criteria, and encourage project submittals. Interviews with brown bag participants conducted for the second MPER concluded that most participants found the brown bags to be a useful way to learn about the program; however, the sessions did not have the educational value of the A+E workshops. Consequently, the brown bag participants are identified separately in Table 3 and excluded from Table 4. Table 5 describes the number of architects reached through the brown bags.

Table 5

UNIQUE FIRMS PARTICIPATING IN 1999 BROWN BAGS, BY NUMBER OF PARTICIPANTS FROM FIRM

FIRMS WITH...	NUMBER OF UNIQUE FIRMS	TOTAL UNIQUE PARTICIPANTS
3 Architects Attending	1	3
4 Architects Attending	1	4
5 Architects Attending	1	5
7 Architects Attending	2	14
8 Architects Attending	2	16
10 Architects Attending	2	20
11 Architects Attending	1	11
25 Architects Attending	1	25
Total	**11**	**98**

When the A+E participants are examined by the size of firm in which they work, it is evident that A+E has been successful in reaching the larger firms.[5] As shown in Table 6, over half of all the Pacific Northwest (PNW) architectural firms with 50 or more employees and with commercial practices have had staff participate in A+E workshops; over one-third of firms with 20 to 49 employees have had participating staff.

[5] Early in the evaluation, it became apparent that we needed to control for the respondents' size of firms. We used the size categories provided in the listing of Pacific Northwest architectural firms that we purchased to generate a nonparticipant sample.

Table 6

PROPORTION OF PNW ARCHITECTURAL FIRMS WITH COMMERCIAL PRACTICES AND STAFF PARTICIPATING IN 1993-2000 A+E WORKSHOPS, BY SIZE OF FIRM

NUMBER OF EMPLOYEES IN FIRM	NUMBER OF FIRMS IN PNW	NUMBER OF FIRMS WITH PARTICIPATING STAFF	PERCENT OF POPULATION PARTICIPATING
50 or More	39	21	54%
20 to 49	68	23	34%
10 to 19	104	15	14%
5 to 9	190	21	11%
Total with 5 or More Employees	**401**	**80**	**20%**
1 to 4	Not available*	59	Not available*
Size Unknown	Not applicable**	25	Not applicable**

** The number of architectural firms in the PNW with 1 to 4 employees is not known, because many self-employed architects and architects working in collaboration with a few colleagues are not included in published commercial listings.*

*** The 25 participating firms with "size unknown" participated prior to 1998 and thus were not interviewed for this study, nor did they have a match in the published commercial listing. Firms of all sizes lacked matches in the commercial listing, however the probability of a lack of match increases as the firm size decreases. It is likely that two-thirds or more of the 25 firms with size unknown have 1 to 4 employees.*

3. EVALUATION OBJECTIVES, METHOD, AND SAMPLE

OBJECTIVES AND METHOD

This third MPER has four primary objectives:

- To assess the likely impact or influence of the A+E program on building design and design practices in the region;
- To learn about the current design practices of the region's architects (irrespective of program participation);
- To better understand market barriers to energy-efficient design as experienced by architects in the region; and
- To explore architects' interest in possible educational forums for learning more about energy-efficient design.

It is not possible to directly measure the effect of the A+E program on participants' design practices for a number of reasons. One reason for the inability relates to the structure of the new construction market. Architects contribute to, and perhaps even drive many design decisions, yet primarily they serve as consultants to clients, providing them with options and the associated pros and cons. The clients ultimately determine what they are willing to pay for and select the features they like. In addition, engineers and contractors make decisions independent of the architect that influence the energy efficiency of buildings. Thus, an architect may fully embrace the principles and methods promoted by A+E, but may be able to apply them only to varying degrees across projects. Program "effects" measured in any given period of time may not reflect what the architects do in another timeframe, such as during a period when rising energy prices lead clients to request more efficient buildings.

Another reason for the inability to directly measure results from the A+E program relates to the impossibility of disentangling the effects of multiple information sources. Architects may be highly influenced by the A+E program and, as a consequence, seek additional information from colleagues, websites, journals, and so on about energy-efficient design. Or conversely, due to architects' interest in the subject, piqued by other sources, they choose to attend the A+E program. Subsequently, it is impossible to say that A+E had an effect of "X" while the other

information sources had an effect of "Y" and, under their combined influence, the architect did "Z," equal to "X+Y."

Nor can the effect of A+E on a specific design project be disentangled from exogenous factors impacting the design, such as the shape and location of the lot, or the inability to use operable windows and passive ventilation in buildings such as medical facilities.

Interviewed architects consistently said that the final design elements are selected based on a large number of factors, including constraints and opportunities associated with the site, the "program" for the facility (its purpose and associated design needs), the skills and limitations of all of the professionals involved, material availability, timeframe for project design and construction, and so on. Knowledge obtained from participation in an A+E event will expand the opportunities for energy-efficient design but will seldom be "causal" in any design decision.[6]

Finally, even were it possible to identify specific designs or design features that would not have occurred in the absence of the A+E program, determining the energy impacts of such features would require an extensive monitoring and modeling effort.

Consequently, this evaluation aims at assessing the influence of A+E. It does this by comparing the energy-efficiency actions taken by participants and nonparticipants during the preceding six to twelve months. The telephone survey instrument, given in Appendix D, asks detailed questions about design activities in order to be confident that respondents are using the same terminology.[7]

For example, respondents who we identify as incorporating daylighting features are not credited as such on the basis of specifying "lots of windows". To be counted as using the features of a daylighting strategy, architects' designs must incorporate one or more of the following:

- Shading devices (e.g., louvers, projections, light shelves);

[6] There have been at least two noteworthy exceptions to this. The second MPER found that an architect, as a consequence of attending a workshop and consulting individually with the presenter, dramatically changed the design that had, prior to the workshop, been nearing finalization. Another architect named a specific design that had been substantially influenced by his involvement with A+E.

[7] The questions on design activities were based on a description given by the A+E program Manager (an AIA/Portland staff member) of the workshops' contents.

- Roof designs to let light in (e.g., clerestories, skylights, roof monitors, stepped roofs, saw-tooth roofs);
- Optimized daylight penetration (e.g., through the location of windows in the wall, floor-to-ceiling heights, floorplate configuration); or
- Other described activities that reduce the building's energy needs through the use of natural light.

After participants and nonparticipants answered detailed questions such as these about their design practices, participants were asked their own assessment of whether, as a result of the A+E workshops, they suggested the energy-efficiency ideas to clients more frequently than they did before attending the A+E event. Participants were also asked whether clients accepted the ideas more; and if so, did they attribute this to changes external to the workshop (such as a general increase in client awareness) or to an increase in their knowledge or enthusiasm as a result of A+E, or to both factors.

Thus, this current study assesses whether there are differences in the design practices of participants and nonparticipants with respect to energy-efficiency features. *If participants are found to design more energy-efficient buildings, the attribution of influence of the A+E program has been made by the participants themselves.*

We interviewed architects that participated in the A+E program between 1998 and 2000, the years for which the Alliance provided funding. We attempted contact with a participating architect from every firm in attendance in order to obtain a sample of 50 surveyed participants. The sample is described in the next section.

To sample nonparticipants, we purchased a business list of architectural firms with offices in the four-state region. From this list, we excluded the firms from which any architects had attended an A+E event in any year. Thus, the list of nonparticipating firms from which we sampled included only firms in which no one had ever been an A+E participant. We stratified the list of nonparticipating firms by size category, so that our sample might approximate the size distribution of the firms from which participants had come. Within the size category, the firms were randomized. We also purchased business lists of contractors and developers and interviewed a sample of firms employing architects. We completed 50 nonparticipant interviews, as described in the section following the discussion of the participant sample.

It is important to note that the method contains unavoidable biases that *reduce* estimates of differences between the actions of A+E participants and nonparticipants. The energy-efficiency actions of the participant sample yield an

underestimate of the actions of all participants, while the energy-efficiency actions of the nonparticipant sample yield an *overestimate of the actions of all nonparticipants*. Thus, any measured difference in energy-efficiency actions between the sampled participants and nonparticipants represents a *lower bound* to the difference between the population of participants and nonparticipants. The estimation biases stemming from the samples are described in the next section and Appendix A, where the samples are discussed in detail.

Also as part of our evaluation method, we interviewed the A+E Program Manager at AIA/Portland.

In this evaluation, we speak of the influence of the A+E "program" without distinguishing between the awards for exemplary designs and the educational workshops. It is not possible to disentangle their respective effects, although the findings shed light on the usefulness of both the awards and the workshops. Participants in 1998 attended both the workshops and the awards presentation, which were held in a single day. Participants in 1999 attended either the combination awards ceremony plus workshops, or workshops held as either stand-alone events or in conjunction with other conferences. Participants in 2000 attended only workshops, as no awards were presented.

The workshops themselves varied in content and presenter. Some workshops focused on lessons learned about energy-efficient design from the awards competition. Other workshops addressed energy-efficient design elements and methods, drawing examples from the awards program, but without making the award lessons the central focus. Because the workshops built on the awards program, and did so to varying degrees, it is not possible to make a statement about the influence of workshops in the absence of the awards program.

Furthermore, as we see in the findings given in Chapter 4, architects' response to the A+E program varied with the extent to which their firms participated in the program. Architects who had coworkers that participated, or who participated in more than one event, appear to be more influenced by A+E than architects who participated in a single event and who lack participating coworkers. Within a firm, an architect who participated in only a workshop may be influenced by a coworker who participated in the combination workshop/awards. The apparent influence of coworkers thus further entwines the awards and workshop components.

PARTICIPANT POPULATION AND SAMPLE

The evaluation addresses the experience and practices of architects participating in A+E workshops and firm visits between 1998 and 2000, the years for which the

Alliance provided funding. We attempted to interview one architect from each participating firm with five or more employees, plus architects from five firms with fewer than five staff members.

Our goal from our contact attempts was to secure a total of 50 interviews with participants having commercial practices. We completed interviews with 43 architects. The firms to which these architects belong comprise nearly two-thirds of all participating firms that qualified for our study. Table 7 shows the disposition of the population of participants.

Table 7

SAMPLING FROM POPULATION OF A+E PARTICIPATING FIRMS 1998-2000

DISPOSITION	FIRM SIZE IN NUMBER OF EMPLOYEES					TOTAL
	50 OR MORE	20 TO 49	10 TO 19	5 TO 9	1 TO 4	
Total Participating Firms	18	20	12	19	51	**120**
Disqualified: No Commercial Design Work	2	0	1	1	10	**14**
Disqualified: Bad Phone Number or Participant Left Firm	0	0	0	3	0	**3**
Previously Interviewed	1	3	3	4	6	**17**
Appropriate for Current Study (Estimate)	15	17	8	11	17	**68**
Refused	0	0	0	2	0	**2**
Interviewed	11	14	6	7	5	**43**
Interviewed as Percent of Appropriate	73%	82%	75%	64%	29%	**63%**

Note: We determined the number disqualified and refusing when we spoke with participants. Although we left messages with all participants and made between two to six contact attempts, we did not speak with all of them. Thus, the number of participants appropriate for the current study is an estimate. For the four largest size categories, the estimated appropriate number assumes that all non-contacted participants qualified for the study. We estimated the number appropriate for the size 1 to 4 employees as follows: we spoke with 15 participants, 10 of whom did exclusively residential work. We assumed that 33% of those not contacted for the current or previous studies qualified for the current study, as did all of those with whom we completed interviews.

We chose not to interview participants that had been interviewed for the first or second MPER. We made this decision largely on pragmatic grounds. The interviews

are lengthy; most took between thirty and sixty minutes. The previous interviews were also lengthy. We did not want to burden these professionals, who typically have pressing design responsibilities and the need to bill virtually all of their time. In addition, we had reported on the views of those who we previously interviewed and so we sought to hear from people who had not yet provided feedback on the program.

Table 8 shows the outcome of excluding from the sample firms in which we had previously interviewed the participants. In the sample, recent participants are somewhat more frequent than they are in the participant population as a whole.

Table 8

SAMPLE BY YEAR OF PROGRAM PARTICIPATION

YEAR PARTICIPATED	NUMBER OF PARTICIPATING FIRMS	FIRMS WHERE PARTICIPANTS WERE PREVIOUSLY INTERVIEWED	FIRMS NOT PREVIOUSLY INTERVIEWED	FIRMS IN SAMPLE
1998-1999	98 (43%)	17 (100%)	81 (38%)	17 (40%)
2000	132 (57%)	0 (0%)	132 (62%)	26 (60%)
Total	**230 (100%)**	**17 (100%)**	**213 (100%)**	**43 (100%)**

The survey, conducted between March 19 and April 18, 2001, asked participants of the 2000 workshops about their actions since attending the workshop—about a seven-month period—and asked 1998 and 1999 participants about their actions during the previous twelve months. For those who attended in 1998 and 1999, it is likely that most, if not all, of the projects they reported on started sometime after they attended. Thus, there was the opportunity for these projects to be influenced from the outset by the methods A+E advocates. For those who attended in 2000, it is likely that many of the projects they reported on started before they attended. For many of these projects, the participants would not have had an opportunity to apply the A+E information. Thus, we expect that the 2000 participants had less of an opportunity than other participants to apply what they learned from A+E during the period we asked about.

Another consequence follows from the fact that 2000 participants comprise 60% of the sampled population; Idaho and Montana comprise 30% of the sampled firms,

even though they comprise only 21% of participants since the program's inception (see Table 9). Of the 53 participants since 1993 that have come from Idaho and Montana, 42 (75%) participated in 2000. This is because the A+E 2000 program purposefully targeted Idaho and Montana to extend its influence throughout the region. Since our sample slightly over-represents 2000 participants, it also somewhat over-represents firms in Idaho and Montana.[8] The study results described subsequently in Chapter 4 show that, on average, participants from Idaho and Montana undertake energy-efficiency actions less frequently than do other participants. Thus, their overrepresentation in the sample results in an underestimation of the actions of the participant population as a whole.

Table 9

PARTICIPANT SAMPLE BY STATE

STATE	NUMBER OF PARTICIPATING FIRMS SINCE 1993		FIRMS IN SAMPLE	
Idaho and Montana	49	(21%)	13	(30%)
Oregon and Washington	181	(79%)	30	(70%)
Total	**230**	**(100%)**	**43**	**(100%)**

NONPARTICIPANT POPULATION AND SAMPLE

To develop the nonparticipant sample, we purchased a business listing of all architectural firms in the four-state region. The list included 391 firms. We set quotas within each size category based on the size distribution of the interviews we expected to complete with participants. Table 10 gives the sample disposition. We completed 44 interviews. We were able to interview architects from half of the largest firms and one-quarter of the next largest firms. Overall, we interviewed 12% of the firms with five or more employees, as well as 4 firms with less than five staff members.

[8] The proportion of Idaho and Montana firms in the sample also owes to the vagaries of who agreed to be interviewed. We contacted participants from every firm to request their participation in the research. We were not able to ensure that the final sample mirrored the distribution of the population by state.

Table 10

SAMPLING FROM POPULATION OF ARCHITECTURAL FIRMS WITH NO A+E PARTICIPANTS IN ANY YEAR (1993-2000)

DISPOSITION	FIRM SIZE IN NUMBER OF EMPLOYEES					TOTAL 5 OR MORE EMPLOYEES
	50 OR MORE	20 TO 49	10 TO 19	5 TO 9	1 TO 4	
Total Population from Business List	20	52	89	230	159	391
Disqualified: No Commercial Design Work	2	7	0	4	0	13
Disqualified: Bad Phone Number	0	0	0	1	0	1
Appropriate for Current Study (Estimate)	18	45	89	169	NA	321
Refused	2	11	5	4	3	22
Interviewed	9	12	9	10	4	40
Interviewed as Percent of Appropriate	50%	27%	10%	6%	NA	12%

Notes: We determined the number disqualified and refusing when we spoke with architects at the firms. The appropriate number for the current study was estimated from the responses of those architects we spoke with. We left messages with architects in each size category and made two to six contact attempts until we completed our quota, which was established to approximate the number of completed participant interviews. For the two categories greater than 19 employees, we either spoke with, or left messages for architects at every firm. For the group with 10 to 19 employees, we did not contact 51 of the 93 firms; for 5 to 9 employees, we did not contact 205 of the 240 firms. For 1 to 4 employees, we did not contact 138 of the 159 listed firms, and many small architectural firms are unlisted; thus, no estimate of the number appropriate for the current study is given.

As mentioned in our discussion of methodology, the reader should be aware that the interviewed nonparticipating architects likely are *not* representative of the nonparticipant population as a whole regarding the very characteristics the study seeks to explore. Whereas participants generally were quite willing to be interviewed, as evidenced by a response rate of 63%, nonparticipants generally were quite reluctant to be interviewed. Twenty-two firms explicitly declined to be interviewed, usually stating that they did not consider the purpose of the research to be relevant to them. Many other firms declined by simply neglecting to return our phone messages. Typically, the nonparticipating architects that agreed to be interviewed were those with a reputation in their firm as being interested in "green" design.

Thus, the nonparticipant sample suffers from what is termed "self-selection bias." In this case, the self-selection bias causes the energy-efficiency actions of the

population of nonparticipants to be overestimated, and thus any potential differences between participants and nonparticipants to be *underestimated*. This bias was unavoidable in a voluntary survey such as this. Were respondents to be provided monetary reimbursement, the act of self-selection would be less likely to affect or bias the activities measured by the survey.

