

DAYLIGHT DIVIDENDS

FOCUS GROUP RESEARCH PROJECT

Final Report

This Focus Group Research Project Final Report was prepared with the support of the U.S. Department of Energy, under Award No. DE-FC26-02NT41497 and from the California Energy Commission, The Connecticut Light & Power Company, New York State Energy Research & Development Authority, Northwest Energy Efficiency Alliance, Iowa Energy Center and the Lighting Research Center. However, any opinions, findings, conclusions or recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the DOE or other aforementioned parties.

Submitted to: Lighting Research Center

Submitted by: Spectrum Associates Market Research

Date: May 12, 2003

TABLE OF CONTENTS

	<u>PAGE #</u>
MANAGEMENT SUMMARY	i
FINAL REPORT	1
I. BACKGROUND.....	1
II. METHODOLOGY	1
III. RESEARCH OBJECTIVES.....	3
IV. STUDY FINDINGS.....	3
A. FAMILIARITY WITH AND KNOWLEDGE OF DAYLIGHTING.....	4
B. OVERALL FEELINGS ABOUT THE USE OF DAYLIGHTING	6
C. PERCEPTIONS OF WHO MAKES THE DAYLIGHTING DECISION	12
D. PERCEPTIONS OF THE KEY FACTORS DRIVING THE DAYLIGHTING DECISION	15
E. PERCEPTIONS OF THE MAJOR BENEFITS DERIVED FROM DAYLIGHTING.....	19
F. PERCEPTIONS OF THE MAJOR BARRIERS TO DAYLIGHTING AND STRATEGIES TO OVERCOME THESE BARRIERS	27
1. <i>Perceived Barriers</i>	27
2. <i>Participants' Suggestions for Strategies to Overcome Perceived Barriers</i>	37
3. <i>Perceived Effectiveness of LRC Suggestions for Strategies to Overcome Perceived Barriers</i>	40
G. CURRENT AND DESIRED SOURCES OF INFORMATION ON DAYLIGHTING	43
1. <i>Current Information Sources</i>	43
2. <i>Desired Communications Strategies</i>	46
3. <i>Reactions to LRC List of Possible Communications Strategies</i>	47

APPENDIX: MODERATOR'S DISCUSSION GUIDE

MANAGEMENT SUMMARY

BACKGROUND

The Daylight Dividends program was designed to increase the use of daylighting to improve indoor environmental quality and reduce electric lighting energy use. The Lighting Research Center (LRC) is coordinating the Daylight Dividends partnership. The partnership is lead by the U.S. Department of Energy and the New York State Energy Research and Development Authority, and partners include California Energy Commission, Connecticut Light & Power, Iowa Energy Center, and the Northwest Energy Efficiency Alliance.

Spectrum Associates was retained by LRC to conduct a series of focus groups to explore barriers to using daylighting in commercial, industrial and institutional buildings, and to identify ways to overcome these barriers. This document highlights the key findings and implications of the focus group study. A comprehensive presentation of the study findings follows the Management Summary.

METHODOLOGY

Spectrum Associates conducted five focus groups with a total of 48 participants. Specifically:

- ◆ two groups were conducted with building designers (i.e., architects, consulting engineers and lighting designers), one each in New York City and Portland, Oregon;
- ◆ two groups were conducted with “end-customers” of daylighting (i.e., building owners, developers and managers), one each in Charlotte, North Carolina and Des Moines, Iowa; and
- ◆ one group, held in Orange County, California, included a mix of building designers and end-customers.

All five focus groups were held in March 2003 and were moderated by Dr. Eliot Hartstone, president of Spectrum Associates. Dr. Hartstone used a moderator’s discussion guide that was prepared by Spectrum Associates with assistance from and approval by LRC.

RESEARCH OBJECTIVES

The research objectives for the focus groups were to explore participants':

- ◆ Familiarity with and knowledge of daylighting.
- ◆ Overall feeling about the use of daylighting.
- ◆ Perceptions of who makes the daylighting decision.
- ◆ Perceptions of the key factors that determine whether daylighting should be used in designing a new building.
- ◆ Perceptions of the major benefits derived from using daylighting.
- ◆ Perceptions of the major barriers to using daylighting, and thoughts on effective strategies to overcome these barriers.
- ◆ Sources of information on daylighting, and suggestions on ways the U.S. Department of Energy and other agencies should get the word out about new advances in daylighting.

KEY FINDINGS

Familiarity with Daylighting

1. All participants indicated they were familiar with the term “daylighting,” and said that it referred to bringing natural light into a building. About one-half of the participants took it a step further and said that by bringing in natural light, daylighting reduced the need for artificial light.

Overall Feeling About Daylighting

2. The overwhelming majority of designers and end-customers were positive, overall, about designing buildings to make widespread use of natural light.
3. Designers (3/4 “very positive”) were more favorable than were end-customers (2/5 “very positive”), and Portland designers (9 of 10 “very positive”) were the most favorable of any of the focus group sessions.

Who Makes Daylighting Decision

4. The final decision about using daylighting is a financial decision made by building owners/developers. However, designers frequently provide the inspiration for daylighting, and often it is their explanation of its benefits that overcome the owners'/developers' reluctance to spend the money needed for daylighting.

Key Factors Driving Daylighting Decision

5. Participants said that a main factor impacting the daylighting decision for a specific building is the desired use of the building, as some uses preclude daylighting and other uses benefit from daylighting. Other major factors cited were: the costs involved (capital costs required, and energy savings expected); the site location of the building (e.g., access to natural light, safety concerns); geographical location (e.g., West Coast most receptive); the time of day the building is being used; the need for security and privacy; the aesthetic fit with the surrounding buildings; and concerns about structural integrity.
6. Building uses that were described as favorable for daylighting were: schools; health care facilities; some types of offices; and manufacturing, retail and wholesale space. Building uses that were described as unfavorable for daylighting were: offices with many computers; “big box” retail stores; specific areas in hospitals (e.g., surgery and x-ray rooms); research and laboratory facilities; military buildings; performance arts centers; sports facilities; art exhibits; and casinos.

Major Benefits of Daylighting

7. Participants said the major benefits of daylighting are: (a) the occupants of the building feeling better/more comfortable; (b) reduced energy consumption (i.e., less energy used and lower energy expenses); (c) increased employee productivity, including higher sales for retail stores; (d) improved building appearance/aesthetics; and (e) the increased marketability of the building to tenants or buyers.

8. A comparison across designers and end-customers reveals that designers focused primarily on the occupant's comfort and reduced energy consumption, while end-customers often emphasized benefits that directly impacted the owner/developer financially – increased productivity, improved building aesthetics, and increased marketability of the building.

Major Barriers to Daylighting

9. Participants said the greatest barrier to the expanded use of daylight is the capital costs involved (e.g., daylighting has very high upfront costs), and the second largest hurdle is problems with technology (e.g., daylighting requires a lot of technology which has yet to be perfected resulting in high maintenance costs).
10. Other important barriers raised by participants were: safety and security; the building's site location and access to sunlight; inconsistency in lighting across the building and during the course of the day; the added design/financial risks posed by using daylighting; confusion about daylighting to end-users; and overcoming the mindset of those involved.
11. Capital costs and technology problems/maintenance costs were viewed as the key barriers by both designers and end-customers. However, end-customers were more likely to emphasize concerns about safety and security and technology/maintenance costs, and designers were more likely to emphasize site location, confusion on the part of end-customers about the benefits of daylighting, the perceived added risks involved in daylighting since it is still a new approach to designing buildings, and the complications involved in designing daylighting.

Ways to Overcome Barriers to Daylighting

12. Participants' unaided suggestions for overcoming barriers to daylighting included:
 - Develop better and less expensive technology to address shading, dimming, heat gain, HVAC, glare, glazing and cleaning; and increase testing on new products before bringing them to market.
 - Increase education of professionals and end-users (e.g., describe daylighting options available, and show examples of daylighting working).

- Provide financial incentives for installing daylighting (e.g., tax abatement, utility rebates, and grants).
 - Conduct more research on benefits of daylighting (e.g., definitive research on productivity).
13. Participants' reactions to nine different strategies for overcoming barriers to daylighting revealed that end-customers feel that substantiated proof of increased productivity would be the most effective strategy, while designers reacted most positively to better communications of benefits to owners/developers and developing better lighting controls and daylighting design tools for architects and engineers.

Current Information Sources on Daylighting

14. Participants said they most often get their information about daylighting from industry publications. Other current information sources are: word-of-mouth from engineers, architects, and lighting consultants; professional associations; seminars; Web sites; sales people/vendors; looking at buildings; trade shows; and studying for the lighting consultant examination.

Desired Communications Vehicles on Daylighting

15. While participants most often get their information through publications, responses to questions about preferred information sources revealed participants would like to be informed about new developments in daylighting through seminars, particularly those offering continuing education credits.
16. Participants also suggested informing them about upcoming seminars via e-mail, keeping the seminars short, and providing information on capital and maintenance cost implications. In addition to seminars, participants expressed interest in a dedicated Web site, e-mails, publications, experts speaking at conferences, and face-to-face meetings on new projects.

IMPLICATIONS

- 1. Designers and end-customers see considerable potential benefit to daylighting and, as such, there appears to be a great opportunity to significantly increase the use of daylighting. However, major barriers exist to daylighting expansion and much work is needed for this to occur.**

The five focus groups revealed that designers and end-customers are positive about the potential of daylighting as they see many benefits to its use (e.g., occupants of the building feeling better/more comfortable and being more productive, reduced energy consumption, improved building appearance/aesthetics, and increased marketability of the building).

However, the focus groups also revealed several critical barriers to expanding the use of daylighting, and suggest that the increased use of daylighting will not occur unless these obstacles are clearly identified, understood, and addressed.

- 2. Many participants seemed to lack sophistication on the way in which daylighting uses natural light to achieve its goal. Education is needed in this area.**

Participants typically referred to view windows and skylighting accessing direct light, and rarely discussed harvesting diffuse light to avoid the problems of glare and overheating. More education is needed on the manner in which natural light is used in daylighting.

- 3. While building owners, developers and managers are often positive about the concept of daylighting, financial considerations often result in their rejecting the use of daylighting for their buildings. As such, efforts to increase daylighting need to address building owner/developer fiscal concerns.**

Our research suggests that designers are much more favorable about daylighting than are building owners, developers, and managers, due to their concerns about capital and maintenance costs associated with daylighting. Since building owners/developers were found to be the key decision-makers, efforts to expand the use of daylighting must address their concerns. Specifically, building owners/developers need to be educated on the: (a) potential for minimizing capital cost increases by

committing to daylighting early in the design process; and (b) different ways they can achieve a return on their daylighting investment. It does not appear that appealing to more altruistic benefits derived from daylighting would be effective.

4. We believe it is critical to provide ammunition to designers that they can use in their efforts to “sell” daylighting to building owners/developers. Such ammunition must effectively address the owners’/developers’ concern about capital cost and return on their investment.

Clearly, the final decision about using daylighting is typically made by the building owners/developers. However, designers typically are the ones who raise the option of using daylighting to building owners/developers and the effectiveness of their argument is often critical in owners/developers agreeing to use daylighting. As such, we believe a key factor in expanding the use of daylighting is providing designers with a strong case to address owners’ fiscal concerns by documenting ways to minimize capital cost expenditures and achieve a high return on the their investments. Specifically, ammunition for designers could include: substantiated proof that daylighting increases occupants’ productivity, including proof that daylighting increases retail sales; documentation on improved technologies that have eliminated or reduced maintenance problems and minimized maintenance costs; documentation of lower energy costs achieved through daylighting; and proof that daylighting increases the marketability of the building (sales and rental).

5. Efforts to expand the use of daylighting must also focus on advancing daylighting technologies. Part of the technology development process must include thoroughly testing new products and technologies before bringing them to market.

Focus group participants stated the need to improve daylighting technologies to overcome barriers to expanding the use of daylighting. Clearly, participants with hands-on daylighting experience have observed many technology problems. Some commented on technology problems resulting in daylighting systems being turned off by the end-user. Specifically, participants feel new technologies and products are needed to address shading, dimming, the connection of shading and lighting controls, heat gain, glare, glazing, and HVAC. Moreover, it is important to thoroughly

test new technologies and products before bringing them to market to avoid problems after the daylighting system is installed.

6. Efforts to increase the use of daylighting must keep in mind that the use and location of the building determines whether a specific building is a good candidate for daylighting or not.

Participants in all five groups said that a main factor impacting the daylighting decision is the desired use of the facility. We believe efforts to encourage daylighting for buildings with specific uses inconsistent with daylighting would not only be unsuccessful, but also counterproductive to expanding the use of daylighting. Specifically, efforts to increase the use of daylighting should not be directed at: computer centers, specific areas in hospitals (e.g., surgery and x-ray rooms), research and laboratory facilities, military buildings, performance arts centers, sports facilities, art museums and galleries, and casinos.

In addition to building use, site location can also be a critical deterrent to daylighting. Specifically, daylighting should not be sought for buildings in areas with many high-rise buildings or in high crime areas.