In addition to purchasing a list of the architectural firms in the PNW, we also purchased lists of contractors and developers in the region. We wondered whether these firms had architects on staff to participate in design/build work.[9] The purchased contractor and developer lists comprised 1,719 firms. We contacted every firm on the list at least twice in an attempt to screen them for eligibility for the study. We were able to ask 949 firms (55%) the screening questions, determining whether they were involved in commercial new construction, and if so whether they had an architect on staff. The firms involved in the commercial sector (defined as commercial, institutional, and industrial) comprised 77% of the population; of these, 92% were engaged in new construction; and of these, 10% reported having architects on staff and 8% provided us with the name of the architect.

When we attempted to reach the named architect, however, in many instances we learned that the person answering the screening questions (typically, the firm's receptionist) was mistaken. The named staff did not provide architectural services to the firm, or had left the firm, or was located out of state, nor were any architects currently employed by the firm in the region. In some cases, the named individual said that the firm did not conduct any commercial new construction design activities. Out of the 53 names generated by the screening, we determined that a minimum of 22 did not qualify for the study. We made at least two attempts to contact every named individual, leaving messages when we did not succeed. We completed interviews with 6 architects. We conclude from this research that no more than 3% of the roughly 1,700 contractors and developers with offices in the PNW have architects on staff here (i.e., approximately 50 contractors).

We thus interviewed 44 architects from the purchased list of PNW architectural firms and 6 architects from the purchased list of PNW contractors and developers. The latter firms include three of size 50 or more, two of size 10 to 19, and one of size 1 to 4 employees.

[9] See Appendix A, *"Distribution Chain"* section, for a definition of design/build.

COMPARISON OF SAMPLED PARTICIPANTS AND NONPARTICIPANTS

Table 11 provides a comparison of the characteristics of sampled participants and nonparticipants. Firms from which participants have come are more likely than the firms of nonparticipants to be located in Idaho (28% versus 2%) and less likely to be located in Washington (37% versus 72%; ❹^2, p<.01). Participants' firms also are more likely than nonparticipants' firms to be involved in institutional design (84% versus 64%) and less likely to be involved in industrial or warehouse design (33% versus 54%; ❹^2, p<.05). Between a half and two-thirds of both the participating and nonparticipating firms engage in design/build work.

Table 11

CHARACTERISTICS OF SAMPLED PARTICIPANTS AND NONPARTICIPANTS

CHARACTERISTICS	PARTICIPANTS (N=43)		NONPARTICIPANTS (N=50)		TOTAL (N=93)	
	FREQUENCY	PERCENT	FREQUENCY	PERCENT	FREQUENCY	PERCENT
NUMBER OF EMPLOYEES IN FIRM						
50 or More	11	26%	12	24%	23	25%
20 to 49	14	32%	12	24%	26	28%
10 to 19	6	14%	11	22%	17	18%
5 to 9	7	16%	10	20%	17	18%
1 to 4	5	12%	5	10%	10	11%
STATE**						
Idaho	12	28%	1	2%	13	14%
Montana	1	2%	3	6%	4	4%
Oregon	14	33%	10	20%	24	26%
Washington	16	37%	36	72%	52	56%

Continued

CHARACTERISTICS	PARTICIPANTS (N=43)		NONPARTICIPANTS (N=50)		TOTAL (N=93)	
	FREQUENCY	PERCENT	FREQUENCY	PERCENT	FREQUENCY	PERCENT
SECTORS SERVED WITH DESIGN WORK (MULTIPLE RESPONSE)						
Commercial	37	86%	48	96%	85	91%
Institutional, Educational*	36	84%	32	64%	68	73%
Industrial, Warehouse*	14	33%	27	54%	41	44%
Residential	23	54%	28	56%	51	55%
CONSTRUCTION ACTIVITY SERVED (MULTIPLE RESPONSE)						
Design/Build[a]	21	54%	29	63%	50	59%
New Construction	43	100%	48	96%	91	98%
Renovation	39	91%	46	92%	82	88%
Remodeling	39	91%	47	94%	86	92%
NUMBER OF DESIGNERS IN OFFICE						
1 to 4 Designers	9	21%	10	20%	19	20%
5 to 9 Designers	9	21%	16	32%	25	27%
10 to 19 Designers	8	19%	8	16%	16	17%
20 to 49 Designers	9	21%	9	18%	18	19%
50 to 99 Designers	5	12%	4	8%	9	10%
100 or More Designers	3	7%	3	6%	6	7%
TITLE OR ROLE OF RESPONDENT						
Owner	13	30%	20	40%	33	36%
Principal	9	21%	12	24%	21	23%
Project Manager	10	23%	9	18%	19	20%
Architect	8	19%	9	18%	17	18%
Intern	0	7%	3	6%	3	3%

Continued

CHARACTERISTICS	PARTICIPANTS (N=43)		NONPARTICIPANTS (N=50)		TOTAL (N=93)	
	FREQUENCY	PERCENT	FREQUENCY	PERCENT	FREQUENCY	PERCENT
LENGTH OF TIME PRACTICING ARCHITECTURE						
1 to 4 Years	6	14%	4	8%	10	11%
5 to 9 Years	0	0%	5	10%	5	5%
10 to 19 Years	12	28%	14	28%	26	28%
20 to 29 Years	20	46%	16	32%	36	39%
30 or More Years	5	12%	11	22%	16	17%
NUMBER OF PROJECTS IN THE LAST YEAR*						
1 to 4 Projects	14	33%	6	12%	20	21%
5 to 9 Projects	7	16%	9	18%	16	17%
10 to 19 Projects	12	28%	9	18%	21	23%
20 to 29 Projects	5	12%	6	12%	11	12%
30 to 99 Projects[a]	4	9%	10	20%	14	15%
100 or More Projects[a]	1	2%	10	20%	11	12%

*Notes: : **Significant difference between participants and nonparticipants, χ^2, p<.01*Significant difference between participants and nonparticipants, χ^2, p<.05. [a]See Appendix B, "Distribution Chain" section for a definition of design/build and "When Transactions Occur" section for an explanation of architects' reports of a very large number of projects in the last year.*

Sampled participants and nonparticipants are comparable in the positions they hold at their firms; over half of those interviewed were owners or principals. Over 80% of both participating and nonparticipating respondents have been practicing architecture for ten or more years.

Participants worked on fewer projects during the period than did nonparticipants (❹^2, p < .05). Nearly half of all participants worked on fewer than ten projects, compared with only 30% of nonparticipants; only 11% of participants worked on 30 or more projects, compared with 40% of nonparticipants. This implies that the surveyed participants were either working on larger projects or had a larger role in the projects discussed than did the surveyed nonparticipants. Given that the two groups of respondents are comparable in their role in the firm and their tenure as

an architect, it seems likely that the former explanation is accurate: that sampled participants worked, on average, on larger projects than did sampled nonparticipants. Given that participating firms were more likely than nonparticipating firms to conduct institutional design work, it may be that the average institutional project is larger than the average non-institutional project.

4. FINDINGS

INFLUENCE OF A+E PROGRAM

As described in Chapter 3, we asked responding architects detailed questions about their architectural practices. Comparable proportions of participating and nonparticipating architects reported engaging at least once during the past year in each design practice probed. In addition, comparable proportions of both participating and nonparticipating architects reported that their clients had requested the various energy-efficient design practices at least once during the preceding year.

Because participants and nonparticipants did not differ with respect to these issues, Table 12 gives these proportions—the proportion of architects engaging in each practice at least once during the survey period and the proportion of architects reporting that at least one client requested the practice during the survey period—for the architect population as a whole.[10] However, significant differences were found between participants and nonparticipants in the proportion of project final designs that reflected the energy-efficient practice, as shown in the table.

For 11 of the 12 energy-efficient design practices explored, a greater proportion of the final designs of participants, as compared with that of nonparticipants, reflected the practice. Seven of these 11 differences between participants and nonparticipants are statistically significant (χ^2, $p<.01$ and .05). Averaging across all 12 design practices, 40% of participant final designs, compared with 30% of nonparticipant final designs, reflected energy-efficient practices.

It is worth emphasizing that the first column of architect percentages in Table 12 describes the proportion of architects who included one or more one of the components of a practice at least once during the period. An architect who incorporated a single skylight in a single project would be counted as a "yes" in the daylighting tally, as would an architect who incorporates a number of shading features, clerestories, and skylights on nearly every project, as well as optimizing floorplate configuration to ensure light penetration.

[10] The PNW population of both participating and nonparticipating architects is known. The actions of the population are estimated by weighting the participant and nonparticipant samples according to their representation in the population.

Table 12

ARCHITECTS' REPORT OF THEIR DESIGN PRACTICES DURING YEAR PRIOR TO SPRING 2001 (WEIGHTED)

PRACTICE OR FEATURE	PERCENTAGE OF ARCHITECTS REPORTING ENGAGING IN PRACTICE OR CONSIDERING FEATURE AT LEAST ONCE	PERCENTAGE OF ARCHITECTS WHOSE CLIENTS REQUESTED THE PRACTICE OR FEATURE AT LEAST ONCE	PERCENTAGE OF FINAL DESIGNS REFLECTING THE PRACTICE OR FEATURE	
			A+E PARTICIPANTS	A+E NON-PARTICIPANTS
Pre-Design Activities to Address Energy Savings	81%	57%	59%**	35%
Site or Orientation Selected Due to Resource Considerations	61%	25%	26%	20%
Envelope Designed to Reduce HVAC Needs	94%	34%	58%	51%
Daylighting Features	88%	36%	52%**	40%
Passive Systems	61%	15%	31%**	18%
Efficient Lighting System	80%	39%	59%**	41%
Efficient HVAC System	79%	36%	44%*	36%
Efficient Water Heating	43%	17%	8%	12%
Use of Life-Cycle Cost Comparisons[11]	73%	39%	36%	30%
Use of Computer Models of Lighting and Building Energy	64%	22%	27%	23%
Use of Consulting Resources	87%	28%	NA	NA

Continued

[11] A reader of a draft version of this report commented that a finding of 73% of architects using life-cycle cost comparisons is inconsistent with the finding, described subsequently, that architects lack good quantitative information on the costs and benefits of efficiency measures. Architects' comments on the use of such comparisons (see Appendix A) reveal the use of informal comparisons in some instances. In addition, the percentage represents the proportion of architects using a life-cycle cost comparison at least once during the year. "Once" is a weak inclusion criterion. See discussions of this issue in this chapter subsequently and in Appendix A.

PRACTICE OR FEATURE	PERCENTAGE OF ARCHITECTS REPORTING ENGAGING IN PRACTICE OR CONSIDERING FEATURE AT LEAST ONCE	PERCENTAGE OF ARCHITECTS WHOSE CLIENTS REQUESTED THE PRACTICE OR FEATURE AT LEAST ONCE	PERCENTAGE OF FINAL DESIGNS REFLECTING THE PRACTICE OR FEATURE	
			A+E PARTICIPANTS	A+E NON-PARTICIPANTS
Other Resource Efficiency Actions	32%	NA	32%**	6%
Average Of All Features/ Practices	NA	NA	40%**	31%

*** A+E participant percentage differs significantly from the nonparticipant percentage at the .01 level (χ^2, p<.01).*

** A+E participant percentage differs significantly from the nonparticipant percentage at the .05 level (χ^2, p<.05).*

Notes: a .The total population of architects in the Pacific Northwest is estimated by weighting the participant and nonparticipant samples. b. Nonparticipants and participants in 1998 and 1999 were queried about their design activities for the 12 months proceeding the survey. Participants in 2000 were queried about their design activities subsequent to the A+E event, which occurred about 7 months earlier, depending on the event. c. Percent of projects for which respondents used consulting resources is not reported because of apparent differences in how respondents interpreted the question. Many respondents reported 100% of their projects, reasoning that what they learned on one project they applied to all the others. Other respondents reported only the number of projects for which they turned to consulting resources for new information.

The architects' comments (given in Appendix A) reveal that the A+E participants who engaged in a practice (e.g., daylighting) generally included a greater variety of the practice's component elements (e.g., clerestories) than did the nonparticipants. Phrased differently, more participants than nonparticipants described incorporating a number of the component elements for each efficiency practice, and more nonparticipants than participants described incorporating one component in a few projects and another component in some other projects.

The second column of frequencies in Table 12 reports the percentage of architects who said that their clients have requested, at least once in the last year, some component of the energy-efficiency feature or practice. Again, consider the practice of daylighting: an architect would answer, "Yes, a client has requested this" if a single client requested one skylight. It does not mean that the client requested a complete daylighting strategy.

Nor should the percentage in the table be construed as the *percentage of clients* requesting the feature. The reader should interpret the percentage as the *percentage of architects* who have, during the course of the last year, had to consider an energy-efficiency feature at least once because a client raised the issue.

Furthermore, even when architects responded "yes," many elaborated that the client request might be more accurately represented as a collaborative decision between the client and architect. (Appendix A provides respondents' comments on the topic of clients requesting energy efficiency features.)

Differences Among Groups of Participants

With the encouragement of the Alliance, the 1999 and 2000 A+E programs sought to increase the participation of architects outside of the Portland and Seattle metropolitan areas. As a consequence, the A+E events attracted architects from firms that had never before participated. Eighteen of the sampled participants in this category attended without the benefit of colleagues accompanying them. Another six sampled firms had two or more architects attending for the first time in 1999 or 2000.

We hypothesized that the architects who attended only one A+E event and who were alone among their coworkers in attending any event might engage less frequently in energy-efficient design practices than architects who attended multiple events or were working with architects who also attended A+E events. Table 13 compares the proportion of projects whose final designs reflect each energy-efficient design practice among three groups: participants who have attended more than one A+E event or whose coworkers have also attended events (termed "multiple-event participants"); participants in a single event with no participating coworkers (termed "single-event participants"); and nonparticipants. (Unlike Table 12, the data in Table 13 are not weighted to the population level, since the table is designed to show contrasts within the participant sample.)

Table 13 suggests that the A+E program might have a cumulative impact. A single individual attending from a firm who attends only one event may not have sufficient knowledge, confidence, or "critical mass" to influence the practices of the design team. An individual who has attended more than one event or who has one or more colleagues that have attended A+E events may have sufficient knowledge, confidence, or critical mass to influence design practices.

Table 13

ARCHITECTS' REPORT OF PERCENT OF PROJECTS HAVING ENERGY-EFFICIENT DESIGN PRACTICES DURING YEAR PRIOR TO SPRING 2001, BY LEVEL OF FIRM PARTICIPATION IN A+E (UNWEIGHTED)

PRACTICE OR FEATURE	PERCENT OF FINAL DESIGNS REFLECTING PRACTICE OR FEATURE		
	MULTIPLE-EVENT PARTICIPANTS (N=25)	SINGLE-EVENT PARTICIPANTS (N=18)	NONPARTICIPANTS (N=50)
Pre-Design Activities to Address Energy Saving	63%	57%	41%
Site or Orientation Selected Due to Resource Considerations	36%*	28%	17%
Envelope Designed to Reduce HVAC Needs	75%*	49%	49%
Daylighting Features	70%**	47%	36%
Passive Systems	45%**a	21%	17%
Efficient Lighting System	76%**a	37%	48%
Efficient HVAC System	61%**a	25%	33%
Efficient Water Heating	19%	3%	7%
Use of Life-Cycle Cost Comparisons	45%	28%	28%
Use of Computer Models of Lighting and Building Energy	50%*a	6%	28%
Other Resource Efficiency Action	42%**	21%	8%
Average of All Features/Practices	54%**a	30%	30%

** *Percentage for multiple-event participants differs significantly from the nonparticipant percentage at the .01 level (χ^2, p<.01).*

* *Percentage for multiple-event participants differs significantly from the nonparticipant percentage at the .05 level (χ^2, p<.05).*

[a] *Percentage for multiple-event participants differs significantly from the percentage of single-event participants at either the .01 or .05 level (χ^2, p<.01 and p<.05).*

Note: Nonparticipants and participants in 1998 and 1999 were queried about their design activities for the 12 months preceding the survey. Participants in 2000 were queried about their design activities subsequent to the A+E event, which occurred about 7 months earlier, depending on the event. "Multiple-event participants" are those architects who attended multiple A+E events or who had participating coworkers. "Single-event participants" are those architects who attended a single A+E event and who lack participating coworkers.

In light of the unavoidable over-sampling of firms in Idaho and Montana described in the methods section of Chapter 3, Table 14 shows the state in which the sampled architects practice, by level of firm involvement in A+E. As expected from the location of A+E events in 1998-2000 (the evaluation period), participants attending for the first time and without benefit of participating coworkers were more likely to come from Idaho and Montana than from Oregon and Washington. Thus, the over-sampling of firms in Idaho and Montana results in an over-sampling of single-event participants, the group that applied A+E methods with less frequency.

Table 14

PARTICIPANT SAMPLE BY INVOLVEMENT OF FIRM IN A+E

STATE	MULTIPLE-EVENT PARTICIPANTS (N=25)	SINGLE-EVENT PARTICIPANTS (N=18)	TOTAL PARTICIPANT SAMPLE (N=43)
Idaho and Montana	6 (24%)	7 (39%)	13 (30%)
Oregon and Washington	19 (76%)	11 (61%)	30 (70%)
Total	**25 (100%)**	**18 (100%)**	**43 (100%)**

Note; "Multiple-event participants" are those architects who attended multiple A+E events or who had participating coworkers. "Single-event participants" are those architects who attended a single A+E event and who lack participating coworkers.