7. Currently, designers and end-customers appear to have limited access to information on daylighting and rely mostly on publications. Efforts to increase daylighting require more systematic and diverse efforts to inform and educate target markets. It appears the most effective communications strategies would be holding daylighting seminars that offer continuing education credits, and developing a dedicated Web site.

Focus group participants said they most often get their information about daylighting from industry publications. However, participants said ideally they would get new information on daylighting through seminars, particularly those offering continuing education credits. The focus groups suggest that an excellent compliment to the seminars would be a dedicated Web site that provides: information on new products, pictures of buildings using daylighting, testimonials, utility costs, virtual tour of buildings using daylighting, and a calculator for determining expected savings on energy consumption.

FINAL REPORT

I. BACKGROUND

The Daylight Dividends program was designed to increase the use of daylighting to improve indoor environmental quality and reduce electric lighting energy use. Daylight Dividends includes: (a) educating the market on the benefits of daylighting to increase market demand; (b) enhancing technological capabilities and addressing barriers to daylighting; and (c) facilitating a pervasive implementation of daylighting (e.g., public benefit programs, educational programs, and implementation of resource acquisition programs).

The Lighting Research Center (LRC) is coordinating the Daylight Dividends partnership. The partnership is lead by the U.S. Department of Energy and the New York State Energy Research and Development Authority, and also includes the California Energy Commission, Connecticut Light & Power, Iowa Energy Center, and the Northwest Energy Efficiency Alliance.

Spectrum Associates was retained by LRC to conduct a series of focus groups to explore barriers to using daylighting in commercial, industrial and institutional buildings, and to identify ways to overcome these barriers. This document presents the findings from the focus group study.

II. METHODOLOGY

Spectrum Associates conducted five focus groups with a total of 48 participants. Specifically:

- ◆ two groups were conducted with building designers (i.e., architects, consulting engineers and lighting designers), one each in New York City and Portland, Oregon;
- ◆ two groups were conducted with “end-customers” of daylighting (i.e., building owners, developers and managers), one each in Charlotte, North Carolina and Des Moines, Iowa; and

- ♦ one group was held in Orange County, California with a mix of building designers and end-customers.

All participants in the focus groups were screened to meet eligibility qualifiers developed by LRC. Specifically:

- ♦ All consulting engineers were electrical or mechanical engineers who frequently worked with architects and/or building owners in designing buildings, and worked on more than 25 commercial/institutional/industrial projects in the past five years.
- ♦ All architects frequently worked with building owners to determine the lighting design of new buildings, and worked on more than 25 projects in the past five years.
- ♦ All building owner representatives had responsibility for making decisions about the building design investments for their company, and had responsibility for making these decisions for at least 100,000 square feet of building space in the past five years.
- ♦ All building developer representatives worked with architects and/or building owners in determining what buildings will look like and include, and participated in such projects for at least 100,000 square feet of building space in the past five years.
- ♦ All building managers had property management decision-making responsibilities for their company including energy management decisions, and had responsibility for at least 100,000 square feet of building space.

The Daylight Dividends program partners provided names of possible focus group participants in New York, Portland, and Des Moines. These groups included a mix of participants recruited from the lists, facility databases, and yellow page directories. Daylight Dividends program partners did not provide names for the Orange County or Charlotte focus groups. Participants received an honorarium ranging from \$150 to \$200, depending on the city, for participating in the two-hour focus group.

All five focus groups were held in March 2003 and were moderated by Dr. Eliot Hartstone, president of Spectrum Associates. Dr. Hartstone used a moderator's discussion guide that was prepared by Spectrum Associates with assistance from and approval by LRC. A copy of the discussion guide is provided in the appendix.

III. RESEARCH OBJECTIVES

The research objectives for the focus groups were to explore participants':

- ◆ Familiarity with and knowledge of daylighting (Section IV.A).
- ◆ Overall feeling about the use of daylighting (Section IV.B).
- ◆ Perceptions of who makes the daylighting decision (Section IV.C).
- ◆ Perceptions of the key factors that determine whether daylighting should be used in designing a new building (Section IV.D).
- ◆ Perceptions of the major benefits derived from using daylighting (Section IV.E).
- ◆ Perceptions of the major barriers to using daylighting, and thoughts on effective strategies to overcome these barriers (Section IV.F).
- ◆ Sources of information on daylighting, and suggestions on ways the U.S. Department of Energy and other agencies should get the word out about new advances in daylighting (Section IV.G).

IV. STUDY FINDINGS

Word of Caution

Spectrum Associates cautions the reader to keep in mind that the study was conducted using qualitative research methods and, as such, the findings can not be statistically extrapolated from the sample to the target populations. Rather, the reader should use the findings in the spirit in which they are intended -- to provide *indications* of the behaviors, attitudes and opinions of end-customers and designers.

A. Familiarity With and Knowledge of Daylighting

Participants were asked if they were familiar with the term “daylighting,” and to write down their understanding of the term daylighting. We found:

- ◆ All 48 focus group participants said they were familiar with the term daylighting.
- ◆ When asked to write down what the term daylighting meant, we found:
 - Virtually all participants referred to using “natural light” or “sunlight” inside of buildings.
 - About one-half of the participants only referred to using natural lighting in the building, and about one-half gave a definition that also included energy conservation as a reason for using natural light (e.g., reduce dependence on artificial light, reduce energy costs, or way of replacing electrical lighting).
 - Portland and Des Moines participants were the most likely to refer to energy conservation.

Representative verbatim responses from those recorded by participants are provided below.

Use of Natural/Sunlight

Designers

- “Use of sunlight indoors.” (Portland)
- “Using natural light to illuminate space.” (Portland)
- “Using ambient light to supplement a building lighting system.” (Portland)
- “Luminance provided via the sun.” (New York City)
- “Borrowing and/or using natural source, the sun, for lighting an indoor environment.” (New York City)
- “Incorporating natural light into the interior environment.” (New York City)
- “Using light from the sun to illuminate interior spaces.” (New York City)
- “Bringing natural light (sunlight) into a space.” (New York City)
- “Lighting an interior with natural and artificial light.” (New York City)

- “The use of natural light to illuminate interiors.” (New York City)
- “The effect of introducing natural light into enclosed areas.” (Orange County)
- “Clear unobstructed direct lighting.” (Orange County)
- “Opening to the outside world. Observation of passage of time.” (Orange County)
- “Natural light created into a space or area.” (Orange County)

End-customers

- “Daytime/natural lighting.” (Charlotte)
- “Natural light in a building.” (Charlotte)
- “The process to allow natural light into a building.” (Charlotte)
- “Natural light.” (Charlotte)
- “Using exterior light to illuminate interior building space.” (Charlotte)
- “Natural light, not man-made.” (Charlotte)
- “Natural light in a building.” (Charlotte)
- “Light created by sun, natural light.” (Charlotte)
- “Dawn to dusk, natural light.” (Charlotte)
- “Natural sunlight.” (Charlotte)
- “The use of natural lighting in the workplace.” (Des Moines)
- “Use of natural light in the office environment.” (Des Moines)
- “Admission of natural lighting to the interior of a building.” (Des Moines)

Reduce Energy Consumption

Designers

- “Maximize the effective use of natural light in order to reduce the dependence of artificial light.” (Portland)
- “Use of natural light to illuminate interior space and control of electric light to prevent use when daylight is present.” (Portland)
- “The introduction of natural light into a space to enhance character, color, experience, etc. while reducing dependency on electrical light.” (Portland)
- “Providing natural light in a building to augment or eliminate the need for false lighting.” (Portland)
- “Use of natural lighting to provide some or all of the illumination in a space.” (Portland)

- “Bringing daylight into a space as a way of adding or replacing electrical lighting.”
(New York City)

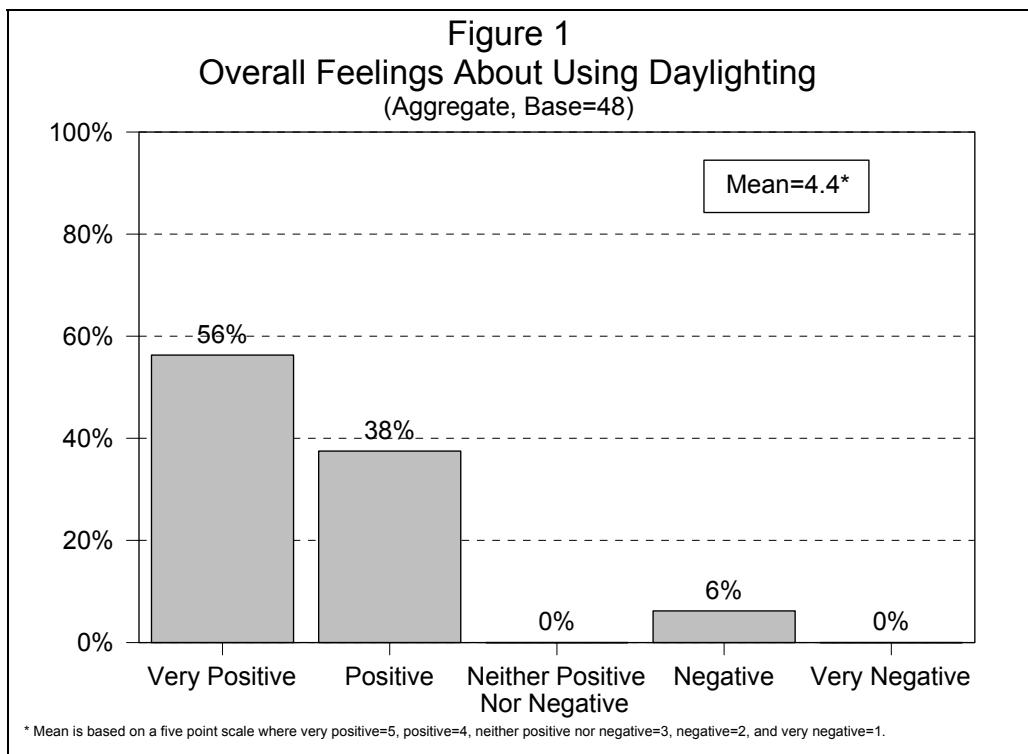
End-customers

- “Use of natural light or windows to replace or supplement artificial light.” (Des Moines)
- “Lighting spaces with natural daylight in order to eliminate or reduce artificial lighting.”
(Des Moines)
- “Use of natural lighting to supplement and/or replace artificial light as an energy conservation measure.” (Des Moines)
- “Using natural light to reduce energy costs. Provide natural lighting to an interior setting.” (Des Moines)
- “Using outside “daylight” to either accent an area with light or provide an area with light. In some cases, lighting controls are used to increase or decrease light.”
(Des Moines)
- “Using daylight to supplement lighting for office use in lieu of light fixture lighting.”
(Orange County)
- “The use of outside ambient light to reduce energy within a building.” (Orange County)

B. Overall Feelings About the Use of Daylighting

The moderator told participants that the working definition of daylighting to be used during the focus group was “designing buildings to make widespread use of natural light.” Participants were then asked to write down: (1) their overall feelings about the use of daylighting (i.e., very positive, positive, neither positive nor negative, somewhat negative, or very negative), and (2) the main reason why they felt the way they did about using daylighting. Participants were asked the reasons for their ratings, but this discussion was kept very brief to avoid redundancy when asking participants to list and discuss the perceived benefits of daylighting later in the focus group.

Figure 1 displays the overall reactions to using daylighting expressed by the 48 participants across the five focus groups.



As shown in Figure 1:

- ◆ Participants' overall reaction to daylighting was typically favorable.
- ◆ The majority of participants (56%) said they were "very positive" about daylighting, and almost all others (38%) were "positive." Only three (6%) of the 48 participants said they were "negative" about daylighting.
- ◆ The mean rating on a 5 point scale was 4.4.

Figure 1a displays the overall reactions to using daylighting broken out by designers (i.e., architects, consulting engineers and lighting designers) and end-customers (i.e., building developers, owners and managers).

Figure 1a
Overall Feelings About Using Daylighting
(By Segment)

	Mean *	Very Positive	Positive	Neither Positive Nor Negative	Negative	Very Negative
End-Customers (Base=23)	4.1	9	12	0	2	0
Designers (Base=25)	4.6	18	6	0	1	0

* Mean is based on a five point scale where very positive=5, positive=4, neither positive nor negative=3, negative=2, and very negative=1.

As shown in Figure 1a:

- ♦ While both designers and end-customers indicated they were favorable about daylighting, designers were more favorable than were end-customers.
- ♦ Specifically:
 - Almost three-fourths of the 25 designers, while about two-fifths of the 23 end-customers said they were “very positive” about daylighting.
 - Designers had a mean rating score for daylighting of 4.6 vs. 4.1 for end-customers.

Figure 1b breaks out ratings by location.

Figure 1b
Overall Feelings About Using Daylighting
(By Location)

	Mean *	Very Positive	Positive	Neither Positive Nor Negative	Negative	Very Negative
End-Customers						
Charlotte (Base=10)	4.4	4	6	0	0	0
Des Moines (Base=10)	4.5	5	5	0	0	0
Designers						
New York City (Base=10)	4.4	6	3	0	1	0
Portland (Base=10)	4.9	9	1	0	0	0
Mixed						
Orange County (Base=8)	3.9	3	3	0	2	0

* Mean is based on a five point scale where very positive=5, positive=4, neither positive nor negative=3, negative=2, and very negative=1.