Other differences in firm and respondent characteristics exist between those architects attending once and lacking participating coworkers and the architects who attended multiple events or have participating coworkers. The multiple-event participants generally come from the larger firms (χ^2, $p<.01$), come from firms that are engaged in all sectors (e.g., commercial, institutional) and all construction activities (e.g., new construction, renovation, design/build), and worked on fewer projects in the analysis period.[12] Both groups of participants are comparable in length of time they have been practicing architecture. Appendix C presents a complete comparison.

[12] The differences between the two groups for sectors worked in, activities engaged in, and numbers of projects are not statistically significant differences.

It is worth noting that of the 25 architects in the multiple-event group, five had coworkers who attended the same event as themselves, 17 had coworkers who attended different events than themselves, and three had no participating coworkers but had attended two or three events on their own.

Twelve of these multiple-event architects attended the awards and workshop combination; seven attended only a workshop but had coworkers who attended an awards-workshop combination; and six attended workshops and had coworkers who attended workshops only. Of the single-event group, 16 attended only a workshop and two attended an awards-workshop combination. When the architects were grouped by whether they had attended a workshop only or had attended the awards-workshop combination, the latter group had a higher proportion of projects that reflected each energy-efficient practice, but the differences were only significant (χ^2, $p<.05$) for HVAC practices, use of life-cycle cost comparisons, and the average of all practices.

To recap the findings, Table 12 shows that A+E participants, compared with nonparticipants, included energy-efficient design practices on a greater proportion of their projects during the period preceding the survey. The difference is heightened when the level of firm involvement in A+E is considered. As shown in Table 13, architects participating in more than one A+E event, or whose coworkers have participated, included energy-efficient design practices on a greater proportion of their projects than did architects who attended only one event and who lack participating coworkers. The question remains: what is the influence of A+E in this difference found between participants and nonparticipants?

Participants' Attribution of the Influence of A+E

As discussed in Chapter 3, it is not possible to directly measure the influence of A+E in the absence of an extensive and costly monitoring and modeling project, if at all. The method used in the current study is to ask the participants themselves what influence they feel that the A+E workshops have had on their design work. Table 15 gives the sampled participants' responses to the question: "*Because of the workshop, would you say that you suggest to clients these energy-efficient ideas more frequently or about the same as you did before attending any A+E events?*"

Table 15

PARTICIPANTS' ATTRIBUTION OF INFLUENCE OF A+E WORKSHOP ON THEIR DESIGN ACTIVITIES

FREQUENCY OF SUGGESTING ENERGY-EFFICIENT IDEAS TO CLIENTS	MULTIPLE-EVENT PARTICIPANTS (N=25)	SINGLE-EVENT PARTICIPANTS (N=18)	TOTAL PARTICIPANT SAMPLE (N=43)
About the Same as Before Event	3 (14%)	13 (72%)	16 (40%)
More Frequently than Before Event	19 (86%)	5 (18%)	24 (60%)
Total	**22 (100%)**	**18 (100%)**	**40 (100%)**

Note: Total excludes three architects who responded "don't know". "Multiple-event participants" are those architects who attended multiple A+E events or who had participating coworkers. "Single-event participants" are those architects who attended a single A+E event and who lack participating coworkers.

As shown in Table 15, 86% of architects attending multiple events or having participating coworkers believe that they suggested energy-efficient ideas to their clients more frequently after attending an A+E workshop, and they believe that this is *because of the workshop.* It is this group of architects whose final project designs most exceed those of nonparticipants in terms of frequency of energy-efficient practices.

In addition to encouraging architects to suggest energy-efficient ideas to their clients, the A+E program might make architects better advocates for energy-efficient design. We asked participating architects whether they thought that their clients accepted energy-efficiency suggestions more frequently since they attended an A+E workshop. We asked participants noting an increase in client acceptance whether they attributed this increase to factors external to A+E (such as increased client awareness or energy prices) or to some influence A+E had on the architect (such as an increase in their knowledge, enthusiasm, or persuasiveness since attending), perhaps in conjunction with external factors.

As shown in Table 16, over half of architects who attended multiple events or who have participating coworkers thought that clients have more frequently accepted their energy-efficiency suggestions and they credit the A+E program with some influence on that change. Several of these respondents elaborated that they feel that they are more persuasive than before because they were armed with examples and information, and because their commitment to energy-efficient design was strengthened.

Table 16

PARTICIPANTS' ATTRIBUTION OF INFLUENCE OF A+E PROGRAM ON CLIENT ACCEPTANCE OF ENERGY-EFFICIENCY SUGGESTIONS

CLIENT ACCEPTANCE OF SUGGESTIONS AND ATTRIBUTION OF INFLUENCE	MULTIPLE-EVENT PARTICIPANTS (N=25)	SINGLE-EVENT PARTICIPANTS (N=18)	TOTAL PARTICIPANT SAMPLE (N=43)
Client Acceptance About The Same as Before Event	8 (35%)	11 (61%)	19 (46%)
Client Acceptance Higher After Event Due to External Factors	3 (13%)	5 (28%)	8 (20%)
Client Acceptance Higher After Event Due in Part to Influence of A+E	12 (52%)	2 (11%)	14 (34%)
Total	**23 (100%)**	**18 (100%)**	**41 (100%)**

Note: Total excludes two architects who responded "don't know." "Multiple-event participants" are those architects who attended multiple A+E events or who had participating coworkers. "Single-event participants" are those architects who attended a single A+E event and who lack participating coworkers.

We asked participants to rate, using a 1-to-5 scale, how valuable they found the A+E workshops to be in terms of their design work. As shown in Table 17, 87% of architects attending multiple workshops or having participating coworkers rated the A+E workshop as "valuable" or "extremely valuable". Just over half of architects who attended a single workshop and who do not have participating coworkers gave a "valuable" or "extremely valuable" rating. The difference in ratings given by the two groups of architects is statistically significant (χ^2, p=.03). See Appendix A for participants' comments on the A+E program.

Table 17

VALUE OF A+E WORKSHOP IN TERMS OF PARTICIPANTS' DESIGN WORK

VALUE OF WORKSHOP	MULTIPLE-EVENT PARTICIPANTS (N=23)	SINGLE-EVENT PARTICIPANTS (N=16)	TOTAL PARTICIPANT SAMPLE (N=39)
Not at All Valuable	0 (0%)	3 (19%)	3 (7%)
2	1 (4%)	3 (19%)	4 (10%)
3	2 (9%)	1 (6%)	3 (7%)
4	14 (61%)	8 (50%)	22 (59%)
Extremely Valuable	6 (26%)	1 (6%)	7 (17%)
Total	**23 (100%)**	**16 (100%)**	**39 (100%)**

Note: Totals exclude two multiple-event participants and two single-event participants who responded "don't know." "Multiple-event participants" are those architects who attended multiple A+E events or who had participating coworkers. "Single-event participants" are those architects who attended a single A+E event and who lack participating coworkers.

Influence of Awards and Workshops

As discussed, the separate influences of the A+E awards component and the workshop component could not be distinguished. Many workshops incorporated lessons learned and examples from the design awards to such an extent that it is not possible to say what the effectiveness of the workshops would be in the absence of the awards program. In addition, participating architects appear to be supported in their design activities by participating coworkers, who may have attended the awards. Thus the effect of a single participant's A+E event cannot be separated from the events that coworkers attended.

Nonetheless a statistical analysis comparing the practices of architects that attended only workshops with those that attended workshops coupled with awards presentations showed that the latter group had incorporated energy-efficient features in their final designs more frequently than the former group. These results lacked statistical significance in most cases and so are not reported in detail.

Fortunately, participants' comments on the A+E program, given in Appendix A, shed light on the influence of workshops and awards. Thirty-five participants offered open-ended comments on the A+E program in general. Of these, 19 were

positive, 4 were negative, 3 were recommendations, and 1 comment was made during another part of the interview. The four negative comments were all made by respondents who had attended only the workshops. Of the other 23 comments, 9 (40%) explicitly mentioned the value of the awards recognition or the information that came from the awards competition. This qualitative finding, coupled with the focus of many of the workshops in disseminating lessons learned from the competition, suggests that the awards component has contributed to the A+E program's effectiveness.

Awareness of A+E Among Nonparticipants

We wondered whether nonparticipants were aware of A+E and so we asked: had they heard of "the Architecture + Energy Awards sponsored by the AIA, Portland Chapter to recognize energy-efficient building design?" Over half (58%) of nonparticipants said that they had heard of the awards program. Eighteen percent of nonparticipants further said that they had visited the A+E website. Thirty-three percent of participants said that they had visited the website. All but two of the 13 participant visitors attended more than one event.[13] None of the website visitors expressed dissatisfaction with the site, although most said that they could not remember it well enough to comment.

Awareness of *betterbricks.com*

The A+E program appeared to have a synergistic effect with another Alliance-funded activity—the *betterbricks.com* website. In support of another program evaluation we were conducting for the Alliance, we augmented the survey (given in Appendix D) to explore architects' awareness of the *betterbricks.com* website. We learned from including these questions that A+E participants were significantly more aware of the website than nonparticipants. Nearly half (44%) of multiple-event participants could recall the *betterbricks.com* name, compared with 22% of single-event participants and 8% of nonparticipants (χ^2, p=.001). Awareness of the website also differed by size of firm, as shown in Table 18.

[13] Three single-visit participants did not answer the question.

Table 18

AWARENESS OF *BETTERBRICKS.COM* CAMPAIGN BY SIZE OF FIRM

NUMBER OF EMPLOYEES IN FIRM	PERCENT OF PARTICIPANTS (N=43)	PERCENT OF NONPARTICIPANTS (N=50)
50 or More	55%	17%
20 to 49	43%	0%
10 to 19	33%	9%
5 to 9	14%	10%
1 to 4	0%	0%

Nearly three-quarters (74%) of the 15 aware participants learned about *betterbricks.com* from their colleagues, including at conferences and from the Alliance and the Energy Ideas Clearinghouse. Forty percent of aware participants (6 of 15) had seen the TV and print campaign for *betterbricks.com*, perhaps in addition to hearing about the website from colleagues. In contrast, one of the four aware nonparticipants learned about it from colleagues, two learned about it from the TV and print campaign, and one learned about it in another context.

DESIGN PRACTICES OF REGION'S ARCHITECTS

As discussed in the methods section of Chapter 3, we asked architects detailed questions about their design practices to ensure that respondents were consistent in their use of terms such as "daylighting" and "energy-efficient lighting." Table 19 gives the proportion of architects engaging in each specific design practice or actively considering the feature at least once during the prior year. Since no significant differences between participants and nonparticipants were found to exist with regard to the design practices they engaged, the table gives the proportion weighted to describe the region's architects as a whole. See Appendix A for architects' comments on their design practices.

Table 19

ARCHITECTS' DETAILED REPORT OF THEIR DESIGN PRACTICES DURING YEAR PRIOR TO SPRING 2001 (WEIGHTED)

PRACTICE OR FEATURE	ARCHITECTS REPORTING ENGAGING IN PRACTICE OR CONSIDERING FEATURE AT LEAST ONCE
Pre-Design Activities to Address Energy Saving	**81%**
...Talking with client about energy savings	79%
...Setting energy-efficiency goals and performance benchmarks	40%
...Educating the team	71%
...Collaborating with project's consultants and contractors	65%
Site or Orientation Selected Due to Resource Considerations	**61%**
Envelope (mass, skin, glazing, etc.) Designed to Reduce HVAC Needs	**94%**
Daylighting Features	**88%**
...Shading strategies (e.g., louvers, projections, light shelves)	68%
...Roof designs (e.g., clerestories, skylights, stepped roofs)	79%
...Daylight penetration (e.g., size & placement of windows, North/South v East/West windows)	83%
Passive Systems	**61%**
...Thermal mass	33%
...Shading	48%
...Solar gain considerations	42%
...Passive ventilation	41%
Efficient Lighting System	**80%**
...Use less lights than typical; use spot & task lighting	69%
...Sensors (occupancy & light)	66%
...Controls	62%
...Discuss energy efficiency with engineers	69%

Continued

PRACTICE OR FEATURE	ARCHITECTS REPORTING ENGAGING IN PRACTICE OR CONSIDERING FEATURE AT LEAST ONCE
Efficient HVAC System	**79%**
...Designing building to optimize factors affecting HVAC requirements	51%
...Comparing different types of chillers and alternatives to chillers	65%
...Addressing ventilation & distribution system	56%
...Controls	63%
...Discuss energy efficiency with engineers	55%
...Use ASHRAE 90 standards (90.1 89 and 90.1 99)	27%
Efficient Water Heating	**43%**
Use of Life-Cycle Cost Comparisons	**73%**
Use of Computer Models	**64%**
...Models of building energy use (e.g., DOE-2)	51%
...Models to simulate lighting	37%
Use of Consulting Resources	**87%**
...Utility and government programs, including incentives	51%
...Published materials (e.g., journals, websites)	64%
...Consultants	81%

MARKET BARRIERS TO ENERGY-EFFICIENT DESIGN

We explored architects' perceptions of market barriers by asking them to rate potential barriers using a 1-to-5 scale to signify the degree to which the factor limits their ability to incorporate energy-efficiency features into their designs. Their responses are shown in Table 20.

Table 20

PERCENT OF ARCHITECTS RATING FACTOR AS "NOT A BARRIER" TO ENERGY-EFFICIENT DESIGN

POTENTIAL BARRIER	PERCENT OF MULTIPLE-EVENT PARTICIPANTS (N=25)	PERCENT OF SINGLE-EVENT PARTICIPANTS (N=18)	PERCENT OF NON-PARTICIPANTS (N=50)	TOTAL (N=93)
Own Interest in Energy-Efficient Features	88%	77%	86%	85%
Getting Design Team to Consider Energy-Efficient Options	64%	47%	54%	55%
Identifying Energy-Efficient Options	56%	77%	60%	62%
Code Requirements	52%	41%	55%	52%
Identifying Consulting Resources or Other Building Professionals Necessary to Execute the Design	48%	35%	60%	52%
Assessing Performance of a Given Option in a Specific Application	36%	47%	38%	39%
Availability of Energy-Efficient Products	16%	56%	38%	35%
Providing Clients with Reliable Estimates of Benefits	16%	35%	38%	32%
Providing Clients with Reliable Cost Estimates	12%	24%	36%	27%
Getting Client to Consider Energy-Efficient Options	8%	13%	20%	15%

Notes: a. "Not a barrier" responses are responses 4 and 5 (the top two boxes) on a 1-to-5 scale where 1 signifies a factor that severely limits the architect's ability to incorporate energy-efficiency features and 5 signifies a factor that is not at all a limitation for the architect. b. χ^2 tests of the differences between the two participant groups give p=.02 for Availability of Products and p=.07 for Performance of Option in Specific Application. χ^2 tests of the differences between nonparticipants and multiple-event participants give p=.04 for Estimating Benefits and p=.07 for Estimating Costs. c. "Multiple-event participants" are those architects who attended multiple A+E events or who had participating coworkers. "Single-event participants" are those architects who attended a single A+E event and who lack participating coworkers.

As shown in Table 20, architects who attended multiple A+E events, or whose coworkers have participated, are more likely than the other two groups to say that their own interest and the cooperation of the design team are not barriers to energy-efficient design. It should be remembered that it is this group that engaged in energy-efficient practices the most frequently of the three groups. This group also reported less difficulty than other participants in finding other building professionals (such as engineers) to team with in executing the design, although more difficulty than nonparticipants reported. However, this group rates five of the six other factors explored as *more* of a barrier to efficient design than the other two groups rated the factors. Thus, the architects who are doing the most energy-efficient designs appear to be more conscious of the barriers they face—rating them as more significant—than do architects producing less energy-efficient designs.

Based on the assumption that those architects that are most frequently engaged in energy-efficient design practices can best speak to the difficulties they face, the greatest barriers mentioned are:

- Getting the client to consider energy-efficient options;
- Providing clients with reliable estimates of the costs of energy-efficient options;
- Providing clients with reliable estimates of the benefits of energy-efficient options;
- Availability of energy-efficient products; and
- Assessing the performance of a given option in a specific application.

Three of these five barriers—reliable cost estimates, reliable benefit estimates, and assessing performance—describe needed technical information. Architects' comments (given in Appendix A) delineated the difficulties resulting from lack of good technical information. They list:

1. Architects have difficulty finding the information they need; perhaps the information does not exist.
2. It takes a lot of time to find what information does exist. Sometimes, the architects need to hire specialists to provide the answer.
3. Design fees do not cover the time or expense of answering these questions. So most often, architects either do it at their own expense, perhaps over time, or they don't do the necessary research.

4. Without answers to these technical questions, they can't convince the client to go with the efficient design.

5. Without the accurate technical information, the engineers and other professionals don't agree to the efficiency measure.

6. The rare client that will go for an extremely efficient design—someone with an environmental mission—will nonetheless hedge the performance uncertainty by building in mechanical redundancy. So those clients pay for performance twice—once from energy-efficient features and once from back-up electrical mechanical systems. Without good performance data, energy efficiency is not economical.

7. Without performance information, the architects themselves are exposed to risk.

Regarding the availability of product, architects offered two points in elaboration. One, a number of energy-efficient options currently need to be specially constructed, yet the architects can envision them being available in an "off-the-shelf" mode. Two, some options that are available off-the-shelf need to be transported long distances, with the consequent transportation costs increasing the product's embodied energy and reducing lifecycle benefits.

Subsequent to architects' participation in the A+E events examined in this report, the West Coast has experienced price spikes and shortages for electricity and natural gas. We asked architects if, in their experience, clients have been more concerned about energy during the last three months than they tended to be prior to that. About two-thirds (64%) of respondents thought that clients had been more concerned during the recent past.[14]

ARCHITECTS' INTEREST IN POSSIBLE EDUCATIONAL FORUMS

Surveyed architects rated their interest in learning more about energy-efficient and sustainable design practices, using a 1 to 5 scale. Nearly 50% of the architects responded that they were "very interested" (a rating of 5) in learning more and another 30% said that they were "interested" (a rating of 4). Only 4 of 93 architects

[14] About 68% of multiple-event participants said that clients were more concerned, versus 60% of single-event participants and nonparticipants, although the difference was not statistically significant. Given the lack of significant difference, the text gives the weighted percent (64%) responding "more concerned," thereby providing an estimate for the total population of PNW architects.

(4%) gave a disinterested rating (a rating of 2 or 1). The four disinterested architects were all large nonparticipants; three were from firms with 50 or more employees and one was from a firm with 20 to 49 employees. A χ^2 analysis indicated that the responses did not differ significantly between participants and nonparticipants, nor between those attending multiple or single events.

We explored architects' interest in different learning venues.[15] Table 21 provides the proportion of architects rating each venue as "very desirable" (a 5 rating) or "desirable" (a 4 rating).

Table 21

ARCHITECTS' ASSESSMENT OF VARIOUS LEARNING VENUES (N=89)

LEARNING VENUE	"DESIRABLE" OR "VERY DESIRABLE" RATING
Teleconference/ Distance Learning	18%
Books	33%
Journals	40%
Internet	62%
Workshops/ Seminars	80%
...In own community	83%
...In own office	78%
...In conjunction with a professional conference	63%
...In another city	26%
...With a multidisciplinary audience	75%

[15] We did not ask the four architects disinterested in learning more about energy efficiency their preferences regarding learning venues, since they would be unlikely to use any of the venues.

A ❹^2 analysis showed a few differences among the groups. Multiple-event participants were more likely than nonparticipants to rate workshops desirable (92% versus 72%, p=.12). Single-event participants fell in between.

Single-event participants were more likely than nonparticipating architects to rate as desirable workshops in conjunction with a professional conference (81% versus 54%, p=.16) and multidisciplinary workshops (94% versus 67%, p=.10), with multiple-event participants falling in between.

Multiple-event participants were more likely than single-event participants to report the internet desirable (63% versus 53%, p=.07) and less likely to report journals desirable (24% versus 53%, p=.14). See Appendix A for comments on learning venues.

5. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY OF FINDINGS

Penetration of A+E

Since 1993, the Architecture + Energy Program has educated over 600 people, nearly 400 of whom are practicing architects in the region. These architects have come from 164 firms. Two or more architects have participated from nearly 30% of the firms.

Architects from 54% of the largest firms in the region—those employing 50 or more people—have participated in A+E; and architects from 34% of firms employing 20 to 49 people have attended. Twenty percent of all firms with more than five employees have had one or more architects participate in the program.

Forty-three percent of the participants work in Oregon, an equal number work in Washington, 10% work in Idaho, and 4% work in Montana. Most of the Idaho and Montana participants attended events in 2000, reflecting efforts made to extend the program's reach throughout the region.

Over half (58%) of nonparticipants said that they had heard of "the Architecture + Energy Awards sponsored by the AIA, Portland Chapter to recognize energy-efficient building design". Eighteen percent of nonparticipants further said that they had visited the A+E website.

Design Behaviors of Architects

The survey research probed the design activities of A+E participants and nonparticipants. As discussed in detail in the sections describing the samples in Chapter 3, unavoidable constraints on the sampling procedure resulted in differences between A+E participants and nonparticipants being *underestimated*. That is, estimates derived from the samples of the degree to which A+E participants employ more energy-efficient design methods than nonparticipants represents a *lower bound for the true values* that describes the two populations as a whole.

The survey asked over 70 detailed questions about design procedures. Questions were grouped by strategy—daylighting and energy-efficient lighting are two. Detailed questions about elements within each strategy ascertained that

respondents were using similar terms to describe their activities. We asked respondents if, during the previous year (or since the A+E workshop, if that was less than a year), they had used any elements of each of the strategies. Respondents were recorded as "yes" for the strategy if they had used even one element even once during the period. The quantitative tally of design practices, therefore, obscures differences between architects who did one thing once or used one element here and another element there, and architects who used multiple elements repeatedly in their project work.

The quantitative tally of design practices showed that comparable proportions of participants and nonparticipants used the efficiency strategies and design elements at least once during the period. The most common strategies are envelope design for energy efficiency (one or more of whose elements were employed at least once during the year by 94% of respondents), daylighting (88%), pre-design activities to address energy savings (81%), energy-efficient lighting systems (80%), and energy-efficient HVAC systems (79%).

The open-ended comments offered by respondents during the course of the questioning strongly suggest that on average, A+E participants employ more elements in each project than do nonparticipants. This conclusion, based on qualitative data of the differences between participants and nonparticipants, is not intended to mean that all participants are similar and all nonparticipants are alike. We found that there were a number of nonparticipants who reported incorporating many efficiency elements in their designs and a number of participants who reported incorporating very few. But overall, participants included more features during the period than did nonparticipants.

We asked respondents to report the number of projects they had worked on during the period and the number of projects that contained one or more design elements from each strategy. These quantitative responses revealed statistically significant differences between A+E participants and nonparticipants. Participants used the energy-efficient elements in a greater proportion of their projects than did nonparticipants.

We also found statistically significant differences in energy-efficiency actions within the group of participants. Participants who had attended more than one A+E event (3 of the 43 sampled participants), or who had coworkers who also attended A+E events (22 of the 43 sampled), more frequently incorporated energy-efficient elements in their designs than did participants who attended only one event and who lacked participating coworkers (18 of the 43). This finding suggests that the A+E events had a cumulative effect. The more architects at a firm who attended, or

the more times a single architect attended, the more likely it is that the architects employ efficiency elements in their designs.

Influence of A+E Program

The question arises, however, as to whether the A+E program has contributed to the efficient design activities of participants or whether the observed differences are attributable solely to other factors, such as the self-selection of architects deciding to attend A+E events.

We asked participants what they thought. The differences between the responses of multiple-event participants (those who attended multiple times or who had participating coworkers) and single-event participants are statistically significant and are given in Table 22. We conclude from the responses of the multiple-event participants—the participant group most frequently engaged in energy-efficient design practices—that the A+E program has succeeded in promoting energy-efficient design in the region.

Table 22

PARTICIPANTS' ATTRIBUTION OF INFLUENCE OF THE A+E PROGRAM

ASSESSMENT OF A+E AND ITS INFLUENCE	MULTIPLE-EVENT PARTICIPANTS (N=25)	SINGLE-EVENT PARTICIPANTS (N=18)
Participants Reporting That They Suggested Energy-Efficient Elements to Their Clients More Frequently After Attending the A+E Event than They Did Prior to the Event	86%	18%
Participants Reporting That Client Acceptance of Energy-Efficient Ideas Was Higher After They Had Attended the Event, Due in Part to the Influence of the Program on Their Degree of Knowledge and Enthusiasm	52%	11%
Participants Describing A+E Events as Valuable or Extremely Valuable in Terms of Their Design Work	87%	56%

Comments included:

- *"We present a more compelling case [because of the program]. We have more enthusiasm, more compelling data. Our enthusiasm carries the*

day....We use the ongoing workshops to train our younger staff. And I still go to workshops that have topics of interest to me, like the one next week."

- *"The program had a big impact on the firm and on me. Our clients are now more interested and educated about energy efficiency."*
- *"We are talking about energy efficiency more [since attending] and clients are asking for it more. A+E is quite valuable."*
- *"The more you understand something, the more convincing you are. I think the program was [initially] a little early for its time. But now is the prime time. I think they need to keep the program out there so that more people know about it."*
- *"Our past award is a selling point. It's noteworthy."*
- *"Going through the assessment exercise to submit a project was great. Also the credential—we won an award. We strongly hope the program continues. We want to submit again."*

Influence of A+E Awards and Workshops

The A+E workshops are lead by former awards jurors and many of the workshops draw heavily on the lessons learned from the awards competition. In addition, architects' practices appear to be influenced by coworkers who have attended A+E events (both workshops and awards). Although the research asked participants to assess the influence and value of only the A+E *workshops* on their design work, it is clear from the content and leadership of the workshops, and the interactive experience of coworkers, that the workshops owe a great deal to the awards program.

Furthermore, participants' open-ended comments on the A+E program in general strongly suggest that they value the awards and the information that flows from the awards competition.

Barriers to Energy-Efficient Design

Multiple-event participants were more likely to rate as significant barriers to efficient design the factors we explored than were single-event participants and nonparticipants. Since multiple-event participants are the architects most

frequently incorporating energy-efficient elements in their designs, we believe that their responses provide a good indication of the barriers to efficiency.

The multiple-event participants rated three barriers relating to technical information as particularly challenging. These are: preparing reliable estimates of the options' costs, preparing reliable estimates of the options' benefits, and assessing the performance of a given option in a specific application.

They elaborated that finding the information takes time, which translates as a cost the architects must bear, since the clients rarely do. In the absence of good information, it is less likely that the client will accept the idea, and more likely that engineers and other consultants will argue against the idea. It is also more likely that the architectural firm will be reluctant to expose itself to the risk of an "unproven" approach. And, in those instances where the client agrees to the feature, it is more likely that the electromechanical design will include redundancy to hedge the performance uncertainty, which vastly reduces the cost-effectiveness of the measure.

In the words of architects:

- *"We are persuasive when we have the back-up for a life-cycle cost analysis. But the numbers are hard to come by."*
- *"Without hard data, everyone is guessing. And everyone is conservative."*
- *"The newness of the feature is a problem. Newness is a tough sell. Our office tends to be conservative—not willing to go out on a limb and expose ourselves to liability."*

A number of architects also rated the scarcity of efficiency-minded engineers and consultants as a barrier to design:

- *"In the past, the engineers have ignored the solar features that we design in."*
- *"Most of our projects have had problems with the mechanical engineers designing systems that are too expansive."*
- *"It's hard for engineers to keep up. Our design team is becoming less of a barrier—both out internal staff and our consulting team. But that's not true for the contractor."*

A few architects made the point that project financing is a barrier. Money for project construction comes from a capital fund that is separate from money for building operations. Yet energy-efficiency measures increase up-front costs and reduce operating costs. In addition, the financial industry does not recognize the operating-cost savings from energy efficiency. The loan terms therefore do not recognize that efficient projects have a lower long-term cost stream and a higher customer acceptance, resulting in a better long-term financial picture than inefficient projects.

Venues for Learning about Energy-Efficient Design

Architects reported that workshops held in their community or their office offered the most desirable learning venues.

Most architects also highly rated the desirability of workshops with a multidisciplinary audience. Their reasons in support of this are the same as their reasons for rating engineers and consultants as barriers to design and for the open-ended comments that a few architects offered on the financial community as a barrier. However, a few architects were quite opposed to the notion of multidisciplinary workshops, warning that such workshops are often too general to be of use to anyone.

The A+E program appeared to have a synergistic effect with another Alliance-funded activity—the *betterbricks.com* website. We augmented the survey to explore architects' awareness of the *betterbricks.com* website, in support of another program evaluation we were conducting for the Alliance. We learned from including these questions that A+E participants were significantly more aware of the website than nonparticipants. Nearly half (44%) of multiple-event participants could recall the *betterbricks.com* name, compared with 22% of single-event participants and 8% of nonparticipants.

Future Awards and Workshops

The Alliance has funded AIA/Portland to provide A+E workshops through 2001, and currently has no plans to continue its funding of the program in its current form.[16] Components of the A+E program are expected to be included in some way in the Alliance's future Commercial Buildings Initiative.

[16] Workshop activities through 2001 have been funded through a no-cost extension of the 2000 contract between the Alliance and AIA/Portland.

In the interim, AIA/Portland has decided to continue the A+E awards and to expand the competition to firms throughout the nation. AIA/Portland does not plan to offer workshops independent of the awards until the awards component of the program is re-established. At that point, it will consider when and how to continue workshops in the future. The program manager at AIA/Portland said that other organizations offer workshops in the region that address topics complementary to A+E (such as sustainable design), but do not address energy-efficient design methods in the same way as A+E.

CONCLUSIONS AND RECOMMENDATIONS

One participant said that the A+E program was ahead of its time, and that its time had now come. We agree with this assessment.

The Value of Awards and Workshops

Conclusion

The A+E program has increased the energy-efficient design activities of architects in the region, especially those of large firms in Oregon and Washington. In addition, the program appears to have a cumulative effect. Participants who attended more than one event or who had participating coworkers most frequently engage in energy-efficient design practices. Participants cited the value of both the awards program and the workshops.

There is value in an ongoing program to educate the region's architects about energy-efficient design practices. Both awards and workshops have merit and complement each other. An ongoing program is more effective than a single event in influencing participants' design activities. It also demonstrates commitment on the part of the sponsor, which respondents noted as valuable.

Recommendation

Awards and workshops should continue. Future educational activities should target places outside of the Portland and Seattle metropolitan areas to increase and repeat participation in those areas. However, events should continue in the metropolitan areas in order to maintain a long-term presence and provide a resource for firms seeking to train newer employees.

The Architecture + Energy Brand Name

Conclusion

The A+E program has high satisfaction among participants and high name-recognition among nonparticipants. Thus, the A+E program has developed a successful brand identity with architects.

Recommendation

Awards and educational workshops should continue under the A+E name.

The Alliance could investigate the regional workshops on sustainable design referenced by the A+E program manager. It could determine where the workshops are held (in particular, what is available east of the Cascades), the role of energy-efficient design in discussions of sustainability, and the workshops' compatibility with Alliance objectives. If an existing workshop series meets the Alliance's needs, it could explore collaboration between that provider, AIA/Portland and the Alliance to continue the A+E brand. If existing workshops do not meet Alliance objectives, the Alliance could issue an RFP to produce the needed workshops. The Alliance could collaborate with AIA/Portland, at a minimum, to use the A+E name and, at a maximum, to continue hosting the workshops.

Other Players in the New Construction Market

Conclusion

Architects report that engineers, consultants, financial institutions and clients need to be educated about the benefits and reliability of energy-efficient design practices. The awards recognize the entire project team, including the client and consultants, and some architects reported taking their engineers and their clients to A+E events. However, the list of A+E participants shows that it has primarily attracted architects (indeed, the program's primary focus), even though considerable efforts were made to attract engineers. Also, some architects warn that a multidisciplinary focus will mean that technical information will be diluted to accommodate different educational backgrounds.

Recommendation

The A+E program offers an opportunity to educate other players in the new construction market. An awards program should continue—and perhaps expand—

the recognition given to the client and other involved professionals. It is likely, however, that engineers, other consultants, and clients can best be reached by *separate* educational efforts that *tie into* the A+E program. For example, a separate effort could promote the activities of A+E award-winning engineers, contractors and owners in educational or awareness forums appropriate for these groups. These forums might include websites, articles in the professional journals read by these groups, and targeted seminars.

The Need for Technical Information

Conclusion

The architects most active in energy-efficient design consider the lack of reliable technical information to be a significant barrier. Technical information includes performance of efficiency options in different applications, cost data, and benefits data.

Recommendation

An effort should be developed that *ties in* with A+E to provide designers with some of the technical information that they need, or with an easy-to-use reference that identifies where designers can locate needed information.

It is likely that a considerable amount of the needed information simply does not yet exist. Thus, the Alliance could:

- Provide access to existing research that offers needed technical information;
- Provide access to the results of current studies—many of which are Alliance-funded—on the productivity benefits of efficient lighting and other efficiency measures; and
- Collaborate with past and future A+E award-winners—the clients, architects, and engineers—to develop *long-term* performance data for those buildings.

Performance data could flow studies ranging from inexpensive investigations of building operating costs and utilization (numbers of people, equipment, hours of operation) to expensive monitoring and metering projects.

It may be useful to approach the acquisition and dissemination of information by commercial building type. For example, a project could be conducted for the grocery store sector, with the results disseminated among the executives of national chains that are expanding or remodeling in the region. Architect and engineering firms that have gained experience in energy-efficient store design could then serve as the "experts" in workshops targeted to this group, an idea that originated in recent discussions among A+E staff, an architectural firm, and its client.

Other Regional Activities

Conclusion

The A+E program appears to have a synergistic effect with other Alliance-funded programs—specifically, with *betterbricks.com* and with the Lighting Design Lab. Participants were more likely than nonparticipants to have heard of, and more likely to have visited, the *betterbricks.com* website. In addition, both participants and nonparticipants have heard of a number of other groups, agencies and design resources in the region. The Lighting Design Lab, the LEED standards and the activities of the City of Portland and Seattle City Light were among those most frequently cited.

Recommendation

Workshop efforts should promote and leverage the work of the other regional activities, without duplicating their efforts.

Summary

Architecture + Energy is an effective, successful brand name for energy-efficient design recognition and education that appeals to the region's architects. Architects are aware of A+E, and they are aware of other regional resources, including other Alliance-funded efforts. The Alliance could develop a long-term perspective and commitment that continues and builds on these valuable assets.

The A+E program will always be most effective in reaching architects, as its name implies. However, the awards program provides examples that can be elaborated on in a separate outreach campaign for the client and consultant community. In addition, a separate effort could be pursued to provide architects with what they say they need most—"the numbers." The Alliance could take steps both to reach other

players in the new construction market and to increase the availability of what all the players need: reliable data that is easy to access and understand.

The A+E awards and workshop programs should continue, but the A+E program cannot address all the players in the new construction market nor give even architects all of the technical information they need. The Alliance could carefully build the missing pieces for transforming the market, being sure to tie the pieces together to continue and expand the A+E message.