As shown in Figure 1b:

- ◆ Participants in the Portland designer focus group were clearly the most favorable about daylighting (mean = 4.9; and 9 of 10 “very positive”).
- ◆ Participants in the Orange County focus group were the least favorable (mean = 3.9, and 2 of 8 were negative).

Responses to the question on the reasons behind participants’ feelings about daylighting revealed the following:

- ◆ Participants who were positive about daylighting listed a wide variety of reasons for this assessment, including:
 - saving money and enhancing the environment via energy conservation;
 - enhancing the interior space (e.g., the quality and warmth of natural vs. artificial light; and changing its color, intensity and focus); and
 - benefiting the people who work in the building physically and psychologically.

- ◆ Participants who were negative, overall, or who volunteered concerns when asked about their overall feelings said:
 - it is expensive (capital and maintenance costs);
 - there are many places daylighting can not be used;
 - it creates inconsistency in lighting the building;
 - it requires a lot of design work;
 - it is difficult to do well, which can lead to costly mistakes; and
 - there is a tendency to cut costs and corners which can create various problems (e.g., HVAC).

Representative verbatim responses are provided below.

Why Positive About Daylighting

Designers

- “Daylight is the substance of life. Without it you don’t have anything.” (Portland)
- “It’s dynamic. It changes so it adds another variable to the space in designing it. It could be a change in color, change in intensity, change in focus.” (Portland)
- “Because it enhances our environments.” (Portland)
- “Physiologically and psychologically. It effects our mood and how we work and how we participate. It even changes performance and the growth level that night does.” (Portland)
- “Using daylight sources reduces our dependence on electricity and other energy sources.” (Portland)
- “Number one would be the financial aspects of energy conservation.” (New York)
- “It provides significant psychological benefits to the occupants. Sense of well-being and daylight and changing time of day.” (New York)
- “Quality of light. It’s the most natural lighting. As opposed to fluorescent, it is a warmer.” (New York)
- “Energy conservation.” (New York)

- “I was very positive. I use daylighting in most of my buildings, particularly in automobile dealerships. When we are inside buildings and exposed to unnatural light, it tends to inhibit us, irritate us and I think that natural light brings out more of the internal being, the natural human. We feel better in natural light.” (Orange County)
- “I wrote down it’s a psychological boost. You’re more aware of the surroundings if you’re in a cubicle or somewhere. You’re not boxed in.” (Orange County)
- “It’s kind of conceptual with the outside. I also added that it provides contrast and a little variety in space with colors, shadows and those kinds of things. The brightness levels.” (Orange County)

End-customers

- “There are numerous advantages including conservation.” (Charlotte)
- “Cost-effective. Just less power. You’re utilizing less power. Therefore, it’s more cost-effective.” (Charlotte)
- “People prefer it; customers and tenants.” (Charlotte)
- “It’s aesthetically more pleasing.” (Charlotte)
- “It provides a better working environment.” (Charlotte)
- “It lets you see outside and it softens the interior . . . I always like to know what the weather is so all I have to do is look up and see.” (Des Moines)
- “I think it has a positive effect on personnel, especially in the workplace for more efficiencies.” (Des Moines)
- “More comfortable, more natural.” (Des Moines)
- “I like natural light. I think it creates a wonderful environment because I think people feel more comfortable with it. Psychologically, I think it is a plus.” (Des Moines)

Why Negative About Daylighting

Designers

- “Because I think of places where it wouldn’t work . . . and it is not very cost-effective.” (New York)

End-customers

- “At some point in time in creating natural lighting in the building one has to begin to think about (maintenance and operations) costs. So the business aspects sometimes dictate and so not quite very positive and just positive.” (Des Moines)
- “I think when it is done correctly it is very positive. Daylighting takes a lot of design effort to make everything come together correctly. If it is not done with a total building then there are a lot of mistakes that can be made and most of them got to be fixed.” (Des Moines)

- “It’s very expensive. It’s more expensive because it’s more circuits to put in and no one ever uses it. I will agree that daylight does make you feel better, but in an office with a task function, a consistency of lighting is generally viewed as more important than the variants. For automobile dealerships or something like that, that’s a whole different issue.” (Orange County)
- “First of all, the construction of the building, a lot of times the ownership and investors don’t put in the right amount of money to put the proper glass in and there is heat load coming in. You have to stay six feet away from the window in the summertime because it’s just too hot. That’s my main problem with that and then that increases your heat load.” (Orange County)

C. Perceptions of Who Makes the Daylighting Decision

Participants were asked who they believed typically has the greatest role in making the daylighting decision. We found:

- ◆ Most participants feel the final decision is made by the building owner or developer, as the decision on daylighting is primarily a financial one.
- ◆ Many participants said that the designers can impact the decision by advocating for daylighting and explaining the benefits of daylighting to the owner to overcome their typical resistance to absorbing the added costs of daylighting.
- ◆ Participants indicated that while the idea of using daylighting usually emanates from the designers, there are instances where it is the owner who actually instructs the architects and designers to design a building with daylighting (e.g., owner wants a “green building,” a signature building, or an atrium, and instructs the designers accordingly).

Designers

- “Typically, we are providing a building or a design for an end-user and that end-user should ultimately have the say on the components of the daylight system. I don’t think it comes up unless the architect brings it up and drives it. The architects may not be the decision-maker, but if they don’t mention it, it doesn’t come up.” (Portland)
- “I think the inspiration starts with the design professionals.” (Portland)
- “Daylighting I think starts with the design professionals (but becomes a financial decision).” (Portland)
- “The owner has the budget set in his mind of what he wants to do and he hires the developer. What is cost-effective to him to operate that building is the decision he needs to make. So at the end of the day, he is going to make the decision but the professional can help him make that decision by doing several studies. There are a lot

of cost factors involved Daylighting does a lot of (good) things, but (often) the bottom line for the owners is that I don't want to spend the money." (New York)

- "I think it's collaborative, but the professionals have to present the idea to the owner. You have the buy in from the professionals, the architects, the engineers and kind of pitch it to the owner. It won't work without a buy in from the other end." (New York)
- "I think it becomes on the owners itself. Some owners want a signature building. (And, in this case) that owner is going to get an architect to come over and design daylighting, no matter how much money it is." (New York)
- "If we are trying to get certified like a DOT building or Green building, sometimes you need some daylighting to get some credits. And that way the owner would want the building to be recertified. In that case (the owner is the one who wants) daylighting." (New York)
- "You get a certain amount of light in the building and you get credit for that. There is different credits if you receive materials this way but one of the credits is daylighting. It is usually the owner (seeking these credits)." (New York)
- "I think it is more often-times not particularly owner-driven. The projects I worked on for daylighting is not something we really talked about. It's something you have to kind of sneak in private. So I think it tends to be from my experience more design-team driven than owner-driven." (New York)
- "I think the owner doesn't even think to go there and I think it is the architects' or team's responsibility to make a pitch for it if someone is going to benefit the building or the occupants and more than likely the owner might be resistant to the idea because of upfront costs or for engineering that is required for upfront costs and design costs and building costs. But it is up to the team to put together the cost analysis to say that long term it might be a savings." (New York)
- "It's also a geographic culture driven decision too. On the East Coast, there is not as much focus on daylighting but if you are working on the West Coast it is much more in the forefront, the issues with the building design and using an energy code that is the same in Europe where a lot of the buildings revolve around a lot of clean corporation and daylighting. It is just you have tall buildings and it is compact and you don't really get much benefit from daylighting in an urban setting." (New York)
- "Office buildings that we have worked on that are high rise, it is never an issue to talk about daylighting. It is just not at the table to discuss but I think today she might be saying the building in California they had an energy crisis, that is one of the things that is going to come to light. There is a strict code in New York State as well, but unless you are trying to go for certain credits for prestige of the project, there are ways for you to get around the fact that if your building owner does not want daylighting then you really don't have to use it." (New York)
- "The owners are going to stomp me down, but they're going to have a hard time doing it. They come in, they tell you what they want and then you try to tell them what they need or what your interpretation of it is. If you feel strongly about daylighting - and I do - then I'm going to push hard. . . . I get my way a few times, but ultimately it's going to be the pocketbook that makes the decision." (Orange County)
- "I've (had daylighting) requested by the owner." (Orange County)
- "I think it's a job that architects try to sell actually." (Orange County)

- “It’s almost always the same scenario. We do a lot of resort work. It always comes down to the same thing. We get a hotel in - and again, that would be area. We did one in Palm Springs where the client came and said, ‘This is going to be an atrium hotel, but it was the client that dictated that to us. The client made the decision ultimately, whether it’s an automobile dealership or hotel, it still comes down to them.’” (Orange County)

End-customers

- “My application normally is industrial so my guys are looking at the basic unit cost of everything. They can get a wall in their factory that’s 250 feet long and it has no windows in it and it costs this versus a window up high which provides daylighting only and substitutes for light fixtures and the first cost is higher because the penetrations and the tilt-up panels would cost ‘X’ much more. And it affects their lease rate or their initial cost. Sometimes they’re less likely to take that space Sometimes (daylighting) is immediately dismissed; but other times, if it’s presented proper . . . they then consider it.” (Charlotte)
- “The designers could pitch the advantages because in the long term, I think there are significant advantages.” (Charlotte)
- “I think designers are the first line. I rely on them to come with the latest research and at least present the coolest ideas.” (Charlotte)
- “I guess because we’re more The companies that I’ve done . . . we own the shopping centers and then we build our own so design plays a big part of it. Then the architect kind of answers to the developer, but we’re also the owner.” (Charlotte)
- “Owner for us makes the decision.” (Des Moines)
- “It would be owner-driven.” (Des Moines)
- “It is probably in conjunction with ownership and design and professional design. Well, the architect has an idea of the type of structure based upon what you are planning to construct. But the owner has his definite inputs on the architect.” (Des Moines)
- “The electrical engineer and the energy aspect come into play too, but it is primarily the owner. I think the architect translates the owner’s vision of the property and project into the use of space and the use of light. That is his job or her job.” (Des Moines)
- “Sometimes it is the architect’s idea initially, and then it is whoever buys into it.” (Des Moines)
- “In my experience, architects involved in residential projects which are concerned about people living in the space often introduce this issue and corporate in what they are doing but I have rarely ever seen it introduced on commercial outage. It’s a by-product. Unless it is a very sophisticated hospital or institutional building or something like that where they get into a lot of nuances but the basic office retail projects I can’t remember when the architect said to me, ‘By the way, you ought to reconsider the orientation of this building so we can introduce more natural light.’” (Des Moines)
- “I think my real collaborative effort in my experience is that we start out saying we really want to see a lot of daylight in this building and the architect comes back with something and we really like that, however, the financial when it comes down to

meeting the budget, that is when we end up taking things out. That is the frustrating thing about it.” (Des Moines)

- “The one who is spending the money.” (Orange County)
- “The developer, the owner makes the decision.” (Orange County)

D. Perceptions of the Key Factors Driving the Daylighting Decision

Participants were asked what were the key factors they look at in deciding when daylighting is or is not desirable for a specific building. We found the following:

- ◆ Participants said a main factor impacting the daylighting decision is the desired use of the facility, as some uses preclude daylighting and other uses would benefit greatly from daylighting.
- ◆ Other major factors cited as impacting the desirability of daylighting were:
 - The costs involved (capital costs required, energy savings expected).
 - The site location of the building (e.g., access to light may be impacted by other tall buildings, the building’s position relative to the sun impacts the intensity of light that enters into the building, some buildings are in areas where safety is a factor, and some buildings are in areas where street noise is a factor).
 - Geographical location of the building (e.g., greater receptivity to daylighting on the West Coast; some areas receive too much sun/heat to use daylighting).
 - Time of day the building is being used (e.g., light not available for buildings used in the evening).
 - The building’s need for security and privacy (e.g., can improve security for some buildings by providing visibility of surrounding areas, but decrease security and/or privacy for others by enabling outsiders to see inside the building and providing easier access to break into the building).

- Aesthetic fit with the surrounding buildings (e.g., will a building designed for daylighting fit in with surrounding buildings?).
 - Concern about structural integrity or strength of the building.
- ◆ With regard to building use, participants listed those uses which lend themselves to daylighting and those that do not. Specifically:
 - Building uses that were described as favorable for daylighting were:
 - ✓ Schools and classrooms (students benefit from using natural light, schools are used mostly in the day hours, increase teacher's ability to observe what is going on outside the building).
 - ✓ Health care facilities (patients benefit from psychological aspect of natural light).
 - ✓ Some types of offices (employees feel better and are more productive/efficient).
 - ✓ Manufacturing, retail and wholesale (employee productivity goes up, sales go up).
 - Building uses that were described as unfavorable for daylighting were:
 - ✓ Offices with many computers (e.g., glare on the computers).
 - ✓ “Big box” retail stores (e.g., too large for effective daylighting, goal is to keep these buildings simple, don't want to distract shoppers).
 - ✓ Specific areas in hospitals (e.g., surgery, x-ray).
 - ✓ Research and laboratory facilities often need to keep the light out.
 - ✓ Military buildings due to their security needs.
 - ✓ Performance arts centers (shows are often held in the evening).
 - ✓ Sports facilities (changing nature of light coming in, and light can get in players' eyes).
 - ✓ Art exhibits (need to control lighting on art work).
 - ✓ Casinos (don't want people to know time of day).

Representative verbatim responses on buildings that do and do not lend themselves to daylighting are provided below.

Buildings Suitable for Daylighting

Schools

- “Classrooms.” (Portland)
- “If you are designing a school you might want to try to get as much natural light into the classrooms as possible. Because the students would probably benefit from it instead of sitting under fluorescent lights. They benefit from having some connection to the outside.” (New York)
- “And also in the school, kids are in school exactly at the prime hours of daylighting where building office workers are there in the winter time and it is probably dark at 4:15 p.m. so you don’t have that.” (New York)
- “Educational facilities. I think students find it a better learning environment if there’s natural light involved. Who wants to be stuck in a room like this trying (to do schoolwork) . . . I just think it lends itself better if there was daylighting or natural light in the room.” (Charlotte)
- “I think the productivity increases (in schools) with natural light, that is what studies have shown.” (Des Moines)

Retail Stores

- “So they can show their products.” (Orange County)
- “Daylight is the most perfect light to bring out the colors and full spectrum of light to bring out the colors in retail goods. Even in a retail center, they’ll use lighting that emulates daylight to be able to bring out all the colors in the fabrics.” (Orange County)

Health Care Facilities

- “Health care because of the psychological benefits of the patients. For the healing process.” (New York)

Some Types of Offices

- “Offices. I would say yes (good space for daylighting). I know there have been some studies that says it does increase office workers’ efficiency if they are in a day lit situation for the same psychological benefits. Mostly, employee efficiency.” (New York)
- “A Class A office building is where you could put some light in the . . . That’s the world I’ve pretty much had to deal with. That’s pretty much a requirement nowadays, it seems. Yes, storefront and curb wall and an atrium are what these corporate headquarters are requiring for their office components of these plans.” (Charlotte)
- “If it’s going to be a Class A office building, it’s going to be easier to convince the owner to put more daylighting in to have better aesthetics, to have a more spectacular

building. If it's a Class C, tilt-up or whatever, he's not going to be spending a lot of extra frill dollars to make the aesthetics perfect." (Orange County)

Manufacturing Facilities

- "Manufacturing facilities. Productivity goes up. There have been studies that with an increase in daylight there is an increase in productivity." (Portland)
- "Retail and wholesale because it is the only thing that has improved sales. Influence us." (Portland)

Warehouses

- "Warehousing lends itself well to daylighting. Convenience for one thing. I don't know how many of you have walked into dark warehouses and struggled to find the lights and wait for them to come on." (Charlotte)

Buildings Not Suitable for Daylighting

Offices With Many Computers

- "Computer Centers don't want too much light. The glare." (Portland)
- "I think you need to be very careful about the office light for a couple of reasons. I don't think daylighting is great for CRT screens so you would have to work it out so there is not any glare on the desks. I think you have to use it in certain areas. I think daylighting is helpful anywhere, in the atrium, in the corridor spaces but right where people are working on computers I think is a negative thing." (New York)
- "For trading floors it is not desirable." (New York)
- "I run into a lot of computer users that don't want natural light because of the interference with their CRT's." (Des Moines)

Big Box Retail Stores

- "Kmart and Home Depot and other large department stores. They just rarely have windows even because they would not be focusing on the merchandise and it is just too large to get daylighting." (New York)
- "It's about keeping these (large retail) buildings simple, it's not about daylighting." (New York)

Some Areas in Hospitals

- "Variety of hospital functions, x-ray and surgery." (Portland)

Research & Laboratory Facilities

- "In a research or a laboratory environment, it would be a con. A lot of facilities that I'm involved with right now are putting up black-out shades to keep the light out for light-sensitive research." (Charlotte)

- “We do aerospace projects and if we’re doing a clean room, we’re not going to be introducing a whole lot of daylight.” (Orange County)
- “Maybe in general places where you have to have a tightly controlled environment. The laboratory and performing arts, prisons, examine rooms.” (New York)

Military

- “Certain military installations because they want to maintain the security.” (Portland)

Performing Arts

- “For performing arts space, most activities occur in the evening and we don’t have (the) resource.” (Portland)

Sporting Facilities

- “Sporting halls.” (New York)
- “The changing nature of the lighting. The sun goes across the sky and light coming in can get in people’s eyes.” (New York)

Art Exhibits

- “Exhibit spaces.” (New York)

Casinos

- “Because they don’t want the players to know (the time of day).” (New York)

Restaurants

- “I can’t say I have seen too many restaurants that use a lot of daylighting. Restaurants are usually a ‘no,’ but not always.” (Des Moines)

E. Perceptions of the Major Benefits Derived From Daylighting

Participants were asked to list the benefits of using daylighting. Once an unaided list was developed, the moderator read a list of possible benefits not named by participants and asked which, if any, of the these possible benefits they wanted added to the list. Participants were then asked to rank order the three most important benefits from the list.

Figure 2 displays participants’ ratings in descending order of total points across the five groups based on 3 points for each 1st place ranking, 2 points for each 2nd place ranking, and 1 point for each 3rd place ranking. The number of participants rating each benefit 1st is also displayed.

Figure 2
Perceived Most Important Benefits to Daylighting
(Aggregate, Base=48)

Benefits	Total Points*	Number Ranking 1st
Occupants more comfortable/feel better (physiological & psychological)	87	19
Reduced energy consumption	71	10
Productivity/sales go up	51	7
Building appearance/aesthetics	42	6
Marketing of building	31	6
Color display of product	5	0

* Total points are calculated based on top 3 ratings (1st=3 points, 2nd=2 points, and 3rd=1 point).

As shown in Figure 2:

- ◆ The five major benefits to daylighting attributed by the 48 participants were:
 - The occupants of the building feeling better/more comfortable (87 total points, and 19 participants ranking it 1st).
 - Reduced energy consumption (i.e., less energy used and lower energy costs) (71 total points, and 10 participants ranking it 1st).
 - Increased employee productivity, including higher sales for retail stores (51 total points, and 7 participants ranking it 1st).
 - The improved building appearance/aesthetics (42 total points, and 6 participants ranking it 1st).
 - The increased marketability of the building to tenants or buyers (31 total points, and 6 participants ranking it 1st).

Figure 2a breaks out ratings separately for the end-customers and designers.

Figure 2a
Perceived Most Important Benefits to Daylighting
(By Segment)

Benefits	End-Customers (Base=23)		Designers (Base=25)	
	Total Points*	Number Ranking 1st	Total Points*	Number Ranking 1st
Occupants more comfortable/feel better (physiological & psychological)	32	5	55	14
Reduced energy consumption	25	2	46	8
Productivity/sales go up	32	5	19	2
Building appearance/aesthetics	24	5	18	1
Marketing of building	25	6	6	0
Color display of product	2	0	3	0

* Total points are calculated based on top 3 ratings (1st=3 points, 2nd=2 points, and 3rd=1 point).

As shown in Figure 2a:

- ◆ The relative importance of the five greatest benefits differed for designers and end-customers.
- ◆ Designers described occupants' comfort as the greatest benefit (55 points, and 14 of 25 ranking it 1st), followed by reduced energy consumption (46 points, and 8 naming it 1st). No other benefit had over 20 points or more than two 1st place rankings.
- ◆ End-customers' responses were fairly evenly divided among the five benefits, with each receiving 24 – 32 points, and four of the five receiving five or six 1st place rankings.
- ◆ End-customers placed much greater emphasis than designers on productivity/sales going up (32 vs. 19 points) and marketing of the building (25 vs. 6 points). In contrast, end-customers placed less emphasis than designers on energy savings/environmental issues (25 vs. 46 points) and the comfort of the occupants (32 vs. 55 points).

Figure 2b breaks out ratings by location.

Figure 2b
Perceived Most Important Benefits to Daylighting
(By Location)

Benefits	End-Customers		Designers		Mixed
	Charlotte (Base=10)	Des Moines (Base=10)	NYC (Base=10)	Portland (Base=10)	Orange County (Base=8)
Occupants more comfortable/feel better (physiological & psychological)					
Total Points*	5	23	20	20	19
Number Ranking 1st	0	5	4	5	5
Reduced energy consumption					
Total Points*	16	8	23	20	4
Number Ranking 1st	2	0	4	4	0
Productivity/sales go up					
Total Points*	9	23	4	13	2
Number Ranking 1st	2	3	1	1	0
Building appearance/aesthetics					
Total Points*	16	3	9	2	12
Number Ranking 1st	4	0	1	0	1
Marketing of building (sales, rented)					
Total Points*	12	7	2	4	6
Number Ranking 1st	2	2	0	0	2
Color display of product					
Total Points*	0	1	0	0	4
Number Ranking 1st	0	0	0	0	0

* Total points are calculated based on top 3 ratings (1st=3 points, 2nd=2 points, and 3rd=1 point).

Shaded numbers display two most important benefits for each location.

As shown in Figure 2b:

- ◆ Charlotte was the only location that did not rate occupants feel better/more comfortable very high, as Charlotte end-customers expressed a greater emphasis on appearance/aesthetics than did the other locations.
- ◆ Des Moines participants ranked increased productivity & sales higher than any of the other locations.

- ◆ The two designer groups (i.e., New York City and Portland) and the Charlotte end-customer group ranked energy savings higher than the Des Moines and Orange County focus groups participants.

Participants were asked to explain their rankings. We found:

- ◆ Participants believe that using daylighting makes occupants feel better both psychologically (“good lighting excites the spirit,” “psychological warmth,” makes small space feel larger, emotional benefits documented by psychological studies) and physiologically (e.g., easier on the eyes, and less likely to get migraines). Participants said this is very important because people spend a lot of time in their office, and designers said they “design space for people.”
- ◆ Participants ranked reducing energy consumption high because it saves the owner money (e.g., “tangible monetary benefit,” “helps the bottom line,” “it is biggest pull” to owners, energy savings offsets daylighting increase to capital costs, reduces “owners’ risk to increasingly volatile energy prices”), and it improves the environment (e.g., we need to improve our environment, it “saves the earth’s resources,” and “it is the right thing to do”).
- ◆ Participants ranking increased productivity/sales high indicated they believe the psychological/physiological benefits lead to increased productivity and sales, and it is the increased productivity that motivates them to use daylighting in their buildings.
- ◆ Those participants ranking aesthetics/appearance high discussed its impact on occupants (makes people want to be there, and makes building more marketable).
- ◆ Participants ranking marketing of the building high said daylighting is a marketing tool for tenants (e.g., space looks classy and improves tenant’s image to others, and daylighting makes tenant look “forward-thinking” and “cutting edge”), and owners/developers (e.g., makes it easier to sell building or lease space, can get people to “come to your property and spend money,” and increases market value of property).

Representative verbatim responses are provided below.

Occupants More Comfortable

- “I redesign spaces and that is our whole objective -- to keep the inhabitants comfortable.” (Portland)
- “Good lighting as something that excites the spirit.” (Portland)
- “There is a reason why everybody wants an office or a window, it makes you feel good to look out a window and to have light and to feel like you are not enclosed in a box all day like you are in this room.” (New York)
- “It is positive emotionally to the individual . . . I mean the more open area the better.” (New York)
- “Also, there has also been a lot of psychological studies and they show that people like daylight and it makes them feel better. They just feel better.” (New York)
- “The feeling of warmth for your employees. Personally, when I’m feeling warm, when I see the sun coming in, it makes me more comfortable. Psychological warmth, yes.” (Charlotte)
- “Easier on the eyes. I’m prone to migraines so any time we get fluorescent lighting for day in and day out.” (Charlotte)
- “I think a lot of companies are going to bullpen style office layouts and they’re making a trade in more lighting as opposed to having an office for yourself.” (Charlotte)
- “I think it’s able to give you the appearance of having a larger area even if you’re still in a smaller confined space. The daylighting opens the area up.” (Charlotte)
- “You design space for people.” (Des Moines)
- “Hard science would tell you, particularly in northern climates, in northern latitudes that there is a health benefit, a mental health benefit and productivity.” (Des Moines)
- “You don’t feel so enclosed.” (Orange County)
- “If you have to be in a building for a certain amount of time, it means a lot if it’s going to make you feel good or bad.” (Orange County)
- “I think it’s the psychology of the human. I think that we feel our very best when we’re outdoors. It’s our nature.” (Orange County)

Reduces Energy Consumption

- “Number one it kind of saves dollars which I think catches everybody’s attention and the sustainability portion of that is where the design industry is moving to save earth’s resources as much as possible.” (Portland)
- “If properly designed, the energy savings will sustain the difference in (capital cost). In other words, there is a payback for doing daylight. It’s probably also the one thing that we can consistently do building after building that will save energy relative to just about anything else we can do in the big picture. There is nothing that is better than what we have in our portfolio than to use daylighting. It is the next thing that we could do better than

hasn't been done as well as it could be and that is part of what is making it popular.”
(Portland)