APPENDICES

Appendices

APPENDIX A

Architects' Elaboration on Survey Questions

Appendix A

ARCHITECTS' ELABORATION ON SURVEY QUESTIONS

ARCHITECTS' DESIGN PRACTICES

Degree to Which Architects Pursue Each Efficiency Practice or Feature

Tables 12 and 19 in Chapter 4 report the proportion of architects engaging in each specific energy-efficient design practice at least once during the prior year. An architect who incorporated a single skylight in a single project would be counted as a "yes" in the daylighting tally, as would an architect who incorporates a number of shading features, clerestories, and skylights on nearly every project, as well as optimizing floorplate configuration to ensure light penetration.

An interview format survey, such as used in this research, is not able to estimate the degree to which the architects pursued a given efficiency practice or feature, such as daylighting or efficient lighting. The complexity required to do this would have been overwhelming, as the practices of each architect vary by the size of the building, the building type (e.g., retail or hospital), whether it is new construction or renovation, whether the client has a mandate to pursue energy efficiency, and so on. As it was, the survey asked over 70 questions on architects' design practices alone (plus over 50 additional questions). To ask the 70 design questions about each one of the architect's projects, or even about each type of project, would have been impossible. To reliably estimate the penetration of these energy-efficiency measures requires a field study.

Thus, the research produced no direct estimate of the degree to which participants and nonparticipants include the elements comprising each efficiency practice.

However, the architects' comments reveal that the participants that engaged in a practice (e.g., daylighting) generally included a greater variety of the practice's component elements (e.g., clerestories) than did the nonparticipants. Phrased differently, more participants than nonparticipants described incorporating a number of the component elements for each efficiency practice, and more nonparticipants than participants described incorporating one component in a few projects and another component in some other projects.

Clients' Requests for an Energy-Efficiency Practice or Feature

Table 12 in Chapter 4 reports the percentage of architects who said that their clients have requested, at least once in the last year, some component of the energy-efficiency feature or practice. Consider, for example, daylighting. An architect would answer "yes, a client has requested this" if a single client requested one skylight. It does not mean that the client requested a complete daylighting strategy.

Nor should the percentage in the table be construed as the percentage of clients requesting the feature. The reader should interpret the percentage as the proportion of architects who have, during the course of the last year, had to consider an energy-efficiency feature because a client raised the issue.

Furthermore, even when architects responded "yes," many elaborated that the client request might be more accurately represented as a collaborative decision between the client and architect. Most architects who provided elaboration said that, in most cases, clients are not requesting specific features, even the broad features of daylighting, efficient lighting, passive systems, and so on. Clients do not have that level of knowledge. If energy efficiency is important to a client, the client requests and selects a firm qualified in energy-efficient design. But even those clients typically do not request specific features. And the clients for whom efficiency is not important do not broach the issue at all.

Architects added that, by and large, the only clients that ask for specific design features are public agencies following an established public policy. Examples given included buildings for the cities of Seattle and Portland, for the Spokane Neighborhood Action Program (S.N.A.P.), and for some universities. In addition, some national firms such as grocery stores may be quite specific in the features that they want, but these features do not necessarily include energy efficiency.

Architects made comments such as:

- *"Clients don't request these. We educate them."*
- *"We are always looking to do these things. The clients do not request them, because they are ignorant about what needs to be done to achieve energy efficiency."*
- *"If the client is interested, the architect is selected on its energy-efficiency qualifications. Whether or not clients request a given feature depends on how knowledgeable the client is. Generally, it's a collaboration."*
- *"Institutional clients get the efficiency idea and usually ask for more."*

- *"We can't say who initiates the discussion, as we have clients who are interested and we are known for doing this kind of work."*

The Role of Energy Efficiency in Pre-design Activities

Architects' comments on their pre-design practices fell into three groups. One group comprising both participants and nonparticipants said that they actively discuss energy efficiency with their clients during the pre-design phase:

- *"Our goal is to incorporate as much energy efficiency as we can. Depending on the client, sometimes we casually mention it and try to incorporate it, other times we push it" (participant).*
- *"We talk about energy efficiency in the pre-design phase 100% of the time. Clients follow through about 30% of the time" (participant).*
- *"Energy efficiency is part of winning the proposal. This has become more of our approach. We look at the appropriate systems, envelope assembly and orientation, natural lighting. We make a matrix of systems. We have the engineers go through a matrix of approaches—balancing the systems, choosing the best one. We bring daylighting out in the pre-design" (participant).*
- *"We do energy modeling during pre-design. Many of our jobs involve the renovation of a school for energy efficiency" (participant).*
- *"We discuss this with our institutional clients. We have an in-house committee that keeps up with energy efficiency. We keep a database of materials and costs" (nonparticipant).*
- *"Energy efficiency is always early in our team discussions" (nonparticipant).*
- *"Building modeling is required for most projects—PRC-DOE-2. We establish an energy budget in terms of watts per square foot" (nonparticipant).*

Another group said that they have energy efficiency in mind, but do not necessarily discuss it with their clients or use any formal procedures:

- *"We always have goals in the back of our mind. Clients' request it, but in a very vague way. They just say they want the building to be energy-efficient" (participant).*
- *"We're conscious of this for all projects and do it to a degree. Our efforts have become much broader in the past year. Standard practice is to consider energy more, as is true for our clients" (participant).*
- *"We discuss it a small amount. But our consultants aren't involved until the schematics" (participant).*
- *"We always do this as part of our thinking. But not formally or analytically" (nonparticipant).*
- *"We do this 100% of the time, but we talk with clients about it perhaps 5% of the time" (nonparticipant).*
- *"We are a design/build firm. We include energy considerations in pre-design planning as one of many factors we investigate" (nonparticipant).*
- *"We're a design/build firm. This is standard practice for us. Energy is not a core issue but we look at it at this stage" (nonparticipant).*
- *"We do this at the outset, but it goes down hill from there" (participant).*
- *"One government project required this" (nonparticipant).*
- *"We try to do this, but we aren't very successful. Perhaps one in five projects has an energy-efficiency goal" (nonparticipant).*

The fewest number of architects said that they do not address energy efficiency at all:

- *"It just isn't coming up. We tried to get a project to do this, but we lost the bid" (participant).*
- *"We design private and public laboratories. We rarely discuss energy efficiency. It's not an important goal. Safety is the highest priority" (nonparticipant).*
- *"Our clients—developers—aren't interested in this" (nonparticipant).*

- *"We talk with clients about this occasionally, but generally do not set goals. The team members are all very aware of building codes for energy conservation" (similar statements made by two nonparticipants).*

Orientation of the Building

Architects reported that a building's orientation is often dictated by constraints that don't allow for a consideration of the energy-use consequences:

- *"The client had already determined the orientation for two of the three projects" (participant).*
- *"Orientation is a done deal" (participant).*
- *"We could only do it for 1 of the 80 projects" (participant).*
- *"We didn't have an opportunity to do that this year" (nonparticipant).*
- *"We couldn't even consider orientation because it had to conform to Federal setback standards for riparian site on streams with salmon" (nonparticipant).*
- *"It may be that the need for a driveway or a parking structure dictates the orientation of the building" (participant).*
- *"We can't do it with renovations" (nonparticipant).*

A number of architects reported that considerations other than energy use drive orientation:

- *"There are too many other things to consider" (participant).*
- *"Usually views or access is more important" (participant).*

A few architects reported that a concern for energy use was a high priority in orientation:

- *"Even in existing buildings, we find a way" (participant).*
- *"It influenced all the projects to some degree and had a major influence on 3 of the 12" (participant).*

- *"This is required to meet the Washington state code, which is quite stringent" (nonparticipant).*
- *"We try to make energy efficiency a driver—locating entrances on protected sides, locating the windows appropriately—yet sometimes we can't do it" (participant).*
- *"We do it where possible. This is a big concern" (participant).*

Building Envelope

Responses to envelope design practices were similar to that for the orientation in that sometimes there are constraints that dictate the envelope (e.g., additions to a brick structure) and always there are multiple factors to consider. However, architects reported considering energy efficiency half again as frequently in envelope design as in selecting the orientation (see Table 18 in Chapter 4).

A few architects spoke of the importance of energy considerations in envelope design:

- *"It's part of our due diligence" (participant).*
- *"We try to do all these things [consider footprint, mass, skin, glazing, tightness] as an integrated system" (participant).*
- *"We constructed the building out of insulated constructed panels. The core was expanded polystyrene. It's very efficient and very soundproof" (nonparticipant).*
- *"We're always looking to do this" (participant).*

A few architects said that they do envelope measures to meet building codes.

A few architects said that they rarely considered this:

- *"We're not concerned about solar gain. We are concerned about the internal heat gain from freezers and other equipment" (participant).*
- *"It's the same old thing. It comes down to money" (participant).*

Daylighting

Clients rarely are sophisticated enough to ask for a daylighting strategy. However, they frequently ask for a lot of light to get in or for a lot of windows.

As shown in Table 18 in Chapter 4, nearly 90% of all architects reported including one or more daylighting features (e.g., a light shelf) in one or more projects during the last year. However, the frequency with which they did this varied considerably among architect groups. The multi-event participants reported using daylighting in 70% of their projects, compared with 47% of single-event participants and 36% of nonparticipants (χ^2, $p<.01$).

Six participants gave responses comparable to:

- *"Clients don't request this. They just thank us for it afterward."*
- *"We do it because it makes for a better work environment."* That respondent continued, *"It is a major characteristic of our design work. We have daylight in virtually all occupied rooms."*

Another participant said:

- *"We propose this increasingly and clients are increasingly recognizing daylighting as an efficiency strategy. Previously, windows were typically considered to be an energy drain."*

Only one participant offered a countering view:

- *"We don't do daylighting because of computers."*

This person was undoubtedly making the assumption that natural light would reduce the visibility of the computer screen.

All architects fully understood that a daylighting strategy is more than just "a lot of windows," and in fact may have fewer windows than an alternate design. Said one nonparticipant:

- *"We include daylighting in all of our new construction projects. All of our buildings require low-e, double-insulated windows, and starfire glass by PPG. Inside, we have used multi layers of laminated glass of different films to increase light and make an aesthetic statement. In some instances, I have discussed multi-layer skins with light redirection units in the glazing."*

As with all the practices discussed in the interview, however, the percentage of architects engaging in the practice reported in Table 18 in Chapter 4 is the percentage that have done at least one element of the practice in at least one project during the past year. So, although all of the architects recognized that a daylighting strategy differs from "lots of windows," it still is the case that most of the architects did not pursue a full "strategy." Instead, they incorporated various elements of a daylighting strategy into their designs. Typical responses to the daylighting question included:

- *"We used shading on one or two [of 20] projects, we used the skylights and such [the roof designs] on five or six projects" (nonparticipant).*
- *"We did a few louvers, a few light shelves, a few overhangs" (nonparticipant).*

A number of architects reported mainly including one of the three sets of elements we discussed—shading strategies (e.g., louvers, projections, light shelves), roof designs (e.g., clerestories, skylights, stepped roofs), and optimizing daylight penetration through location of windows, floor to ceiling height, floorplate configuration, etc. Some architects mainly did shading, others mainly did the roof designs, and others mainly addressed penetration.

Architects also reported using Kalwall for diffused light and investigating various types of glazing materials to reduce solar gain.

Passive Systems

A number of architects spoke of the barriers to designing passive systems, such as optimizing the building's thermal mass, using shading devices, considering solar gain, and incorporating passive ventilation:

- *"The fault is on the mechanical side. The engineers are not there. We suggest these things, but they reject them" (participant).*
- *"We considered passive systems but couldn't implement them because of the codes" (participant).*
- *"Our long-term goal is to incorporate energy conservation into the structure, but we never find clients willing to support this" (nonparticipant).*

- *"We looked at passive approaches, but it didn't go far because of the lack of expertise on the part of the clients. There is client resistance" (nonparticipant).*
- *"Passive systems are contrary to laboratories" (nonparticipant).*
- *"We only use passive ventilation occasionally, because we work on medical facilities" (nonparticipant).*
- *"We are looking at mass now for the first time. We've done natural ventilation on smaller projects and recently on a few larger ones" (participant).*

Elaborating on passive ventilation, architects said that they incorporate operable windows, stack ventilation, flow-through ventilation, and venting high spaces.

Lighting System

Architects spoke of limits to energy-efficient lighting systems:

- *"Lighting sensors get value-engineered out at the end. We design them consistently, but they never make it in the final design" (participant).*
- *"We don't do lighting sensors due to the cost" (participant).*
- *"We recommend energy-efficient lighting, but the clients override this. We have discussed sensors with clients, but no one has accepted them" (nonparticipant, also expressed by another nonparticipant).*
- *"We have not had a lot of success in getting education clients to adopt the task lighting strategy" (nonparticipant).*
- *"This is a constant battle with retailers, getting them to reduce the lighting consumption" (participant, similar idea expressed by nonparticipant).*

On the bright side, the participant who spoke of the battle with retailers added:

- *"However, more retailers are going beyond code these days. Safeway is replacing all of its existing lighting with T8s as it remodels its stores."*

A number of architects said that they use engineering consultants to design the lighting system and that they assume the final designs were energy-efficient. A few said they did not know whether the designs were efficient:

- *"The consultants specify the fixtures, sensors, and controls" (nonparticipant).*
- *"We do not have standards that we follow regarding lighting efficiency, but I'd say in most projects it [efficiency] is the norm. We rely on the electrical engineers to design economical lighting systems" (nonparticipant).*
- *"We have a lighting consultant, be we don't discuss energy efficiency" (nonparticipant).*

HVAC

As with the lighting system, many of the architects said that they assume their engineers design energy-efficient HVAC systems. Again, a few answered that they did not know. One architect answered that the engineers that specify the HVAC system work directly for the client.

- *"The engineers always go through the analysis [to compare the different types of chillers and the alternative to chillers], but I can't say where we land efficiency-wise" (participant).*
- *"We don't optimize the HVAC needs from the outset. Our designs meet multiple objectives, and then we optimize the HVAC" (nonparticipant).*

A number of architects discussed the ramifications of a focus on initial costs:

- *"We look at all the options [different equipment and systems]. We try to get all this in balance and compare with our budget" (participant).*
- *"The clients choose from several design options and usually take the least expensive" (nonparticipant).*
- *"It's all budget-driven" (participant).*
- *"HVAC measures are often cut due to budget constraints" (nonparticipant).*

Some architects addressed barriers to efficient HVAC systems:

- *"There are times that the options that are appropriate are in conflict with district requirements" (participant).*

Another participant said that the Washington standards for fresh air in buildings pose a constraint. A nonparticipant said that the engineers over-designed the HVAC systems.

One nonparticipant had this to say about controls:

- *"We had controls, but they didn't work. They are only as good as the people maintaining them. You can't assume it will work."*

Of the HVAC elements mentioned, clients most frequently request controls. One nonparticipant twice had clients request geothermal heat pumps. Clients require the system options to be compared, but usually on the basis of first cost and not with a view of the energy costs.

Water Heating

Seven architects elaborated that clients had requested instantaneous water heaters. A few clients had requested solar systems:

- *"We've had some clients request solar, but we have not done any because our engineers inform us that there is no satisfactory solar water heater" (nonparticipant).*

On the other hand, one nonparticipant said that a project had used passive solar for water heating and radiant heat. One participant said:

- *"We considered a ground source for water heating, but did not implement it because of the cost."*

Life-Cycle Cost Analysis

Several architects said that they do a life-cycle cost analysis "in a general way, but not analytically" (nonparticipant). Some architects said that they have done such analyses so many times that they now know the outcome and which designs will work:

- *"Some measures that we do frequently, we already know the answers" (participant).*

Architects spoke of the cost of conducting life-cycle analyses, costs that clients are usually unwilling to pay:

- *"We usually do back of the envelope calculations. Clients don't want to pay for the analyses" (participant).*
- *"We need a fee to cover this or we need to figure out how to do it more expediently" (participant).*
- *"We don't do this because of the budget" (participant).*

Because of the cost, as well as for other reasons, several architects reported that they only do it on very complex projects:

- *"We do it for the more complex buildings. The smaller ones have fewer options" (participant).*
- *"Maybe a quarter of our clients request this. These are the clients that are truly concerned. Everybody 'talks' it, but few people 'walk' it" (participant).*
- *"Institutional clients get the idea about energy efficiency and usually ask for more, sometimes requesting life-cycle cost analyses" (participant).*
- *"We need to educate the client. There is too much information to sort out. Some clients are just getting to understand life-cycle costs" (nonparticipant).*
- *"We push this. We're persuasive when we have back up for the ideas. But the numbers are hard to come by" (participant)*
- *"I hate this. It always turns out not in our favor [i.e., against efficiency]. Our ideas get 'valued-engineered' out of the design" (participant).*

Modeling

As shown in Table 18 in Chapter 4, fewer architects reported conducting computer modeling to estimate building or lighting loads than reported conducting life-cycle cost analysis (64% versus 73% did the respective action at least once during the last year). Architects' comments suggest that they undertake modeling in part to provide inputs for a life-cycle cost analysis. The difference in the rates that the two actions are undertaken may reflect the fact that a number of architects who did life-cycle analysis said that they did informal, "back of the envelop" calculations. As with the cost analysis, modeling was mainly undertaken for complex projects.