- “Another piece to that is reducing the owner's risk to increasingly volatile energy prices so it is not just right now. He can't control what can happen with electric rates five years and ten years down the road so his risk is reduced if he doesn't use as much energy.” (Portland)
- “I think all of us would first and foremost say this is the right thing to do. It makes intuitive sense, we have been doing it for centuries for thousands of years we did it before the energy crunch and the advent of air conditioning. We're just now sort of getting back to it being a popular tool. It sort of speaks for itself in terms of the other side being a long-term payback.” (Portland)
- “I might also add that it is the only tangible benefit measurable in dollars and cents. Right now we talk about productivity and we talk about sales and all of those other things. Some people feel some of that data is tangible but some people would argue with the data as well. Nobody questions the fact that energy savings can be achieved. That is where the internal benefits, those are again somewhat intangible. You have to believe in them. There are people that don't. Not around this table in that aspect.”
(Portland)
- “It all comes down to money.” (New York)
- “If it is done right and it is in the proper application, you would save money. The harvesting of the daylighting. Because it is a tangible monetary benefit and somebody can actually put their hands on it.” (New York)
- “From an owner's point-of-view (saving money) is the biggest pull.” (New York)
- “It saves them money. You are going to see the meter not go as fast every month.”
(New York)
- “Cost right and it all has environmental impact, too. Just in terms of all of the issues and the landfill situation and all that, plus materials that you have to dispose of, plus less energy is required to make the materials you are using.” (New York)
- “I was going to say long-term I think we all have a feeling that we have to do something to lessen our impact on the environment so that anything that we can do to start that trend and learn and improve as we go is the way to do it.” (New York)
- “Everybody is looking to save money.” (Charlotte)
- “The bottom line.” (Charlotte)
- “It translates to the bottom line. Anything you save in terms of energy; if you can reduce the energy without increasing your building costs and your return is adequate, why wouldn't you do it?” (Des Moines)
- “In my facility, the number one cost is paying people and the second is energy. That is why I rated those two as high. Those two together are probably 50% of my budget or more.” (Des Moines)

Increased Productivity/Sales

- “Increase productivity of the employees by better attendance and also they are more efficient.” (New York)
- “If there was no return on the human capital we would be bumbling in square concrete boxes.” (Des Moines)

Building Appearance/Aesthetics

- “I think it goes hand-and-hand and I think it makes the place more appealing in general when you come into a place and you are not in a cave and you have a feeling of what is going on outside and what the weather is and the light situation. I think it is just a general sense of being appealing to you.” (New York)
- “When something is aesthetically pleasing, people want to be there in that environment and it just makes it more desirable.” (New York)
- “People don’t want ugly buildings. They won’t sell, they won’t lease, they won’t turn over, they won’t last. They’ll be torn down.” (Charlotte)
- “If the building looks good, I’d probably want to go in there.” (Orange County)
- “In my profession, what I do every day, I have to believe that aesthetics make people want to be there.” (Orange County)

Marketing of the Building

- “It is also used as a marketing tool (as people will) think you are forward-thinking and on the cutting edge. For tenants and also when you bring clients in to see your space. Whoever is inhabiting the space.” (New York)
- “Tenants want to bring their clients and their customers to places that they’ll be proud of.” (Charlotte)
- “For selfish reasons or superficial reasons, the tenant who goes in that building also sees that other people will see them as the tenant in the space with all the windows and I think that lends to their image, you know. Like I was saying before, Class A tenants go in these buildings with all this glass and I think people look to glass as being a classy thing. Glass, not necessarily, but windows and if someone is in a space with an abundance of windows and light whether or not it increases productivity or not, other people think that this company is a step up, personally.” (Charlotte)
- “For us, it is all about leasing our space. It is a bottom-line thing. People want it, we provide it and that is how we lease our space faster or sell the buildings faster.” (Des Moines)
- “I had marketing first and it is two-sided because you have to sell the space and you have to lease the space to a retailer and then you have to entice people to come in and buy from a retailer. The whole thing is a marketing game getting people to come to your property and spend money and that is number one with me.” (Des Moines)
- “For us (the key benefit is) called marketing The more windows the easier it is to lease the space.” (Des Moines)

- “Just from the perspective of the ownership and being able to bring tenants in and make the building pay for itself.” (Orange County)
- “With my boss, he owns several properties and one thing that he would have to go by is the market value, as far as for him and with the tenants.” (Orange County)
- “If you use more of the daylighting, then it’s more of a marketable property. People will be interested in bringing in their businesses into that atmosphere.” (Orange County)

F. Perceptions of the Major Barriers to Daylighting and Strategies to Overcome These Barriers

1. Perceived Barriers

Participants were asked to list the barriers to using daylighting more often for new buildings where daylighting could be introduced. After an unaided list was developed by the participants, the moderator read a list of possible barriers not named by participants and asked which, if any, of the these possible barriers participants wanted added to the list. Participants were then asked to rank order the three most important barriers from the list developed by the group.

Figure 3 displays participants' ratings in descending order of total points across the five groups based on 3 points for each 1st place ranking, 2 points for each 2nd place ranking, and 1 point for each 3rd place ranking.

Figure 3
Greatest Barriers to Using Daylighting
(Aggregate, Base=48)

	Total Points*	Number Ranking 1st
Capital Cost	116	33
Problems with technology/maintenance costs	67	4
Complicated design	30	2
Safety/security	17	2
Site	13	2
Inconsistency in lighting	13	2
Added risk	9	2
Confusion of end-customers	9	0
Mindsets	6	1

* Total points are calculated based on top 3 ratings (1st=3 points, 2nd=2 points, and 3rd=1 poi

As displayed in Figure 3:

- ◆ Far and away, the 48 focus group participants most often cited capital cost as a major barrier to using daylighting (116 points, and 33 of 48 ranking it 1st).
- ◆ Problems with technology (e.g., controls, glare, HVAC) and resultant maintenance costs incurred was viewed as the 2nd greatest barrier to daylighting (67 points).
- ◆ The complexities involved in daylighting design (e.g., requires an educated and costly team) was viewed as the 3rd greatest barrier (30 points).
- ◆ Other important barriers raised by participants were: safety and security (17 points), the building's site location (13 points), and inconsistency in lighting (13 points), followed by the added risks posed by using daylighting (9 points), confusion about daylighting to end-users (9 points); and the mindset of those involved (e.g., used to doing things a certain way) (6 points).

Other barriers mentioned, but not ranked high on importance were: proprietary systems preventing competitive bids and increasing costs, difficulties implementing quality control on construction, and visual distraction to occupants caused by a lot of glass.

Figure 3a contrasts ratings for end-customers and designers.

Figure 3a
Greatest Barriers to Using Daylighting
(By Segment)

	End-Customers (Base=23)		Designers (Base=25)	
	Total Points*	Number Ranking 1st	Total Points*	Number Ranking 1st
Capital Cost	57	18	59	15
Problems with technology/maintenance costs	40	3	27	1
Complicated design	12	0	18	2
Safety/security	14	2	3	0
Site	0	0	13	2
Inconsistency in lighting	7	0	6	2
Added risk	1	0	8	2
Confusion of end-customers	0	0	9	0
Mindsets	0	0	6	1

* Total points are calculated based on top 3 ratings (1st=3 points, 2nd=2 points, and 3rd=1 point).

As shown in Figure 3a:

- ◆ The same two major barriers (i.e., capital costs and technology problems/maintenance costs) were viewed as the key barriers by both designers and end-customers.
- ◆ Differences observed included:
 - End-customers were more likely to say that a concern about safety and security (14 vs. 3 points) was a major barrier to the expanded use of daylighting. Moreover, while both end-customers and designers emphasized the role of technology/maintenance costs, more end-customers ranked it high than did designers (40 vs. 27 points).
 - Designers were more likely to say important barriers to increasing the use of daylighting were: the site location (13 vs. 0 points); confusion on the part of end-customers about the benefits of daylighting (9 vs. 0 points); the perceived added risks involved in daylighting since it is still a new approach to designing buildings (8 vs. 1 point), and the complications involved in designing daylighting (18 vs. 12 points).

Figure 3b breaks out ratings by location.

Figure 3b
Greatest Barriers to Using Daylighting
(By Location)

	End-Customers		Designers		Mixed
	Charlotte (Base=10)	Des Moines (Base=10)	NYC (Base=10)	Portland (Base=10)	Orange County (Base=8)
Capital Cost					
Total Points*	19	29	21	26	21
Number Ranking 1st	6	9	4	8	6
Problems with technology/maintenance costs					
Total Points*	16	21	6	13	11
Number Ranking 1st	2	1	1	0	0
Complicated design					
Total Points*	10	2	13	5	0
Number Ranking 1st	0	0	2	0	0
Safety/security					
Total Points*	10	0	0	0	7
Number Ranking 1st	2	0	0	0	0
Site					
Total Points*	0	0	12	1	0
Number Ranking 1st	0	0	2	0	0
Inconsistency in lighting					
Total Points*	4	2	0	0	7
Number Ranking 1st	0	0	0	0	2
Added risk					
Total Points*	1	0	2	6	0
Number Ranking 1st	0	0	0	2	0
Confusion of end-customers					
Total Points*	0	0	0	9	0
Number Ranking 1st	0	0	0	0	0
Mindsets					
Total Points*	0	0	5	1	0
Number Ranking 1st	0	0	1	0	0

* Total points are calculated based on top 3 ratings (1st=3 points, 2nd=2 points, and 3rd=1 point).

As shown in Figure 3b:

- ◆ New York City participants were the most likely to emphasize site location as a major barrier to daylighting.
- ◆ New York City and Charlotte participants were most likely to rank complicated design work as a major barrier to increasing daylighting.
- ◆ Charlotte and Orange County participants expressed the most concern about safety and security.
- ◆ Portland participants were the only participants to emphasize end-customer confusion about daylighting.

Participants were asked to explain their rankings. We found:

- ◆ Participants ranked capital costs so high because the owners making the daylighting decision said using daylighting has very high upfront costs (e.g., tinted glass, controls, shades, awnings, etc.) which creates problems for both staying within fixed budgets and getting a return on their investment. Participants said owners/developers usually do not want to spend more than is necessary to have a marketable building.
- ◆ Participants ranked technology and maintenance costs high because daylighting requires a lot of technology (e.g., lighting control, dimmers, sensors, shading) to work effectively; and there are significant maintenance costs involved to support the technology (e.g., re-caulking, repairing breakage and leaks, heat loss, HVAC costs, and cleaning the windows and skylights). Moreover, participants said that often the technology malfunctions (e.g., can't turn lights on when occupants need them) resulting in occupants disconnecting the equipment. Participants suggested that the idea of daylighting is ahead of the technology needed to successfully accomplish it and to make it transparent to the occupants.
- ◆ Participants who ranked daylighting design complexities high said daylighting is a specialty and, as such, owners are faced with high design costs for retaining multidiscipline specialists. Moreover, designers who lack the skills do not recommend

daylighting because they would make less money by taking the time to try to figure out how to do it or subcontracting with experts to be on the team.

- ◆ With regard to safety and security, participants said daylighting makes the building less secure (easier to see inside and break into), threatening the safety of the people and increasing the risk of theft of expensive equipment. Participants also referred to many buildings that would not be suited for daylighting due to security/safety needs (e.g., schools, police stations, banks, research facilities, government buildings).
- ◆ Participants ranking building site location as a major barrier referred to problems accessing natural light (e.g., the building's position regarding the sun, shading from existing adjacent buildings, and the potential for new buildings to be built that will prevent access to sunlight).
- ◆ Participants ranking inconsistent lighting high referred to: being unable to control the different amount of light across the building and at different times during the day, people getting “blinded” or being unable to see computer screens at a certain time of day, and occupants needing to open and close blinds throughout the day.

Representative verbatim responses are provided below on why specific barriers were rated high on importance and what issues are involved.

Capital Cost

- “Shading glass is very expensive.” (Portland)
- “The owner is calling the shots (so capital cost is the major barrier).” (New York)
- “Payback, whether it will pay for itself.” (New York)
- “The lighting technology is expensive for controls and dual balance controls.” (Portland)
- “As an owner, that’s what I’m looking at upfront, my dollars. What my dollars are going towards.” (Charlotte)
- “And can I get that money back?” (Charlotte)
- “Tinting widows, awnings, shades. Just additional costs.” (Charlotte)
- “We are in commercial buildings, (looking for) return on investment.” (Des Moines)

- “For us it is not return on investment, rather you have got a fixed budget and you want to get the biggest bang for that budget. If that envelope costs more, then you just run out of money sometimes.” (Des Moines)
- “I can rent the space for \$15 - \$20 a clip, whatever the number is. And the end result is how much I need to put it in upfront to make it work.” (Des Moines)
- “It’s very difficult, a lot of times, to get a developer to spend front-end money even if it does create energy efficiencies because the tenants, in a sense, are going to pay the operating costs as they go along and the pay increases or whatever so it’s always a struggle getting the developer . . . They’ll build in as much cost into the project as they think they need to be marketable and be a marketable product in this particular market niche. They won’t spend money when they don’t see a direct return.” (Orange County)
- “That is the biggest hurdle in the development scheme . . . The first issue is getting past the developer and the upfront cost is going to be the number one issue.” (Orange County)

Technology/Maintenance Costs/HVAC

- “The controls in the lighting controls and the dimmers, the sensors and all of these kinds of things that have to work in perfect synchrony and harmony to make it really work for them.” (Portland)
- “Commission. It can be everything from the photo cell being installed in the wrong location and then it could be that the manufacturer told me that the photo cell could do everything and it really can’t and now it is in and it doesn’t work. Then the occupants aren’t happy so it gets disconnected and so you spent a lot of money and you didn’t get results. Then the next time daylighting comes up (it is rejected).” (Portland)
- “Not all daylighting is electric controls, there is a whole architectural shading element that needs to be addressed and that is a very immature industry at best. It is a whole barrier.” (Portland)
- “There is one thing that is worse when they have no choice over the environment because all of a sudden it is automatically and mechanically controlled and all of a sudden they can’t even turn the lights on if they wanted to because the sensors don’t work.” (Portland)
- “It is a little bit of everything because we don’t always put the systems in as smart as we should. It is not as transparent to the user as we would like it to be. They get frustrated and they say the heck with the system and they tape it over or paint it or do something. All kinds of stuff happens.” (Portland)
- “Under shading what I was going to say is the same thing as heat gain. A lot of daylighting has to do with large areas of glass and so we have to shade them to prevent heat gain and sometimes that is difficult.” (Portland)
- “And you can add glare to that too.” (Portland)
- “Because it is very complex and it is still in its infancy so we have a huge demand on the system to do 55,000 things to make it transparent to the end-user and make it real easy to use. It is just not working, there is just physical technology problems. The software there is a little bug in it and you don’t know where the hell it is but you can’t get the light to go on or off and all that kind of stuff.” (Portland)

- “Our ideas are often way ahead of the reality of what is really out there to accomplish all of that stuff. I think that is a really succinct statement.” (Portland)
- “I’ve never seen a building that has a sensor on the lights so that it turns up and down the lights as the daylight gets darker.” (Charlotte) (note: 9 of 10 agreed)
- “I don’t want to expend money on something that I’m going to have to keep on going out and re-caulking and putting new gaskets in for skylights and things like that.” (Charlotte)
- “The cleaning issues. The windows. Skylights, windows or whatever. They’ve got to be cleaned. Breakage.” (Charlotte)
- “The roof leaks in the skylight.” (Charlotte)
- “Glass is more fragile. It leaks and it has to be cleaned so higher maintenance.” (Des Moines)
- “Breakage, cleaning, leaking.” (Des Moines)
- “Thermal breaks and condensation issues.” (Des Moines)
- “It could result in a heat gain or loss. I mean it really can effect your HVAC operation. It is a different thing than that. On the east side it heats up in the morning and on the west side it heats up at night.” (Des Moines)
- “There is more to that heating and cooling issue, if you are sitting very close to the window in the winter you are going to feel cold or if the sun is shining in winter or summer you could feel hot. So beyond HVAC there is other if you are sitting in direct sunlight or sitting next to an insulated envelope.” (Des Moines)
- “If you put a lot of skylights in your building you have got to clean them. You put a lot of windows in your building and you have got to clean them. If you put up brick walls and just put a roof on the thing, you don’t have to clean the roof.” (Des Moines)
- “If you are responsible for maintenance or cleaning, you are going to hate the windows. You just do whatever exterior that you don’t have to worry about.” (Des Moines)
- “And the leaks and the breakage.” (Des Moines)
- “And, once again, it’s all part of the building envelope so the thermal breaks and how all the different pieces of the window go on can create condensation problems inside the facility. Creates leaks and flashing problems. You end up with wedges. It is just penetrations in buildings create issues over time and that is a maintenance issue, you have to keep those things up.” (Des Moines)
- “Several buildings we have done is at an air conditioning low. You have all that glazing on there and you start with the shading first and after you can only take the shading so far and the HVAC contractor says, ‘I will knock off 50 tons of air conditioning if you get rid of four of those windows over there.’ Okay, windows are gone.” (Des Moines)
- “I think part of it too is how much is enough? How much natural lighting is enough to address the needs that we came up with before, the psychological aspects and things like that. How much is enough to accomplish those purposes? Because once you go beyond that point you get no additional gain from it but you have additional cost in terms of

capital cost and maintenance cost. This is where the designer and the owner have difficulties in arriving in that point where enough is enough.” (Des Moines)

- “Your heating and cooling costs go up, your maintenance goes up.” (Orange County)

Complexities Involved in Daylighting Design

- “I think (daylighting) is kind of a specialty. So, if your team isn’t familiar with it or one of the players isn’t up to speed on it, they are not going to do it well. They are not going to suggest it. I think it is a specialized design that not everybody knows about.” (New York)
- “I agree with that completely. I think people spend time reinventing something that may have already been invented when they have to spend time reading about it and learning about it and finding out about it and it doesn’t become cost-effective for you to bring that forward unless you are somebody who already understands it. You are going to waste your own fee.” (New York)
- “I think there is a (daylighting) specialty. I think there are specialized people that design daylighting and you would have to hire those people or have those people educate the rest of the team.” (New York)
- “It is just that there are different studies that you need to do, you know how the sun is going to hit the building and not everyone knows how to do the studies. There are different calculations. I think there are companies that are known for doing daylighting.” (New York)
- “It’s complicated. It takes time, it takes money. As far as an owner goes, you have to think about it and are you willing to pay?” (Charlotte)
- “Is an owner willing to pay a consultant for more time? It’s more money to re-invent the wheel every time.” (Charlotte)
- “You have to solve those problems. If you try to solve them after the fact, that’s going to cost more money.” (Charlotte)
- “The technology is there (for daylighting) . . . I think the architects are all over the place (in their knowledge). I think we’re behind the times (in Charlotte).” (Charlotte)
- “It is a specialty for the architect or lighting person. You really have two different people that are dealing with it. You have the lighting guy that usually works for your electrical firm and then you have an architect that is talking about window and glazing positioning within your facility and where usually the architect goes out and hires in a lot of cases because they are multidiscipline. You really have to be sure that you have a contract that allows the correct collaboration between those two firms because most times the architect is coming in and says this is what you get to spend and that is the way it goes for the mechanical people.” (Des Moines)

Safety and Security

- “Liability.” (Charlotte)
- “It’s just a big issue. There are some buildings that have bars over the windows. So crime is a big deal to a lot of companies when they’re looking where to locate. It (creates) more places to break in.” (Charlotte)

- “They see (skylights and glass) as an easy access point.” (Charlotte)
- “With the expense of office equipment and the safety of the office employees, security is a paramount issue.” (Charlotte)
- “Break-ins. You can break the glass and walk in.” (Charlotte)
- “They can also see what’s inside.” (Charlotte)
- “They can break into the skylight.” (Charlotte)
- “Safety. School districts - urban school districts - have criteria of not having daylighting or have openness that can be directly accessible to the students because of drive-by shootings and that type of thing.” (Orange County)
- “A police station.” (Orange County)
- “Banks limit the number of windows they have.” (Orange County)
- “Research facilities.” (Orange County)
- “Government buildings.” (Orange County)

Building's Site Location

- “Site whether it is urban vs. suburban and rural. Urban setting is very difficult to get effective daylighting into a lot of places (due to) the shading from the adjacent buildings.” (New York)
- “And you also don’t know what is going to happen a few years from now when there is a building built across the street so you might lose it whatever you put in.” (New York)
- “We may not be able to get proper daylighting at the site. ” (Des Moines)
- “Four-story buildings are surrounded by ten-story buildings.” (Des Moines)
- “If your facility is not positioned correctly in the orientation with the sun.” (Des Moines)
- “Daylighting is not always available.” (Orange County)

Inconsistency in Lighting

- “What about the issue of sunlight coming in if you’re facing certain directions? I know when you face a building in a certain direction, no matter what you do inside, everybody ends up blocking it all off with shades or whatever.” (Charlotte)
- “I think it goes again with you can’t control that light. You know, shadowing, what time of day does the light hit this area.” (Charlotte)
- “If it faces west, at the end of the day you’re blind. Everybody gets blinded in the middle of the day.” (Charlotte)
- “Everything goes back to computer terminals and how you control the light coming in so people can see their screens. You may have a point where that sun goes across the

sky and it comes right in and you have 15 minutes where everybody that walks through the doorway is blinded.” (Des Moines)

- “You can’t really control (light coming in).” (Des Moines)
- “Every morning I walk into my office I have to close this row of blinds here and open these over here and then in the afternoon open these over here and these over here.” (Des Moines)

Added Risks Posed by Using Daylighting

- “We have a limited amount of information and a limited amount of experience, a limited amount of hardware and we don’t have a ton of education and know how to use it.” (Portland)

Confusion of End-Users About Daylighting

- “To me a successful daylighting system has got to be transparent to the user. I don’t think that you can have them flipping switches, I don’t think you can have them getting lights turned off on them. In my opinion if it is not transparent to the user or it is set up to fail.” (Portland)
- “I think it is important to remember that the end-user is also the custodian who has now been given the exclusive use of this very complex computer with 5,000 points of control in it and he hasn’t got a clue what the hell it is. That is where one of the real major problems is. The stuff is so complicated and that is not his job. He is supposed to be cleaning the floors.” (Portland)

Mindset of Those Involved

- “Mindset of maybe the owner because and it could be mindset of engineers but a lot of people have done things before a certain way and it worked and they don’t want to change. I just thought it was the mindset.” (New York)
- “People may have experienced bad installations and said I am not going to do that again.” (New York)

2. Participants’ Suggestions for Strategies to Overcome Perceived Barriers

Participants were asked what they thought needed to be done to overcome the major barriers to daylighting. Participants most often suggested:

- ♦ Better and less expensive technology (e.g., allocating more money to research to improve technology; companies testing technology better before bringing products to market; and developing new technologies and products to address shading, dimming, glare, heat gain, glazing, cleaning, HVAC, and the connection of shading and lighting controls).

- ◆ Education of professionals and end-users (e.g., describe daylighting options available, and show examples of daylighting working).
- ◆ Financial incentives for installing daylighting (e.g., tax abatements, utility rebates, and grants).
- ◆ More research on benefits of daylighting (e.g., definitive research on productivity).

Representative verbatim responses are provided below.

Better And Less Expensive Technology

- “I think in terms of the technology it is a matter of probably getting money to the company that is developing it and allowing them to test it better before putting it to market so that you don’t have problems with photo cells or we understand them better. Once the equivalent of UL ratings that something is more thoroughly definitely allowed before it hits the street.” (Portland)
- “You have sheaths of glass that have lubbers on the inside that can be changed when you change the light level. And there is glass that can be adjusted like polarized glass types that can light it darker without all of the other controls. The industry needs to go out there and do something for us also.” (Portland)
- “I had shading, heat gain and glare as my number three barrier and the way to improve that is through better design with the technology we got.” (Portland)
- “In some cases the technologies have not connected yet. There is only one company on the control side that I know connecting shade control and lighting control and really doing a recently decent job of it. If you want to take advantage of daylighting and you have a dimming system that raises and lowers the lights. Okay, let’s say the lights are off but I have direct sun lighting there, well, maybe I need some method of automatically controlling the shades in order for me to really get the benefits. Otherwise, I want to control the shades and there is no benefit at all.” (Portland)
- “Cut cost in the technology drastically. With today’s technology, I think we can decrease the cost.” (New York)
- “New products.” (Charlotte)
- “Come out with a glass that repels water.” (Charlotte)
- “You can reduce the cost and reduce the maintenance of the glazing or glass that would. Better technology, I guess. Better, cheaper technology.” (Des Moines)
- “Lighting controls, dimming the lights because then you can actually save that lighting cost during nine months out of the year.” (Des Moines)
- “If you can devise a coating to the glass that would not allow dust to stick . . . would reduce cleaning need.” (Des Moines)

- “Self-cleaning windows which exists today. That was invented a couple of years ago and a lot of people don’t know about it. Obviously, because of the new technology most people don’t believe it works or are not willing to spend the extra cost that is involved in it. We looked at the self-cleaning windows and from what we have seen it is possible that they actually work.” (Des Moines)
- “Technology improving the quality of glass.” (Orange County)
- “You’re asking us what needs to happen. If you look at what happens with electronics, when these marvelous new things come out and they cost We paid \$20,000 or \$25,000 for our first CAD station. Now they cost \$600. Why can’t that happen in other areas of technology?” (Orange County)
- “The number one barrier was cost so those technology improvements can reduce costs that make it more usable. For instance, improving the technology of heating and cooling systems so that the increased load of the light costs you less to heat and air condition. The technology in all areas of building energy efficiency will cause people to use it more. Less (financial) impact from using daylighting.” (Orange County)
- “And that last one can be expanded to governmental or industry, greater contributions to research. And spending more money on research, whether that’s the government putting more money into research on energy savings devices.” (Orange County)