Modeling was also done for unusual circumstances:

- *"We had one client, a zoo, request a lighting model to determine if the animals would get enough light" (nonparticipant).*

Contrasting the unusual circumstance, a participant said:

- *"We've been doing modeling for years. We were quite strong on this in the past, and then it ebbed. We built up a knowledge level, so we don't need to do it every time. We did not do any modeling this last year."*

Resources/Programs

Three large participants and one small participant spoke of using the Lighting Design Lab. Four nonparticipants likewise used the Lab: one firm, size 20 to 49 employees; two firms, size 10 to 19 employees; and one firm, size 5 to 9 employees.

Seven architects elaborated on using utility energy-efficiency programs. One nonparticipant said:

- *"In general, we always call up about rebate programs. They change from time to time. We've been working currently with a Seattle City Light program to get rebates."*

Three architects said that utility programs were not user-friendly:

- *"We mention PGE's Earth Smart® program. Clients feel this complicates things for them" (participant).*
- *"The utility program was more trouble than it was worth in the one instance we tried it" (nonparticipant).*
- *"We contacted Seattle City Light about the BUILT SMART℠ program, but the client didn't like it" (nonparticipant).*

One nonparticipant said the firm had used the Super Good Cents™ Program and a participant mentioned the Earth Smart® program in positive terms. This architect also said that the City of Portland offers money for energy efficiency, and mentioned as well state tax credits.

A nonparticipant noted that the utility programs were winding down, although his firm still uses programs for lighting replacement. The nonparticipating architect currently working with Seattle City Light had more to say on the role of utilities:

- *"There is a lack of leadership in the area of energy efficiency. It is too market driven. I really believe that utilities all cut back on education and rebate programs. Now there is an energy crisis and we don't have investments in the products or in conservation. They really have to push conservation now."*

The questionnaire used for the study included some questions assessing awareness of the *betterbricks.com* ad campaign. The first questions probed unaided awareness of "a website that provides information on improving employee productivity in commercial buildings." Respondents who said they were aware of such a site were asked if they could recall the site's sponsor. Some of their answers provide insight into who architects associate with the topic of employee productivity and commercial design. Their answers included websites of: the Lighting Design Lab, the Energy Lab in Seattle (2 mentions), Seattle City Light, PGE, the Green Building Program with the City of Portland, and the Make It Green Campaign of King County.

One nonparticipant said that they seek consultation from experts at the University of Oregon and a participant said that they consult with the Oregon Office of Energy. One participant said, "We seek in-house presentations." Four nonparticipants said that they consulted with suppliers.

Other Efficiency/Sustainability Actions

Architects were asked if they had undertaken any actions that were not probed by the preceding survey questions.

Participants offered the following comments:

- *"Plug loads are not addressed by the energy code. Also, flat screen monitors reduce the heating load. We use a comprehensive approach: passive solar, consideration of materials."*

- *"We use wall systems, thermal mass, rock wool and cellulose insulation, not fiberglass."*

- *"We even buy bus passes for our employees to get to work. We exhaust the building's heat, even in residences. In house, we do this with flues. We do high-end residential work, and these folks don't care about energy efficiency. But we do and we bring that concern to the projects."*

Nonparticipants offered the following comments:

- *"We've decide to create a set of energy-efficiency goals and discuss them with clients and carry them out as standard practice."*
- *"We've been looking at green materials for interior design. This is a routine part of our work. We're working on raising consciousness."*
- *"We've buried the building into the side of a hill."*
- *"We use passive evaporative cooling."*
- *"Occasionally, we discuss photovoltaics."*
- *"We use durable materials that require fewer repairs or replacements. Thermal breaks between the inside and outside. Light skin [exterior] to reduce heat absorption. Battery-powered flush valves. Reuse old building materials. Use recycled content materials. We replace deteriorating induction units. We study temperature control zoning."*
- *"The amount of insulation is important. We have been in energy-related competitions and programs and have found it is better to put in insulation than to use exotic glass materials."*

COMMENTS ON THE A+E PROGRAM

We asked participants for any comments that they would like to make about the A+E program.

Positive Comments

The following comments expressed purely positive views.

- *"The more you understand about something, the more convincing you are. I think the program was [initially] a little early for its time. But now is the prime time. I think they need to keep the program out there so that more people know about it. We love what they showed. They are great design tools and they begin to define the architecture."*
- *"We present a more compelling case [because of the program]. We have more enthusiasm, more compelling data. Our enthusiasm carries the day. And sometimes our clients have attended and gotten enthusiastic. We use our past award as a selling point. It's noteworthy. We use the ongoing*

workshops to train our younger staff. I still go to the workshops that have topics of interest to me, like the one next week in Portland [4/9/01]."

- *"A+E is a great program and I hope it will continue. I hope to attend other workshops. It seems like I have at least one architect attend one A+E component each year."*
- *"The program had a big impact on the firm and on me. Our clients are now more interested and educated about [energy efficiency]."*
- *"The workshop has us being more thoughtful, rather than business as usual. Light shelves were reinforced, as well as other daylighting things. We are now refocused on these. The workshop re-energized me. I've gotten back to things I did before."*
- *"There is a seminar in Portland next week—Gail Lindsey, on sustainable design. I'd love to go but the travel cost is too high. If we could have the same seminar in Spokane, I know at least ten people who would attend. But out of town is tough."*[17]
- *"We are talking about energy efficiency more [since attending] and clients are asking for it more. A+E is quite valuable. It's a wonderful program. Going through the assessment exercise to submit a project was great. Also the credential—we won an award. We strongly hope the program continues. We want to submit again."*
- *"It was valuable. It gave me ideas about things we can use."*
- *"On a scale of 1 to 5, I'd rate it a 9! I got exposure to both good and bad ways of doing things—both were valuable. To see what other people are doing is great. I would not say that I gained any new information."*
- *"The more I'm aware, the more I try to sell my increased knowledge and training. The workshop was great. I came away with a lot of enthusiasm knowing that I and a lot of people are trying to save the environment. I don't think I learned new information, but it reinforced what I knew. And I always learn at least one new thing."*

[17] A+E workshops were held in Spokane in April 1999 with Steve Ternoey and in August 2000 with Gail Lindsey.

- *"It gives you more background knowledge and information about your peers. Energy efficiency is not exotic or "fringe". [Due to the program] we realize its mainstream."*
- *"The workshop is important. It keeps you going, enthusiastic. I feel bolstered, like I can make a difference."*
- *"Certainly understanding information and where to get it helps. Hearing how others apply products and solutions is also valuable."*
- *"It was an excellent presentation. Well worth the time. The challenge is to implement it."*
- *"One of the things the workshop helped with was on how to sell the client on energy efficiency. How to sell life-cycle costing."*
- *"What I recall that was most effective was that the workshop laid out ways of comparison to show the client. It laid out the costs of daylighting versus nondaylighting for the client."*
- *"It's a good program. I wish more Idaho architects would submit things."*
- *"We don't recommend measures any more frequently, but the program heightened our awareness and ability to talk to owners."*
- *"We're now taking a more holistic approach."*

Negative Comments

- *"I was not that impressed with A+E. They billed the workshop as interactive and it wasn't. It was a lecture."*
- *"I can't remember. I heard a speaker from Kansas that was very good, and a speaker on glazing that wasn't. Which was A+E?" (respondent attended Idaho 9/21/00 workshop).*
- *"A+E proposed band aids. They did not have a good comprehension of the problems we face. They didn't have a good definition of the problem or select the proper solution."*
- *"I'm not in a position to use the information much" (comment made by two interns).*

Recommendations

- *"Some examples were so unique that they did not apply in most cases. I would recommend more practical or common examples. Invite local energy experts to the conference. Get the local utilities at the conference, too."*
- *"The workshop didn't do me as much good as it would do younger architects. We either do this stuff or have read about it in journals. I had a strong base. I didn't see anything new other than how other architects integrated it into their buildings. Give me tools I can use...if we had new cost-effective means or methods. Give me the numbers."*
- *"The awards are a good thing. It would be good to have more practical workshops. I'm always looking for the practical."*

COMMENTS ON LEARNING VENUES

Six architects elaborated that they thought multidisciplinary workshops would be extremely important:

- *"It stretches things."*
- *"Engineers are always left out of the workshops."*
- *"It is probably the most effective, if you can get them to discuss it afterwards."*

One architect did not like a multidisciplinary focus because "it ends up being too general to be useful to anyone."

Four architects said that multidisciplinary groups, or other aspects of the venue, were not the critical factors, but rather the subject matter and the presenter:

- *"Hands-on experience from a face-to-face seminar is best."*

A number of architects commented that it was important that the educational forum present them with new, technical information:

- *"Most seminars go over the same stuff that's been done before."*
- *"Most journals aren't technical enough."*

The Internet and books were considered good resources, but time-consuming to use. A conference is able to offer selected information.

One architect said that he was always looking to attend workshops while at professional conferences, while two others said that a workshop at a conference was not desirable:

- *"There is too much at a conference to absorb."*
- *"An AIA conference is not useful and they are stingy with the credits."*

Three architects noted that they needed a workshop to be held locally:

- *"I especially like a workshop in the community because its a learning opportunity for the community."*

Several others noted that they already hold training sessions in-house.

One architect who reported a low interest in learning more about energy efficiency elaborated:

- *"Given the nature of our business—its exclusively retail design—my interest in that is a 2. But my interest in recycled materials is a 5."*

COMMENTS ON BARRIERS TO ENERGY-EFFICIENT DESIGN

Technical Information

Comments regarding the need for good technical information included:

- *"Assessing the performance in a specific application—that's time consuming, difficult, expensive, tedious. It's hard to get the information. Assessing the costs is also cumbersome. It's hard to compile, hard to be exact, hard to sell [to clients]. And there is just not enough time. Everything requires the architect to do more work, and we can't charge for it" (nonparticipant).*
- *"We can assess how well an option will perform. We work with modelers—creative types—who know how to do this. But getting clients to pay for this is the hard part" (participant).*
- *"We need reliable estimates. And we can't get the sign off from the client to spend the money to generate the estimates" (participant).*

- *"We need a budget to assess the options" (participant).*
- *"We heavily depend on the advice of experts" (similar view expressed by two nonparticipants).*
- *"We are persuasive when we have the back-up for our ideas through a life-cycle cost analysis. But the numbers are hard to come by" (participant).*
- *"For identifying the options, it takes time to track them down. There are always new things. For assessment—again, it's hard to keep up" (similar view expressed by two participants).*
- *"Not a lot of information is available on assessing performance or on estimating costs. These are vague" (participant).*
- *"Architects use cost estimators [consultants], but they don't offer lifecycle analysis, typically. They do quantity estimating for materials. They can't tell you about resource savings. There is a big gap in knowing. An opportunity is there for entrepreneurs" (participant).*
- *"The problem is the availability of examples and technologies. We need first rate examples. Look at Europe, and Berlin in particular" (nonparticipant).*
- *"Without hard data, everyone is guessing. And everyone is conservative. So we need to build redundancy into the building. The current payback for the features we have included in the Business School is 10-15 years. But we are hedging our bets. We are doing a passive system with redundant mechanical systems. So right now, energy efficiency costs a lot. But with performance data, it will cost less—not much more than a standard efficiency building" (participant).*
- *[In the absence of performance information]"the newness of the feature is a problem. Novelty is a tough sell. Our office tends to be conservative—not wanting to go out on a limb and expose ourselves to liability" (participant).*
- *"A lot of corporations have just one way to do things. It's hard to get them to look at the options without long-term research backing you up" (nonparticipant).*
- *"Our own MEs have approached it with strong skepticism until the design consultants said that the mass equaled X or stack effect was Y. This technical information enables them to be enthusiastic participants" (participant).*

Another participant, in expressing dissatisfaction with the A+E program, said:

- *"If we could get some good numbers—of the costs of the systems. For example, 'As more outside light comes in, you can dim the internal lights, and then do the reverse.' My clients are the long-term owners. But I need to show them in the life-cycle of the building the energy costs. Give me tools I can use. Give me the numbers."*

Codes/Regulations

Architects expressed mixed opinions about the degree to which building codes were a barrier to energy-efficient design. About half of all interviewed architects described codes as "not a barrier" (a rating of 4 or 5).

- *"Code restrictiveness can be a 1 or a 5, depends on the bldg type. For laboratories, code exemptions limit the opportunity to apply efficiency options. Certain buildings are exempt form normal code. Labs require lots of air flow" (nonparticipant).*

- *"Codes are often conflicting, but not a real limitation" (nonparticipant).*

Comments of some of the architects who thought codes can be a barrier include:

- *"We need to go after the big energy drains, but the codes are conflicting. Code requirements are always five years behind" (nonparticipant).*

- *"The education building codes are a problem. They are out of date" (nonparticipant).*

- *"We've considered passive systems but we couldn't implement them because of the codes" (participant).*

- *"In Washington, the requirements for fresh air in buildings limits our ability to explore different HVAC options. They have the same fresh air requirement for urban and rural areas. Yet sometimes in urban areas the outside air is more polluted than the inside air" (participant).*

- *"The energy codes limit glass. This can be counterproductive. You have to go through extremely elaborate calculations to justify more glass. It's not worth the effort or the cost to do the justification. Clients would not pay for those costs" (participant).*

- *"Stack ventilation and flow-through ventilation has some barriers from the fire and building codes" (participant).*

- *"The code can be a huge barrier. We started to make the university building a Type 1 building. But we needed fireproofing insulation. So instead we compartmentalized the space into separate buildings with a fire separation between them, but no fireproofing. Without fireproofing, part of the structure can be exposed and contribute to the thermal mass. And we can have open corridors and better ventilation. An engineer has asked how we moved the air through a rated corridor, and we answered, 'it's not a rated corridor'" (participant).*

- *"A big problem that we face is government regulations. We try to be energy efficient, but can't because of requirements. Government agencies typically expect every square foot to be the same with respect to lighting. The regulations lack common sense" (participant).*

- *"If you try to do something they don't understand or haven't seen, they don't like to approve it" (nonparticipant).*

- *"If you do something different, you need to convince the official the design is as good or better. Usually, they are receptive" (participant).*

Consultants/Engineers

Most, but not all, architects elaborating on engineers and consultants indicated that they were a barrier:

- *"Engineers are a key barrier" (participant).*

- *"It's hard for the engineers to keep up. Our design team is becoming less of a barrier—both our internal staff and our consulting team. But that's not true for the contractor" (participant).*

- *"Most of our projects have had problems with the mechanical engineers designing systems that are too expansive. So now we mainly go to experienced contractors instead of the MEs and EEs—we save money up-front and also through the life-cycle costing" (nonparticipant).*

- *"In the past, the engineers have ignored the solar features that we design in—they ignore the sunscreens. They are now considering these to save money. But it also costs money to go beyond code" (participant).*

- *"Identifying consultants would be a "1" [a "show stopper"] if I were doing cutting edge work" (participant).*

- *"The sub-consultants (engineers) aren't flexible to alternatives to water heating and HVAC systems" (nonparticipant).*

- *"Eighty percent of the firms out there have a long way to go. So we use the 20% that do know" (participant).*

One participant said that the firm switched both electrical and mechanical engineering firms because:

- *"The engineers ignored the solar features we designed in. We had to go to Vancouver (Canada) to get a more sophisticated ME."*

Another commented:

- *"The other professionals are not a problem. Their numbers have grown over the last five years. This region of the country has high awareness. In almost every category of expertise we have a choice of two or three—in most categories, there are five or six—who are outstanding" (participant).*

Project Budget and Financing

Nine architects, when asked, "Are there any other barriers that we have not discussed?" answered "cost" or "budget." These architects said that clients have a lowest-first-cost perspective:

- *"Economics is largest problem. It takes time to research and there's the cost of materials and the labor to install—it's more expensive to install energy-efficient features" (nonparticipant).*

- *"The budget can be a limit if it is ridiculously low, but we address this" (participant).*

- *"The financing on projects has to change. I wish someone would tackle this. Project budgets are set up for the lowest costs. So paybacks must be very short for a feature to fly. Yet the benefits accrue over the building's life. The real estate and financial community is ignorant" (participant).*

- *"A barrier is the project budget. Budgets need to be structured differently, so money can come from the capital fund and the operations fund" (participant).*
- *"The loss of tax incentives has been a problem" (participant and nonparticipant).*

Getting the Client to Consider Energy-Efficient Options

All three of the architect groups (multi-event participants, single-event participants, and nonparticipants) agreed that the greatest barrier to energy-efficient design is getting the client to consider energy-efficient options. Only a few architects, however, elaborated on this:

- *"The only real limitation is the client. A lot of corporations have just one way to do things" (nonparticipant).*
- *"There are so many competing objectives for a project. Energy efficiency is not a driver" (participant).*
- *"Client awareness of energy has gone up over the last three months, their anxiety has gone up, but their willingness to act on it and treat it as an investment hasn't changed" (expressed by a number of participants and nonparticipants).*
- *"We can get them to consider it, but implementing it is another story!" (participant).*

One nonparticipant, however, took the focus off of clients:

- *"Our biggest limitation is our office culture. We need to institutionalize energy efficiency as a consistent part of our analysis."*

COMMENTS ON THE MARKET AND TRANSFORMING IT

Market Descriptions

More than half of the surveyed firms (57%) said they did design/build work; of these, about one-quarter (28%) said they did "only a little". One firm estimated that 70% of its commercial work was design/build. Design/build also occurs in the industrial sector, but not in public or institutional work. One nonparticipant said:

- *"Design/build is increasingly the choice of many clients. This is an important market for education on energy efficiency."*

Other comments included:

- *"We mainly discuss energy efficiency with schools. We discuss it less so with retail, where the design requirements are sent down from the corporate headquarters. For municipalities, their RFPs usually ask what strategies we propose for green design" (participant).*
- *"Commercial developers are not concerned with energy yet, because of the tax situation. Energy conservation doesn't pay back quickly enough" (nonparticipant).*
- *"We work for developers who aren't interested in this" (nonparticipant).*
- *"Retailers look at front-end costs. And it's very tough with developers who build and then sell" (participant).*
- *"Our kind of projects [Internet server farms] are really inefficient no matter how well you design them" (nonparticipant).*

Transforming the Market

Comments regarding market transformation included:

- *"We need to educate the client" (participant).*
- *"It would be interesting for a non-profit energy organization to put on energy-efficiency workshops for client groups" (nonparticipant).*
- *"Educating the users is an important next step. Even for work on an existing building [renovation, remodel] we need to make the users active participants, to demonstrate that they have an impact on the energy environment" (participant).*
- *"If the Alliance is going to put money into this, they should do it all the way. They should do it like the City of Portland is doing with its Green Buildings program. Portland is making an effort to be a huge resource, and I think they are making a change. Consistency—a commitment for multiple years—this is very important. Be a presence. Be visible, with real backing. Always have the visibility so people know what you are doing. The A+E*

Awards program gives that visibility. Or do this with betterbricks.com, *so people know it's out there—but I'm afraid it's hidden now" (participant).*

One participant is currently designing the University of Oregon Business School. The building is being extensively monitored to produce performance data. Other state universities and agencies have expressed much interest in the design.