Increased Education and Knowledge

- “I think it is education, not just the design professionals but everybody, the end-user, everyone, needs to be in the loop. They need to understand the options and also the limitations so that expectations can be fulfilled. Training courses, seminars, articles, marketing.” (Portland)
- “Education of the professionals.” (New York)
- “Education of owners, architects, designers. Seeing examples of how it’s worked for other people.” (Charlotte)
- “Just one thing. What we have seen in the last 20 years is the technology outstrips the men in the field. So, in other words, a lot of fancy products are out there but the guys aren’t used to using them and it’s not that they don’t want to do a good job, it’s just that they don’t have the background or education to use this new product. All the way from the architect to the carpenter to the glazer, everybody in the chain does not always adapt to the technology as fast as the technology comes up. It’s a little bit like the IT department at work, you never understand anything these guys are doing with computers and it changes every week anyways.” (Des Moines)

Financial Incentives for Installing Daylighting in Buildings

- “Maybe offering some type of incentive or grant by tax abatement or by the government to do daylighting. Because if cost is the number one reason people are not doing it then there are programs where you can get tax abatements.” (New York)
- “Offer a utility rebate. If you put this in the utility will pay you back \$40 per fixture or something like that.” (New York)
- “Financial incentives.” (Charlotte)

- “Tax credits.” (Charlotte)
- “Grants.” (Charlotte)
- “Under financial incentives, I think there should be some kind of a credit if you can show what your energy costs would be with the extra glass versus what your energy costs would be without the extra glass. You get a credit towards utility costs.” (Charlotte)
- “Government and utility incentives. I want Southern California Edison to pay me to put this stuff in.” (Orange County)

More Research on Benefits of Daylighting

- “We need more definitive research on the benefits of daylighting such as productivity. That is one word. There is actually no specific measured research on productivity improvements.” (Portland)

3. *Perceived Effectiveness of LRC Suggestions for Strategies to Overcome Perceived Barriers*

The moderator handed out a list with nine specific strategies for addressing barriers to daylighting. Participants were asked to fill out a form displaying their assessment of the effectiveness of the potential strategies in overcoming barriers to daylighting. Specifically, participants were asked to rate each strategy for effectiveness (i.e., 4 point scale, where 4 = very effective, 3 = effective, 2 = somewhat effective, and 1 = not effective); and rank order the three strategies they believed would be most effective.

Figure 4 displays participants’ aggregate ratings, including: the mean rating for each strategy, total rank order points for each strategy (calculated based on 3 points for each 1st place ranking, 2 points for each 2nd, and 1 point for each 3rd); and the number of participants ranking each strategy 1st, 2nd or 3rd.

Figure 4
Perceived Effectiveness of Possible Strategies
to Address Barriers to Using Daylighting
(Aggregate, Base=48)

	Total Points*	Number Ranking 1st	Mean Rating**
Proof of increased productivity	58	15	3.3
Daylighting design tools for architects & engineers	45	7	3.3
Better communication of benefits to owners/developers	41	7	3.4
Better windows to reduce glare	38	6	3.3
Better controls	32	8	3.1
Proof of increase in retail sales	25	2	3.2
Proof of health benefits	22	2	3.1
Better communication of benefits to designers	8	1	2.7
System to deliver daylight deep into building	8	0	2.8

* Total points are calculated based on top 3 ratings (1st=3 points, 2nd=2 points, and 3rd=1 point).

** Mean is calculated on a 4 point scale (4=very effective, 3=effective, 2=somewhat effective, and 1=not effective)

As shown in Figure 4:

- ◆ Participants felt the most effective strategy for overcoming barriers to daylighting would be to have substantiated proof that daylighting increases productivity (58 points, 15 ranking it 1st).
- ◆ The next highest rated strategies were:
 - daylighting design tools for architects and engineers (45 points);
 - better communications of benefits to owners/developers (41 points); and
 - better windows to reduce glare (38 points).

Figure 4a breaks out ratings separately for the end-customers and designers. Figure 4a displays each strategy's mean rating, total rank order points, and number of 1st rankings.

Figure 4a
Perceived Effectiveness of Possible Strategies
to Address Barriers to Using Daylighting
(By Segment)

	End-Customers (Base=23)			Designers (Base=25)		
	Total Points*	Number Ranking 1st	Mean Rating**	Total Points*	Number Ranking 1st	Mean Rating**
Proof of increased productivity	42	12	3.4	16	3	3.2
Daylighting design tools for architects & engineers	20	3	3.2	25	4	3.3
Better communication of benefits to owners/developers	11	2	3.1	30	5	3.6
Better windows to reduce glare	18	3	3.4	20	3	3.3
Better controls	2	0	3.0	30	8	3.2
Proof of increase in retail sales	17	2	3.3	8	0	3.1
Proof of health benefits	14	1	3.1	8	1	3.1
Better communication of benefits to designers	2	0	2.7	6	1	2.7
System to deliver daylight deep into building	7	0	3.1	1	0	2.6

* Total points are calculated based on top 3 ratings (1st=3 points, 2nd=2 points, and 3rd=1 point).

** Mean is calculated on a 4 point scale (4=very effective, 3=effective, 2=somewhat effective, and 1=not effective).

As shown in Figure 4a:

- ◆ Designers and end-customers offered different perceptions of the relative effectiveness of different strategies to overcome barriers to daylighting.
- ◆ The major differences between designers and end-customers were that:
 - End-customers rated proof of increased productivity and proof of increased sales much higher than did designers.
 - Designers rated better communications of benefits to owners/developers and better controls much higher than did end-customers.

Figure 4b breaks out ratings by location.

Figure 4b
**Perceived Effectiveness of Possible Strategies
 to Address Barriers to Using Daylighting
 (By Location)**

	End-Customers						Designers						Mixed		
	Charlotte (Base=10)			Des Moines (Base=10)			New York City (Base=10)			Portland (Base=10)			Orange County (Base=8)		
	Total Points*	Number Ranking 1st	Mean Rating**	Total Points*	Number Ranking 1st	Mean Rating**	Total Points*	Number Ranking 1st	Mean Rating**	Total Points*	Number Ranking 1st	Mean Rating**	Total Points*	Number Ranking 1st	Mean Rating**
Proof of increased productivity	19	6	3.7	19	5	3.3	5	0	2.9	5	1	3.6	10	3	3.1
Daylighting design tools for architects & engineers	12	1	3.3	7	2	3.0	18	4	3.5	7	0	3.5	1	0	2.8
Better communication of benefits to owners/developers	8	2	3.2	1	0	3.2	14	2	3.6	8	2	3.6	7	1	3.3
Better windows to reduce glare	3	0	3.3	10	2	3.3	12	2	3.3	4	0	3.5	9	2	3.4
Better controls	0	0	2.9	2	0	3.0	5	1	3.0	25	7	3.8	0	0	2.8
Proof of increase in retail sales	9	1	3.6	2	0	2.9	1	0	2.5	0	0	3.4	13	1	3.6
Proof of health benefits	7	0	3.2	7	1	2.9	3	1	2.7	3	0	3.6	2	0	2.9
Better communication of benefits to designers	1	0	2.7	1	0	2.8	1	0	2.8	2	0	2.9	3	1	2.6
System to deliver daylight deep into building	2	0	3.0	5	0	3.2	1	0	2.8	0	0	2.3	2	0	3.0

* Total points are calculated based on top 3 ratings (1st=3 points, 2nd=2 points, and 3rd=1 point).

** Mean is calculated on a 4 point scale (4=very effective, 3=effective, 2=somewhat effective, and 1=not effective).

As shown in Figure 4b, the greatest differences across the five locations were that:

- ◆ The two end-customer groups (i.e., Charlotte and Des Moines) rated proof of increased productivity very high, and much higher than the designer groups.
- ◆ Among the designer groups, Portland participants rated better controls much higher, whereas New York City participants rated daylighting design tools and better communication of benefits to owners/developers particularly high.

G. Current and Desired Sources of Information on Daylighting

1. Current Information Sources

Participants were asked how they were currently getting information about daylighting. We found:

- ◆ The most frequent information sources were industry publications (e.g., *Building & Operations*, *Building Design and Construction*, *Building Owner's Manager's Association*, *Architectural Record*, *Architecture*).

- ◆ Participants also mentioned: word-of-mouth from engineers, architects, and lighting consultants; professional associations; seminars; Web sites; sales people/vendors; looking at buildings; trade shows; and studying for the lighting consultant examination.

Representative verbatim responses are provided below.

Publications

- “I was just going to say different journals where you get products that are published that use the technology that is another way to learn about it.” (Portland)
- “Magazines. I find any magazine that has a good project would use daylighting for example, draws my interest and have they resolved it.” (New York)
- “Trade magazines. *Building & Operations*, I can’t remember others.” (Charlotte)
- “Well, I don’t get involved with the architects or anything like that so I would say my stuff would come through literature, magazines and trade magazines.” (Charlotte)
- “Trade magazines.” (Des Moines)
- “Magazines like *Building Design and Construction* and sometimes trade shows. There are studies that have been done and the department of natural resources has a lot of research that has been done on daylighting and lighting controls as it relates to energy savings and productivity and so I have used some of the different information from those areas.” (Des Moines)
- “Industry publications. *Building Owner’s Manager’s Association*. All those educational things. Buildings magazines - there are ones that have articles about different changes in technology and techniques.” (Orange County)
- “Most of us resort to journals such as trade magazines, such as *Architectural Record* or *Architecture*.” (Orange County)

Word-of-Mouth (Professionals/Peers)

- “Seek out the experts. We as architects are dabbling in a number of different things. Let’s go right to a lighting designer or somebody that has got that data and they view it as day in and day out.” (Portland)
- “The peer group.” (Portland)
- “I think word-of-mouth from the engineer and from the architect from the lighting consultant when you sit down with them if you hire a lighting consultant you expect them to educate you and tell you what it is.” (New York)
- “Or you might end up asking the contractor you’re working with.” (Charlotte)
- “Architects, engineers and salespeople.” (Des Moines)

- “Electrical Engineers. We deal with several that help with our tenant build outs so . . . and having a relationship and dealing with them on a regular basis. They just keep me updated on what the latest technology is.” (Orange County)

Professional Associations

- “Clubs. Associations, yes, that discuss buildings and apartments and things like that.” (Charlotte)
- “I get a lot of information from professional organizations, whether it’s within the industry or other industries that deal with a specific type of topic like daylighting. As well as the government.” (Orange County)

Seminars

- “There have been a lot of seminars in the last few years put on by the Lighting Design Lab.” (Portland)
- “Going to seminars. Architectural seminars and design seminars.” (New York)
- “IES seminars. Illuminating Engineering Society.” (New York)
- “With the continuing education requirements now a lot more professionals have to go to seminars so this is a great opportunity to offer seminars with credits through the AIA or whatever your professional organization is.” (New York)

Web Sites

- “BetterBricks Web site.” (Portland)
- “It would be the Internet. I just type in what I want and start searching.” (Orange County)
- “I’ve used the Internet several times to get some key information.” (Orange County)

Looking at Buildings

- “I remember them most from looking at other buildings.” (Charlotte)
- “What’s working out, yes. Other parts of the country or something.” (Charlotte)

Trade Shows

- “Trade shows. The building shows in Atlanta.” (Charlotte)
- “I get information from the Internet, but I get exposed to new ideas usually at trade shows or trade conventions. I go there to learn about new things there.” (Orange County)

Vendors

- “Vendor presentations. The vendor usually calls up and requests you sit down with all of the other electrical engineers in the firm and have a little lunch or something and go through and have a presentation.” (New York)

Studying for Lighting Consulting Exam

- “I learned a lot about daylighting studying for the LC exam but that is the only thing where I felt I was weak. Lighting consultant. There is a whole section on daylighting questions. I read the lighting handbook and I read there was a list of books to give you information. There was a whole, they give you a list of sites. NCQLP, National Certification of Lighting Professionals.” (New York)

2. Desired Communications Strategies

Participants were asked how the U.S. Department of Energy and other agencies should get new information on daylighting to them. We found:

- ◆ Participants most often said seminars, followed by Web sites and e-mail, and publications.
- ◆ Suggestions about seminars included: providing continuing education credits; informing them about the seminars via e-mail; keeping the seminars short; and providing information on capital and maintenance cost implications.