Seven of the architects referenced the LEED standards from the Green Building Council. Four of these were participants from large firms (three of whom were with firms of 50 or more employees and one with a firm of 20 to 49 employees). The other three were nonparticipants, one in each of the three smallest size categories.

Participants offered the following comments:

- *"The LEED rating system has been a major influence on our work."*
- *"We did a LEED review on one project and are now seriously considering doing this on every project. We're sold on the system, and more and more of our clients are, too. For example, the National Parks, the City of Portland, and others."*
- *"We apply LEED in most projects."*
- *"One project was a new office building for Marion County. It has gone through LEED, and monitoring by the utility."*

Nonparticipants said:

- *"Some of our educational clients are starting to implement energy-efficiency standards, such as LEED."*
- *"I've heard about Seattle's LEED program. The standards are excellent. For years we have done projects that meet the standard. This past year, however, few of the projects incorporated much energy-efficiency elements."*
- *"I am planning to get LEED-certified."*
- *"I used the LEED standards."*

APPENDIX B

Commercial Building Design Market: Market Assessment and Barriers to Energy-Efficient Design Practices

Appendix B

COMMERCIAL BUILDING DESIGN MARKET: MARKET ASSESSMENT AND BARRIERS TO ENERGY-EFFICIENT DESIGN PRACTICES

The First MPER provided an assessment of the commercial building design market. It suggested a conceptual framework for considering the market barriers to energy-efficient design and evaluated the A+E program with respect to this framework. It determined that the A+E program directly targets two market barriers in the new commercial design market: performance uncertainty and organizational practices for architects and consultants. The recommendations offered in the first and second MPERs were directed at expanding the program to address additional barriers such as hassle costs, search and information costs, and lack of awareness for other market participants (e.g., owners and contractors).

The following market assessment and description of barriers to energy-efficient design practices is excerpted from the first MPER, except where noted.

MARKET DEFINITION

The market addressed by the A+E program is the market for commercial building design in the Pacific Northwest, defined as all of Washington, Oregon, Idaho, and Montana.

MARKET STRUCTURE

Services Exchanged

The commercial building design market occurs when a landowner or building owner contracts for services to design a building or alter an existing building. Commercial building design includes new construction and major renovations, as well as design for existing buildings such as remodeling and tenant improvements.

Market Participants

The market participants include:

- *The landowner, developer, or building owner;*
- *Possibly the owner's agent* – a construction or project manager to oversee the project;

- *The architect*;
- *The various design consultants* – e.g., mechanical engineer, lighting designer, electrical engineer, landscape architect, interior designer, structural engineer, civil engineer;
- *The general building contractor and various sub-contractors* – e.g., HVAC contractor, electrical contractor, sheet metal fabricators, plumbers; and
- *The end-user* – building occupants who might own or lease the facility.

Distribution Chain

The combination of market participants the owner hires varies based on the scale of the project and the intent of the owner in constructing the building. These combinations form the structure of the design services.

Design services range between traditional design and various design/build approaches. The fundamental difference between the two strategies lies in how the owner contracts with different parties. In a traditional design strategy, the owner contracts with architects and general contractors, who in turn contract with consultants and sub-contractors. The client seeks an architect at the very outset of the project to provide recommendations and expertise. Typically, the contractor is hired after the design is underway. Traditional design strategies are based on the notion that architects should be the primary design decision-makers (subject to the clients' agreement, of course) and contractors should execute the design to the best of their ability.

In design/build approaches, the owner contracts independently with architects, consultants, contractors and some sub-contractors for the services each provide. One rationale for using a design/build strategy is to reduce cost. The strategy brings expenses under the direct control of the owner or the owner's agent, a construction manager. As compared with traditional design, design/build reduces the influence on the overall design exerted by any one player, other than the owner or the owner's agent.

When Transactions Occur

Some design decisions affect building energy consumption, some do not. In addition to occurring for new construction and major renovations, design occurs whenever a tenant or owner wishes to change the use or configuration of a building. Design also

occurs whenever major new equipment is installed in a building, regardless of whether the equipment uses energy. Even equipment replacement can lead to design decisions if resizing is required or if the configuration of the equipment has changed since initial installation.[18]

With the number of instances in which design decisions occur, the expansion of design/build can be easily understood. Subcontractors gain experience with design through equipment replacement that they then parlay into design capability for new installations.

The increased use of design/build strategies has significant consequences as to which market actors make the key design decisions and at what points in the process key transactions affecting energy use occur. At the extreme, an architect in some design/build approaches may have very little influence on the design of anything but the minimum required by law. Even in traditional design, the complexity of new HVAC systems means that the mechanical contractor and mechanical engineer make key decisions that affect the energy consumption of the building. Often these decisions are made late in the design process, with minimal input from the architect.

Estimate of Architectural Population

Table 6 of this Third MPER provides an estimate of the number of architectural firms with commercial practices in the Pacific Northwest. To recap the number of firms by size (number of employees):

- 50 or more employees: 39 firms;
- 20 to 49 employees: 68 firms;
- 10 to 19 employees: 104 firms;
- 5 to 9 employees: 190 firms; and
- 1 to 4 employees: an estimate of firms with commercial practices is not available. The purchased business list of architectural firms identifies 159 firms, although this number does not exclude firms that design only

[18] Design projects for equipment installation or replacement were described by architects interviewed for the Third MPER who reported completing more than 50 or so projects in the past year.

residences, and the number omits many architects that are self-employed or otherwise have small firms not included on the purchased list.

In addition, we conclude from research conducted for the third MPER that no more than 3% of the roughly 1,700 contractors and developers with offices in the PNW have architects on staff there (i.e., approximately 50 firms).

Identification of the total population of market participants for commercial building design is incomplete. To complete the estimate we would need to include landowners and developers (those without architects), building owners and managers, engineering consultants for lighting and mechanical systems, and interior and landscape designers who might be part of an integrated design team on some projects. The size of the full market population for commercial design is thus much greater than that of commercial architects alone.

Percentage of Energy-Efficient Sustainable Design

In Oregon, Montana and Washington, and in parts of Idaho, all new commercial buildings are subject to energy code standards (although there is currently no energy code enforcement in Montana.) According to the architects we spoke with, energy-efficient and sustainable design should go beyond code compliance in energy performance. No estimate of energy-efficient sustainable design exists for the PNW commercial market, although a recent study for the Alliance concluded that the standards represented by the Oregon Non-Residential Energy Code or the ASHRAE Standard 90.1 generally represent common practice in the region.[19]

Communication Channels and Information Sources

Architects learn new tools and techniques in a variety of environments. The two most common formal learning formats are conferences and publications. This third MPER found that architects rated workshops and the Internet as the most desirable learning venues.

Within architectural firms, information on specialty topics frequently is made available to staff by firm members who are assigned the topics and given the task of tracking and disseminating relevant information. Several of the firms we spoke with have "green teams" who focus on sustainable and environmentally-beneficial

[19] Baylon, David, Mike Kennedy, and Shelly Borrelli. (March, 2000). *Baseline Characteristics of the Non-Residential Sector in Idaho, Montana, Oregon, and Washington.* Northwest Energy Efficiency Alliance.

products. Other firms have specialists assigned to cover Construction Specification Institute (CSI) division topics.

The Ideal Market

The ideal market describes one where the level of investment in energy efficiency is equal to that which is societally cost-effective. The current research did not undertake to quantify the ideal level of investment nor to determine with precision the degree to which the current market fails to achieve this goal.

MARKET BARRIERS TO EFFICIENT DESIGN

Table B-1 describes barriers to energy-efficient commercial building design that players in the design market may face. The barriers are defined as follows:

Lack of Awareness

Lack of awareness refers to the fact that some market participants are unaware that energy-efficient design is possible and can yield benefits to the building owner, operator, and occupants.

Performance Uncertainty

Performance uncertainty is a barrier when market participants are uncertain that the energy-efficient and sustainable building practices will deliver the energy savings expected. Performance uncertainty affects claims to the financial benefit of measures and the acceptability, applicability, and reliability of measures.

Table B-1

BARRIERS TO ENERGY-EFFICIENT DESIGN PRACTICES

OWNER	ARCHITECT	CONSULTANTS	GENERAL CONTRACTOR	SUB-CONTRACTOR	END-USER
Lack of Awareness			Lack of Awareness	Lack of Awareness	Lack of Awareness
Performance Uncertainty	Performance Uncertainty	Performance Uncertainty	Performance Uncertainty	Performance Uncertainty	Performance Uncertainty
Search Costs	Search Costs	Search Costs	Search Costs	Search Costs	Search Costs
	Hassle Costs	Hassle Costs			
Organization Practices	Organization Practices	Organization Practices	Organization Practices	Organization Practices	
Split Incentives					Split Incentives
Low Energy Costs					Low Energy Costs
	Structural	Structural	Structural	Structural	
Access To Financing					
Asymmetric Information	Asymmetric Information	Asymmetric Information	Asymmetric Information	Asymmetric Information	

Information and Search Costs

Information and search costs refer to the difficulty of tracking down energy-efficient design solutions and products. This barrier includes:

1. Identifying specific energy-efficient techniques and products;
2. Obtaining sufficient information on the techniques and products to assess their strengths and limitations in the given application or to understand how to implement or use them;
3. Finding experts or experienced professionals to provide consultation;

4. Obtaining the tools to determine the cost effectiveness of a technique or product; and

5. Generating the information to be used in a cost effectiveness analysis.

Architects noted that clients typically are unwilling to bear the costs to search for products and information, so architects increase their information base in small increments, often at their own cost.

Hassle Costs

There are a number of hassle costs that architects incur in implementing energy-efficient design. One hassle is the time-consuming, and therefore expensive, process of actually conducting the calculations required to assess performance efficiency and payback. If design professionals are unskilled in such tools as the DOE-2 analysis, they would need to hire others to do such analyses.

A second hassle can occur in attempting an integrated design approach with team members who are inexperienced with integrated design or with energy efficiency. Hassles occur (that is, time is spent) assessing the team members' knowledge and expertise in various areas, obtaining and maintaining commitment to energy efficiency, developing a collaborative, flexible working relationship, and persuading members to tackle solutions outside of their comfort area. The architects we spoke with viewed time spent by a team as much more expensive than time spent by an individual, and hassling through these tasks only lays a foundation for the design work but does not, in itself, generate output (a design).

Organizational Practices

This barrier concerns the internal business practices and institutional practices of market participants that limit the likelihood that the market participant will use energy-efficient sustainable design practices. Such organizational practices include: owners who select contractors and consultants using a lowest-cost criterion; design firms who set their fee based on project cost; firms that lack processes for employees to learn new techniques; and firms that stick to "tried and true" methods rather than trying new approaches.

Split or Misplaced Incentives

Substantial split or misplaced incentives occur in commercial building design. Only in owner-occupied projects are the incentives sufficiently aligned that operating costs and construction costs are assessed in tandem. In most construction settings, the owner of the building will not operate it. The owner has an incentive to lower the up-front costs of the project without regard to long-term operating costs. This is mainly a barrier to the owners and end-users. Architects, consultants and contractors do not experience it as a barrier to their work, but rather as a barrier to the sale of the concept of energy-efficient and sustainable design.

Low Energy Costs

Low energy costs are a barrier to energy-efficient and sustainable design if the costs and benefits do not align. Architects noted that it is difficult to economically justify energy-efficient design solutions where the payback is long due to low energy costs. Owners are more likely to accept without economic justification sustainable design solutions than energy-efficient solutions because of the appeal of the variety of quality-of-life issues involved in sustainability. This is mainly a barrier to the owners and end-users, affecting architects, consultants and contractors in the sale of the concept and not in doing the work itself.

Structural

Referring to existing conditions in buildings that may limit the opportunities for energy efficiency, this market barrier primarily affects retrofit and build-out design. Energy code requirements do not cover most design activities for existing buildings. The lack of code requirements limits the impetus to look for energy-efficient solutions, constituting one structural barrier. A second barrier concerns the cosmetic focus of much design work in existing construction: owners typically change out systems only if necessary to attain some cosmetic or functional goal. This barrier affects designers, consultants, contractors, and subcontractors, primarily in design for existing buildings.

Access to Financing

Not surprisingly, “cost” is the reason most commonly stated by architects for the low penetration of energy-efficient sustainable design. Access to financing is one aspect of cost limitations. Though owners typically have acquired financing by the time design starts, usually short-term loans finance the development, design, and

construction costs. Interest rates on these loans are often high and time is of the essence. In such a financial context, it is difficult for architects to justify the time and expense necessary to conduct research and analysis of potential energy-efficient features. Financial institutions do not value energy efficiency and are unlikely to provide additional funding to cover those activities. This is mainly a barrier to the owners and end-users since the architects, consultants and contractors do not experience it as a barrier to their work, but to the sale of the concept of energy-efficient and sustainable design.

Asymmetric Information

Asymmetric information occurs when one party to an exchange has more information than another party and makes claims that cannot be verified by the person with less information. Product manufacturers make claims the consultants, owners, architects, contractors and end-users are often unable to test without proprietary information, large quantities of materials, or specialized equipment or training. This barrier affects owners, architects, consultants and contractors.

BARRIERS ADDRESSED BY A+E PROGRAM

Table B-2 shows the barriers to efficient design that the A+E program addresses. The dark shaded boxes indicate the barriers most effectively addressed by the program. Lightly shaded boxes are barriers addressed to a lesser extent—barriers that could be that could be better addressed by the A+E program were it to modify its outreach activities and the advertising materials used to publish its accomplishments. The first and second MPER provided specific recommendations in this regard.

Table B-2
BARRIERS TARGETED BY A+E

OWNER	ARCHITECT	CONSULTANTS	GENERAL CONTRACTOR	SUB-CONTRACTOR	END-USER
Lack of Awareness			Lack of Awareness	Lack of Awareness	Lack of Awareness
Performance Uncertainty	Performance Uncertainty	Performance Uncertainty	Performance Uncertainty	Performance Uncertainty	Performance Uncertainty
Search Costs	Search Costs	Search Costs	Search Costs	Search Costs	Search Costs
	Hassle Costs	Hassle Costs			
Organization Practices	Organization Practices	Organization Practices	Organization Practices	Organization Practices	
Split Incentives					Split Incentives
Low Energy Costs					Low Energy Costs
	Structural	Structural	Structural	Structural	
Access To Financing					
Asymmetric Information	Asymmetric Information	Asymmetric Information	Asymmetric Information	Asymmetric Information	

APPENDIX C

Comparison of Architect Groups

Appendix C

COMPARISON OF ARCHITECT GROUPS

Chapter 4 discussed the influence of the A+E program on the frequency with which participating architects have incorporated energy-efficient design practices during the past year. The chapter presented evidence that, within the population of participating architects, the program has differentially affected the activities of two groups. These groups are: (1) those architects who attended multiple A+E events or who have coworkers who participated in A+E events (termed "multiple event participants"); and (2) those architects who attended one A+E event and who have no participating coworkers (termed "single event participants"). Of the 25 architects in the multiple-event group, 5 had coworkers who attended the same event as themselves, 17 had coworkers who attended different events than themselves, and 3 had no participating coworkers but had attended two or three events on their own.

Table C-1 elaborates on the characteristics of the two groups.

Table C-1

CHARACTERISTICS OF ARCHITECT GROUPS

CHARACTERISTIC	MULTIPLE-EVENT PARTICIPANTS (N=23)		SINGLE-EVENT PARTICIPANTS (N=18)		TOTAL PARTICIPANTS (N=43)	
	FREQUENCY	PERCENT	FREQUENCY	PERCENT	FREQUENCY	PERCENT
NUMBER OF EMPLOYEES IN FIRM**						
50 or More	11	44%	0	0%	11	26%
20 to 49	10	40%	4	22%	14	32%
10 to 19	1	4%	5	28%	6	14%
5 to 9	2	8%	5	28%	7	16%
1 to 4	1	4%	4	22%	5	12%

Continued

Appendix C

CHARACTERISTIC	MULTIPLE-EVENT PARTICIPANTS (N=23)		SINGLE-EVENT PARTICIPANTS (N=18)		TOTAL PARTICIPANTS (N=43)	
	FREQUENCY	PERCENT	FREQUENCY	PERCENT	FREQUENCY	PERCENT
STATE						
Idaho	6	24%	6	33%	12	28%
Montana	0	0%	1	6%	1	2%
Oregon	10	40%	4	22%	14	**33%**
Washington	9	36%	7	39%	16	37%
SECTORS SERVED WITH DESIGN WORK (MULTIPLE RESPONSE)						
Commercial	23	92%	14	78%	37	86%
Institutional, Educational	22	88%	14	78%	36	84%
Industrial, Warehouse	9	36%	5	28%	14	33%
Residential	15	60%	8	44%	23	54%
CONSTRUCTION ACTIVITY SERVED (MULTIPLE RESPONSE)						
Design/Build	13	57%	8	50%	21	54%
New Construction	25	100%	18	100%	43	100%
Renovation	23	92%	16	89%	39	91%
Remodeling	23	92%	16	89%	39	91%
NUMBER OF DESIGNERS IN OFFICE**						
1 to 4 Designers	1	4%	8	44%	9	21%
5 to 9 Designers	3	12%	6	33%	9	21%
10 to 19 Designers	6	24%	2	11%	8	19%
20 to 49 Designers	7	28%	2	11%	9	21%
50 to 99 Designers	5	20%	0	0%	5	12%
100 or More Designers	3	12%	0	0%	3	7%

Continued

CHARACTERISTIC	MULTIPLE-EVENT PARTICIPANTS (N=23)		SINGLE-EVENT PARTICIPANTS (N=18)		TOTAL PARTICIPANTS (N=43)	
	FREQUENCY	PERCENT	FREQUENCY	PERCENT	FREQUENCY	PERCENT
TITLE OR ROLE OF RESPONDENT						
Owner	5	20%	8	44%	13	30%
Principal	7	28%	2	11%	9	21%
Project Manager	5	20%	5	28%	10	23%
Architect	7	28%	1	6%	8	19%
Intern	1	4%	2	11%	0	7%
LENGTH OF TIME PRACTICING ARCHITECTURE						
1 to 4 Years	3	12%	3	18%	6	14%
5 to 9 Years	0	0%	0	0%	0	0%
10 to 19 Years	7	28%	4	24%	12	28%
20 to 29 Years	13	52%	7	41%	20	46%
30 or more Years	2	8%	3	18%	5	12%
NUMBER OF PROJECTS IN THE LAST YEAR						
1 to 4 Projects	9	36%	5	28%	14	33%
5 to 9 Projects	4	16%	3	17%	7	16%
10 to 19 Projects	7	28%	5	28%	12	28%
20 to 29 Projects	2	8%	3	17%	5	12%
30 to 99 Projects[a]	3	12%	1	6%	4	9%
100 or more Projects[a]	0	0%	1	6%	1	2%

*** Significant difference between the groups, χ^2, p<.01.*

Note: a. See "When transactions occur", above, for an explanation of very large numbers of projects.

APPENDIX D

Survey Instruments

Appendix D

ARCHITECT INTERVIEW GUIDE
ARCHITECTURE + ENERGY, SPRING 2001 EVALUATION

Name: _____

Firm: _____

Phone Number: _____

A+E Activity: _____

or ___Nonparticipating member of participating firm

or ___Nonparticipant

Date of Interview: _____

If Nonparticipant: Attempt to reach a principal or lead architect.

I am conducting research for the Northwest Energy Efficiency Alliance, a consortium of Northwest electric and gas utilities formed to address energy use in the region. The Alliance hopes to address energy use in commercial buildings and so has asked me to talk with architects about current architectural practices. Can you suggest a lead architect with your firm that I might talk with briefly?

A. First let me ask you what sectors your firm designs for.

a. Commercial facilities (such as offices, retail space, restaurants)?

Yes ___ No ___ Elaboration: _____

b. How about government, health care, or educational facilities?

Yes ___ No ___ Elaboration: _____

c. Industrial or warehouse facilities?

Yes ___ No ___ Elaboration: _____

d. How about residential space (such as houses, apartments, assisted living)?

Yes ___ No ___

{If exclusively residential, thank and terminate}

B. Which of the following activities is your firm involved in?

a. Renovation of existing structures (if necessary: renovation is a major remodel)

Yes ___ No ___

b. Remodel of existing structures

Yes ___ No ___

c. New construction (if necessary: construction on a cleared lot)

Yes ___ No ___

d. Design/build projects

Yes ___ No ___

C. About how many designers (unlicensed OK) work for your firm: _____

D. What is your role or title?

E. How long have you been practicing architecture? _____

F. Approximately how many projects did you work on last year: _____*{If 2000 participant, ask, "since attending the A+E workshop"}*

I want to discuss with you a number of things that architects might do as part of their design practices. I would like to know the number or proportion of projects you've worked on in the last year {or: since the workshop} that reflect these elements in their final design.

Questions relating to the earliest stages of project design:

In the last year, have you engaged in:

Y N 1. **Pre-design activities** to address energy and resource savings project-wide

⇒ ***If Yes, probe for specifics:***

Y N a. **Talking to client** about efficiency and resources in the pre-design stage

Y N b. Setting energy-efficiency **goals** and performance benchmarks

Y N c. Educating the **team** on how the design affects a building's energy use

Y N d. Collaborating with **consultants** and contractors involved in design and construction

Y N e. Other: _____

f. # or % of projects: _____

Y N g. Were any of these activities specifically requested by the client?

In the last year, for any of the projects was the building's:

Y N 2a. **Site** or **orientation** selected because of solar access, shading, or other resource considerations

b. # or % of projects where this was reflected in the final design: _____

Y N c. Were any of these specifically requested by the client?

Questions relating to the building envelope and glazing:

In the last year, have you considered:

Y N 3a. Designing the **building envelope to reduce** heating, cooling, and ventilation needs, such as through the building's footprint, mass, skin, glazing, or tightness

b. # or % in final design: _____

Y N c. Was this ever requested by the client?

Y N 4. In the last year, have your projects incorporated **daylighting** features

⇒ ***If Yes, probe for specifics:***

Y N a. Lots of windows {==>this alone is not daylighting}

Y N b. Incorporating **shading** strategies, e.g., louvers, projections, light shelves

Y N c. Designing the **roof** to let light in, e.g., clerestories, skylights, roof monitors, stepped roofs, saw-tooth roofs

Y N d. Optimizing **daylight penetration** through location of windows in wall, floor to ceiling heights, floorplate configuration, etc.

Y N e. Other: _____

f. # or % included in final design: _____

Y N g. Were any of these features requested by clients?

Y N 5. In the past year, have you considered **passive systems** to augment the electromechanical building systems

⇒ ***If Yes, probe for specifics:***

Y N a. Optimizing the **thermal mass** of building

Y N b. Using **shading** devices and strategies (either on the outside or inside)

Y N c. Considering **solar** gain, night cooling, night flushing

Y N d. Passive **ventilation**

Y N e. Other: _____

f. # or % included in final design: _____

Y N g. Were any of these features requested by clients?

Questions relating to the buildings electromechanical systems:

In the last year, have you sought to:

Y N 6. Design the **lighting system** to be more efficient than required by code or than typically found in similar applications.

⇒ ***If Yes, probe for specifics:***

Y N a. Use **less lights** than typical; use **spot or task lighting** instead of general illumination

Y N b. Specifying occupancy **sensors** or photocells

Y N c. Specifying **controls**, switching strategies, staging sequences, stepped controls

Y N d. Discuss issue with **engineers**

Y N e. Other: _____

f. # or % included in final design: _____

Y N g. Were any of these features requested by clients?

Y N 7. Design the **HVAC system** to be more efficient than required by code, e.g. through system selection and building design:

⇒ ***If Yes, probe for specifics:***

Y N a. **Designing the building** to optimizing the factors that affect HVAC requirements

Y N b. Comparing **different types** of chillers, and alternatives to chillers such as heat pumps, hydronics, radiant heat, waste heat

Y N c. Considering **ventilation rates**, distribution systems, variable fan speeds, and variable air volume (VAV) systems

Y N d. Considering **controls**, e.g., direct digital, integrated, user

Y N e. Discuss issue with **engineers**

Y N f. Use **ASHRAE 90 standards** (90.1 89 and 90.1 99)

Y N g. Other: _____

h. # or % included in final design: _____

Y N i. Were any of these features requested by clients?

Y N 8a. Explored different **water heating** options (e.g., solar, instantaneous heating, heat recovery or reclaim)

b. # or % included in final design: _____

Y N c. Were any of these features requested by clients?

Questions relate to methods and tools you might use:

In the last year have you:

Cl Sf 9a. **Compared options** by estimating **life-cycle cost** savings from downsized equipment, reduced energy use, maintenance, and replacement cost savings

b. # or % included in projects: _____

Y N c. Did any clients request this?

Y N 10. Used **computer models** to simulate building energy use or lighting

⇒ ***If Yes, probe for specifics:***

Y N a. Use of models to **simulate building** energy use, e.g., Energy 10, DOE-2, Energy Sim

Y N b. Use of models to **simulate lighting**, e.g., daylighting models, lighting simulation modes

Y N c. Other

d. # or % included in projects: _____

Y N e. Did any clients request this?

Y N 11. Used **consulting resources**—either people or reference materials—assist with energy efficiency

⇒ ***If Yes, probe for specifics:***

Y N a. **Utility** and government programs, including incentives for energy efficiency

Y N b. Books, **journals, websites**, or CDs with methods or strategies

Y N c. **Consultants—**project-specific or general education

Y N d. Other:

e. # or % included in projects: _____

Y N f. Did any clients request this?

Y N 12. Are there **any** energy efficiency suggestions that you have made in the last year that **we have not covered**?

⇒ ***If Yes, probe for specifics:***

a. Other: _____

b. # or % included in final design: _____

Y N c. Were any of these features requested by clients?

Y N 12.2 In your experience, **have clients been more concerned** about energy during the last three months than they tended to be prior to that?

A+E PARTICIPANTS ONLY:

{If not A+E participant, SKIP to Q14}

13a. **Because of the workshop,** would you say that you suggest to clients these energy-efficiency ideas more frequently or about the same as you did before attending any A+E events?

___ More ___ Same

b. How about **client acceptance**? Would you say that your clients accept these energy-efficiency ideas more frequently or about the same as they did before you attended any A+E events?

___ More ___ Same

b1. **{If more:}** Why do you think this is so? **{Probe to code:}**

Y N You are more persuasive, enthusiastic, knowledgeable

Y N Factors external to workshop influence

c. I'd like for you to rate how **valuable you found** the **A+E** workshops to be in terms of your design work. Please use a scale of 1 to 5, where 1 signifies not at all valuable, and 5 signifies extremely valuable.

1 2 3 4 5

d. **Comments** about A+E:

ALL RESPONDENTS:

14. Please rate your **interest in learning** more about energy-efficient and sustainable design practices using a scale of 1 to 5, where 1 signifies not at all interested and 5 signifies very interested.

a. 1 2 3 4 5 {***If answer = 1 or 2, SKIP to Q15}***

Using a 1-to-5 scale rating desirability, where 1 signifies not at all desirable and 5 signifies highly desirable, rate the following potential educational forums for learning more about energy-efficient and sustainable design practices:

b.	How about from journals	1	2	3	4	5
c.	Books	1	2	3	4	5
d.	The Internet	1	2	3	4	5
e.	A teleconference/ distance learning	1	2	3	4	5
f.	Workshop trainings/ seminars	1	2	3	4	5

⇒ ***If answer = 3, 4, or 5, probe for specifics:***

f1.	Workshop held in your office	1	2	3	4	5
f2.	Workshop held in your community	1	2	3	4	5
f3.	Workshop held in another city	1	2	3	4	5
f4.	Workshop held in conjunction with a professional conference	1	2	3	4	5
f5.	Workshop for a multidisciplinary audience: i.e., gathered together are architects, engineers, lighting designers, contractors, owners, etc.	1	2	3	4	5

15. To what extent do the following factors **limit your ability** to incorporate energy-efficiency features in your design work? Use a 1 to 5 scale where 1 signifies that the factor severely limits your ability to incorporate energy-efficiency features and 5 signifies that the factor is not at all a limitation for you.

a.	Your own interest in energy efficiency features	1	2	3	4	5
b.	Identifying energy-efficient options	1	2	3	4	5
c.	Assessing how well a given option will perform in a specific application	1	2	3	4	5
d.	The availability of products	1	2	3	4	5
e.	Getting the design team to consider energy-efficient options for a project	1	2	3	4	5
f.	Getting the client to consider energy-efficient options for a project	1	2	3	4	5
g.	Providing clients with reliable estimates of the **costs** of incorporating energy-efficient features into a design	1	2	3	4	5
h.	Providing clients with reliable estimates of the **benefits** of incorporating energy-efficient features into a design	1	2	3	4	5
i.	Identify consulting resources or other building professionals necessary to execute energy-efficient design elements	1	2	3	4	5
j.	Code requirements	1	2	3	4	5
k.	Other (describe)	1	2	3	4	5

{PROBING UNAIDED RECALL OF BETTERBRICKS.COM}

Y N 16a. Have you seen or heard any advertising or news stories about a website that provides information on improving employee productivity in commercial buildings? ***{If no, SKIP to Q17}***

b. Where do you recall seeing or hearing the ads that mentioned improving employee productivity by improving workspaces? ***{Check all that apply.}***

Y N b1. Television

Y N b2. Magazines/trade journals

Y N b3. Newspapers

Y N b4. Internet advertising

Y N b5. Other: _____

c. What do you recall seeing or hearing in those ads? ***{code as:}***

Y N c1. "Nailed" the description (eg., said *betterbricks.com* or identified the characters or gave other specifics)

Y N c2. Answer echoed theme of question (improving employee productivity by improving workspaces)

Y N c3. Can't recall or answer spoiled

d. Do you recall the name of the ad sponsor or their website? What is it? ***{code as}***

Y N d1. BetterBricks.com ***{If yes, SKIP to Q18}***

{PROBING AIDED RECALL}

Y N 17a. Have you seen or heard anything about an organization or website called *betterbricks.com*? ***{If no, SKIP to Q19}***

b. Where do you recall seeing or hearing that? ***{Check all that apply.}***

Y N b1. Television

Y N b2. Magazines/trade journals

Y N b3. Newspapers

Y N b4. Internet advertising

Y N b5. Other: _____

c. What do you recall seeing or hearing in those ads? ***{code as:}***

Y N c1. "Nailed" the description (e.g., said *betterbricks.com* or identified the characters or gave other specifics)

Y N c2. Answer echoed theme of question (improving employee productivity by improving workspaces)

Y N c3. Can't recall or answer spoiled

IF RECOGNIZE "BetterBricks.com" NAME, ASK:

{If don't know BB.com, SKIP to Q 21}

Y N 18a. Have you visited the BetterBricks.com website? ***{If No, SKIP to Q19}***

Y N c. Do you intend to use information from the website in your design work?

Y N d. Do you intend to visit the website again?

Y N e. Do you have any suggestions that might make the website more useful? Elaborate:

Y N 19. Do you intend to visit the BetterBricks.com website in the next 2 weeks?

{If Yes, SKIP to Q21}

Y N 20. How about in the next 3 months?

ASK OF NONPARTICIPANTS:

Y N 21a. Have you heard of the Architecture + Energy Awards sponsored by the AIA, Portland chapter to recognize energy-efficient building designs?

{If No, SKIP to Q22}

Y N b. Have you attended any of the award workshops?

{If No, SKIP to Q22}

c. Approximately when was that? _____

⇒ ***COMPLETE Q13***

ALL RESPONDENTS:

Y N 22a. Have you visited the Architecture + Energy website?

{If No, Thank and Terminate. If Yes, ask:}

b. Using a 1 to 5 scale, can you rate how well the website met your expectations, where 1 signifies not at all and 5 signifies fully met or exceeded your expectations? 1 2 3 4 5

Y N c. Do you have any suggestions that might the website more useful? Elaborate:

{Thank and Terminate}

SCREENER OF CONTRACTORS AND DEVELOPERS
ARCHITECTURE + ENERGY, SPRING 2001 EVALUATION

Hello. My name is _____ and I work for Gilmore Research Company. I am calling for the Northwest Energy Efficiency Alliance, which is trying to better understand the activities of firms in the construction and development fields.

I just have a few short questions. ***(If reluctant, ask to speak with an office manager or someone available who can very briefly describe the areas the company works in.)***

1. Does your organization have any involvement in developing or constructing:

   a. Commercial facilities (such as offices, retail space, restaurants)?

      Yes ___ No ___

   b. How about government, health care, or educational facilities?

      Yes ___ No ___

   c. Industrial or warehouse facilities?

      Yes ___ No ___

   d. How about residential space (such as houses, apartments, assisted living)?

      Yes ___ No ___

If Q1a AND Q1b AND Q1c =No, Thank and terminate.

2. Which of the following activities is your organization involved in?

a. Renovation of existing structures (if necessary: renovation is a major remodel)

Yes ___ No ___

b. Remodel of existing structures

Yes ___ No ___

c. New construction (if necessary: construction on a cleared lot)

Yes ___ No ___

3. Does your organization employ any architects?

Yes ___ No ___

⇒ ***If No, thank and terminate***

a. May I have the name of your organization's lead architect?

_____ (probe for first and last names)

b. Is this the right number to call to reach him/her *(or "that person")*?

Yes ___ No ___

If Q2b=Yes: ***Is there an extension? Ext. ____***

If Q2b=No: ***What is his/her phone number and extension?***

_____