Seminars

- “Symposiums and seminars.” (Portland)
- “I would add that if you gave the credits, they are all interested in that so that would be a really good thing.” (Portland)
- “Seminars would be very valuable. I think it would be difficult to read technical information like that in a magazine but maybe seminars.” (New York)
- “(Seminars with continuing education credits) because if you don’t offer credits no one is going to come. They could work with the AIA to offer credits through there.” (New York)
- “I think even if they contact you via e-mail like members of the AIA or ILD and at least let you know they are sponsoring a program and then they can start doing things locally.” (New York)
- “Would go to a short, short program that has a very low cost or is free. I mean a couple of hours, not all day.” (Charlotte)

- “Like national conferences at a professional association. A lot of times when you go to those you end up with someone that really doesn’t add the facts and figures. It would be nice to go to more of them that really understand daylighting and applications and cost per square foot reductions and operations and capital costs.” (Des Moines)
- “Seminars.” (several) (Orange County)

E-mail/Web Site

- “E-mail is a great way.” (Portland)
- “On the Web site.” (Portland)
- “Web site.” (New York)
- “E-mails saying here is our latest development. Go to the Web site and check this and this is how you get information.” (New York)
- “E-mail them.” (Orange County)
- “I was going to say the Internet. More of us are on the Internet.” (Orange County)

Publications

- “A business journal or some kind of direct mail.” (Charlotte)
- “Trade magazines.” (Orange County)

Presentation at Office

- “I want somebody to come to me and make a presentation in my office and talk to me about the product.” (Orange County)

3. *Reactions to LRC List of Possible Communications Strategies*

The moderator handed out a form displaying a list of ways that the U.S. Department of Energy or other agencies could attempt to communicate about daylighting. Participants were asked to write down how useful they felt each strategy would be in reaching key audiences with important information on daylighting. Responses are displayed in Figure 5.

Figure 5
Perceived Usefulness of Possible
Communication Strategies
(Aggregate, Base=48)

	Mean Score*	# Saying Very Useful
Conducting seminars for design professionals with Continuing Education Credits	3.7	35
Dedicated Web site	3.4	24
Publishing articles in magazines & journals	3.3	18
Experts speaking at conferences	3.3	20
Speaking directly about options for new projects	3.2	21
Opt-in e-mails	3.1	14
Proactive e-mails	3.0	15
Undergraduate courses	3.0	16
Binder of demonstration sites to tour	2.9	17

* Mean is calculated on a 4 point scale (4=very useful, 3=useful, 2=somewhat useful, and 1=not too useful).

As shown in Figure 5:

- ◆ Participants seemed to feel the various communications strategies would be useful, with mean scores ranging from 2.9 – 3.7, and 14 to 35 of the 48 participants saying each strategy would be “very useful.”
- ◆ Participants rated conducting seminars for design professionals with continuing education credits as the most useful communication strategy (mean = 3.7; 35 of 48 saying “very useful”).
- ◆ Seminars were followed by a dedicated Web site (mean = 3.4; 24 of 48 saying “very useful”).

When probed for what they want on a Web site, participants mentioned: new products, pictures of buildings using daylighting, testimonials, utility costs, virtual tour of buildings using daylighting, and a calculator for determining expected savings on energy consumption.

Figure 5a breaks out ratings separately for the end-customers and designers.

Figure 5a
Perceived Usefulness of Possible Communication Strategies
(By Segment)

	End-Customers (Base=23)		Designers (Base=25)	
	Mean Score*	# Saying Very Useful	Mean Score*	# Saying Very Useful
Conducting seminars with continuing education credits	3.5	15	3.8	20
Dedicated Web site	3.1	8	3.7	16
Publishing articles in magazines & journals	3.2	7	3.4	11
Experts speaking at conferences	3.4	10	3.3	10
Speaking directly about options for new projects	3.3	12	3.2	9
Opt-in e-mails	2.9	6	3.2	8
Proactive e-mails	2.7	7	3.2	8
Undergraduate courses	3.1	7	2.9	9
Binder of demonstration sites to tour	2.7	8	3.0	9

* Mean is calculated on a 4 point scale (4=very useful, 3=useful, 2=somewhat useful, and 1=not too useful).

As shown in Figure 5a:

- ◆ Designers rated six of the nine strategies higher on usefulness than did the end-customers.
- ◆ The largest differences were for: dedicated Web site (designers, 3.7; and end-customers, 3.1), and proactive e-mails (designers, 3.2; and end-customers, 2.7).

Figure 5b breaks out ratings by location.

Figure 5b
Perceived Usefulness of Possible Communication Strategies
(By Location)

	End-Customers				Designers				Mixed	
	Charlotte (Base=10)		Des Moines (Base=10)		New York City (Base=10)		Portland (Base=10)		Orange County (Base=8)	
	Mean Score*	# Saying Very Useful	Mean Score*	# Saying Very Useful	Mean Score*	# Saying Very Useful	Mean Score*	# Saying Very Useful	Mean Score*	# Saying Very Useful
Conducting seminars with continuing education credits	3.9	9	3.1	4	3.9	9	3.8	8	3.6	5
Dedicated Web site	3.2	4	3.1	4	3.6	6	3.7	7	3.4	4
Publishing articles in magazines & journals	3.1	3	3.0	1	3.4	4	3.3	4	3.9	7
Experts speaking at conferences	3.5	5	3.3	3	3.6	6	3.2	3	3.1	2
Speaking directly about options for new projects	3.6	7	2.9	3	3.2	3	3.1	3	3.6	5
Opt-in e-mails	3.0	3	2.9	3	3.2	4	3.6	6	2.6	0
Proactive e-mails	3.1	3	2.1	2	3.0	3	3.4	4	3.1	2
Undergraduate courses	3.5	6	2.9	1	2.9	3	3.0	4	2.6	2
Binder of demonstration sites to tour	2.9	4	2.9	1	3.1	4	3.1	4	3.1	4

* Mean is calculated on a 4 point scale (4=very useful, 3=useful, 2=somewhat useful, and 1=not too useful).

As shown in Figure 5b:

- ◆ Among the two designer groups, New York City participants rated experts speaking at conferences higher for usefulness than Portland participants, whereas Portland participants rated opt-in and proactive e-mails higher than New York City participants.
- ◆ Among the two end-customer groups, Charlotte participants gave much higher usefulness ratings than Des Moines participants for: conducting seminars with continuing education credits, speaking directly about options for new projects, proactive e-mails, and undergraduate courses.
- ◆ The mixed group in Orange County gave the highest usefulness ratings to publishing articles in journals and magazines.

APPENDIX:

MODERATOR'S DISCUSSION GUIDE

DAYLIGHTING DIVIDENDS FOCUS GROUP (Final)

I. INTRODUCTION (10 minutes)

- ◆ Welcome/Moderator Introduction
- ◆ Focus group explanation
- ◆ Explain who participants are.
 - Orange County: In tonight's group we have a mix of people: building managers, developers and owners, as well as architects and engineers.
 - Portland and NYC: In tonight's group we have a mix of architects, engineers and lighting designers who are involved in designing buildings or systems for these buildings.
 - Charlotte and Des Moines: In tonight's group we have a mix of people whose companies: develop buildings, own buildings, and manage buildings.
- ◆ Purpose of today's group: Explore your thoughts regarding daylighting (e.g., your feelings about daylighting, including the pros and cons)
- ◆ Ground rules (i.e., would like everyone to participate, please share the floor, one person at a time, feel free to disagree with each other).
- ◆ Participant introduction go around (name, company, your position).

II. PARTICIPANTS' KNOWLEDGE OF DAYLIGHTING (5 minutes)

1. How many of you are familiar with the term “daylighting?”
2. Please write down your understanding of daylighting. That is, what does this term refer to?

GET/DISCUSS DESCRIPTIONS

III. PARTICIPANTS' FEELINGS ABOUT DAYLIGHTING (10 minutes)

My understanding is that daylighting refers to designing buildings to make widespread use of natural light.

3. Please use this form to write down your overall feelings about the use of daylighting (very positive, positive, neither positive nor negative, somewhat negative, or very negative), and the main reason why you feel the way you do about using daylighting.
4. How many of you said very positive? Positive? Neither positive nor negative? Somewhat negative? Very negative? **EXPLORE REASONS FOR PARTICIPANTS' FEELINGS**

IV. DECISION MAKING ON USE OF DAYLIGHTING (5 MINUTES)

5. It would appear that there are many types of individuals who could be involved in the decision to use daylighting in new buildings such as: building owners, building developers, building managers, architects, consulting engineers, and lighting designers. Based on your experience, who typically has the greatest role in making this decision?

V. PERCEPTIONS OF WHEN DAYLIGHTING IS DESIRABLE (10 minutes)

6. What are the key factors you look at in deciding when daylighting is or is not desirable for a specific building?

VI. PERCEIVED MAJOR BENEFITS OF DAYLIGHTING (20 minutes)

7. What are the benefits of daylighting? Why design buildings to make widespread use of natural light? **(LIST ON FLIPCHART)**
8. **BENEFIT PROBES IF NOT MENTIONED BY PARTICIPANTS**

I am going to ask you in a few minutes to choose what you each believe are the three most important benefits from this list and to rank order them 1, 2, 3. Before I do, I want to read some statements that are described by some people as benefits to daylighting, and see if you believe these statements accurately describe benefits to daylighting. If you do, I will add them to the list so that you can include it as an option when you choose your top three. If you feel a benefit I mention is already adequately covered on the flipchart already, please let me know (I won't add it to the list). If you don't feel the statement accurately describes a benefit of daylighting, I simply won't add it to the list.

READ BENEFITS FROM LIST NOT MENTIONED AND ADD TO FLIPCHART AS APPROPRIATE

- ◆ Daylighting decreases overall energy consumption.
 - ◆ Daylighting improves the general appearance of the building.
 - ◆ Daylighting improves the occupants' comfort.
 - ◆ There is less absenteeism among school children and employees who occupy day lit buildings.
 - ◆ Daylighting improves occupants' productivity (e.g., students and employees).
 - ◆ People are healthier because they work in day lit buildings.
 - ◆ Daylighting increases stores' retail sales.
 - ◆ Daylighting makes interior spaces more appealing to building occupants.
 - ◆ The "green" image of a day lit building is valuable for the building owner and/or occupants.
 - ◆ Daylighting enables building owners to charge a rental premium for their space.
9. Please write down and rank order what you feel are the three most important benefits from the list you just created.

GET RANKINGS AND REASONS FOR HIGHEST RANKED BENEFITS

VII. PERCEIVED BARRIERS TO DAYLIGHTING (20 minutes)

10. What are the barriers to using daylighting more often for new buildings? (**LIST ON FLIP CHART**)

11. **BARRIER PROBES IF NOT MENTIONED BY PARTICIPANTS**

I am going to ask you in a few minutes to choose what you each believe are the three greatest barriers to increasing the use of daylighting using the list you just developed and to rank order them 1, 2, 3. Before I do, I want to read some statements that describe what some people see as possible barriers to the increased use of daylighting. I want to know if want me to add the stated barrier to the flipchart list (so that you have it as an option when you choose your top three), if you feel the statement is true but already covered by a barrier on the flipchart (no need to add it), or if you don't feel the statement accurately describes a barrier to daylighting (I will leave it off the list of barriers).

READ BARRIERS FROM LIST NOT MENTIONED AND ADD TO FLIPCHART AS APPROPRIATE

- ◆ Capital costs to construct the buildings are increased.
- ◆ Design costs for the building increase.
- ◆ Maintenance costs of the building increase
- ◆ There is an increase in the total amount of energy consumed by the building.
- ◆ Glare and occupant discomfort increase.
- ◆ It is too difficult to get all the additional controls to work properly.
- ◆ It limits the shape of the building and its fit onto the building site.
- ◆ Day lit buildings require special design. You have to reinvent the building each time you want to use daylighting.
- ◆ There is no reason to bother with daylighting because building occupants always close the window shades anyways.
- ◆ The use of daylight is not suitable for this climate.
- ◆ Daylighting is an unknown factor that introduces more risk into the building project (e.g., cost risk, time risk, quality risk, operational risk).

12. Please write down and rank order what you believe are the three greatest barriers to daylighting.

GET RANKINGS AND REASONS FOR GREATEST BARRIERS

VIII. OVERCOMING BARRIERS TO DAYLIGHTING (25 minutes)

13. You folks just listed what you consider to be the major barriers to daylighting. What needs to be done to overcome these barriers?
14. I am going to hand out a list with of some specific strategies for addressing barriers to daylighting. I would like to hear your reactions to each of these potential strategies: Would it be a very effective, effective, somewhat effective or ineffective strategy for overcoming barriers to daylighting?

HAND OUT SHEET, READ EACH ITEM AND ASK PARTICIPANTS TO RECORD REACTION TO STRATEGY

ASK FOR RATINGS OF EACH

15. **ASK FOR REASONS FOR OVERALL REACTION (positive, mixed or negative) TO EACH SUGGESTION.**
16. Now, please write down in rank order what you believe are the three best suggestions on this sheet.

GET RANKINGS AND REASONS FOR HIGHEST RANKED STRATEGIES

IX. INFORMATION SOURCES AND COMMUNICATIONS (10 minutes)

17. How do you currently get information about daylighting? Which of these information sources provide the most useful information?
18. As the U.S. Department of Energy and other agencies develop new information about daylighting, how would you want them to get this information to you?
19. This form displays a list of ways that the U.S. Department of Energy or other agencies might attempt to communicate with you about daylighting. Please record how useful you feel each would be in reaching key audiences with important information on daylighting: very useful (4), useful (3), somewhat useful (2), or not too useful (1).

HAND OUT LIST, READ LIST AND ASK TO RECORD RATINGS.

20. **(IF TIME PERMITS) GET AND DISCUSS RATINGS**

X. ADDITIONAL QUESTIONS (5 minutes)

ASK QUESTIONS FROM BACK ROOM