BetterBricks Design and Construction Initiative

Market Progress Evaluation Report

PREPARED BY

PWP, Inc

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Executive Summary

The first evaluation of the Design & Construction component of NEEA's BetterBricks initiative finds that early progress is being made toward the goal of promoting high performance buildings through the practice of integrated design. Accomplishments in 2006 include signing agreements to work intensively with three prominent architecture firms to design buildings that perform at least 25% better than current code; starting integrated design labs in Spokane and Bozeman; introducing architects at a variety of firms throughout the region to integrated design by assisting on over 40 projects; and developing an integrated design curriculum that ensures a consistent presentation of the topic.

The D&C team fell short of some 2006 progress goals, however, including:

- Lab directors and business advisors being able to clearly communicate to the market the value of integrated design. Their ability to do this was limited because they did not come to agreement on a definition of integrated design until the summer of 2006 and thus far no consistent label has been employed to differentiate what BetterBricks promotes from other, similarly named concepts. The difficulty of gaining consensus among the five highly diverse labs should be taken into account when setting timelines for future goals;

- Achieving a complete range of integrated design expertise at each lab including mechanical engineering;

- Establishing formal "firm focus" relationships with 4-5 architectural firms.

The effect of BetterBricks activities on buildings actually designed and constructed will take years to be seen in the marketplace, since the design and construction process (from planning and financing through the warranty period after occupancy) can span up to a decade in large, complex buildings, and even the development of completed construction documents can take several years.

MARKET STATUS

While architects are the main focus of the program, design engineers are critical participants in an integrated design process and the initiative understands that their practices need to change if initiative goals are to be achieved. A baseline survey of 24 HVAC design engineers was therefore completed in the summer and fall of 2006. It found that most engineers are aware of and interested in energy efficiency, integrated design, and sustainable design. They attain efficiency levels well above code on some projects and participate early in the design process on a significant percentage of projects. However, they are limited in their ability to implement efficient designs by cost considerations, lack of architect and owner interest, the timing of their participation in the design process, lack of experience with the more advanced aspects of integrated design, and gaps in the knowledge of the contractors who must implement the design and the building staff who must operate it.

A baseline survey of architects done in 2004 will be repeated in 2007 and included in the next MPER.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion: A definition of ID was only agreed to by all the labs during the summer, even as FF firms were being recruited, and no consistent terminology has been employed that differentiates what BetterBricks is promoting from other, similarly named concepts.

> **Recommendation**: A single term should be decided on and consistently used.

Conclusion: Some of the labs see Integrated Design as just one means to the end of having more efficient buildings designed and constructed, while the premise of the initiative is that implementing an Integrated Design process is essential if the market is to be transformed. Since the labs all agree that integrated design is the strategy they will use to achieve high performance buildings the disagreement appears on the surface to be more semantic than substantive. However, there were strong sentiments expressed on this topic during discussions with the Lab directors, making it clear that discussions should take place to come to agreement on the relationship between integrated design and high performance buildings.

> **Recommendation:** This issue should be resolved to ensure more consistent communication to the market and make it more likely that initiative goals will be attained.

Conclusion: The ramp-up of the new IDL labs is still ongoing. Spokane and Bozeman are building relationships and finding projects to work on. Boise, established earlier, has a full workload, a successful advisory committee, and a growing network of relationships with owners, architects, and engineers, as well as utilities, state agencies, and other IDLs.

> **Recommendation:** The Spokane and Bozeman IDLs should establish advisory committees similar to the one in place in Boise to help in establishing relationships and bringing in new projects, as well as in helping shape and adjust their strategies.

Conclusion: Initial indications are that the current Firm Focus relationships are positive. At a practical level, though, it remains to be seen whether the Seattle and Oregon labs can support the three existing FF firms to the extent needed to truly develop their capability and support their marketing.

> **Recommendation:** The labs should firmly establish their initial FF relationships and confirm that they can provide the needed support before adding more FF firms – particularly if the next firms added are large.

Conclusion: The selection process for Firm Focus firms recruited three firms that are likely to succeed in both adopting ID and showcasing it to the broader market, but did not select some of the largest architecture firms, which will need to be influenced to adopt ID if the D&C Initiative is to meet its 2010 market share objectives.

Recommendation: Subject to the previous recommendation, FF relationships should be pursued with one or more of the three largest firms serving the target markets.

Conclusion: Firm Focus firms appear to be committed to building ID capability, and they recognize the business benefits of ID as well as their own lack of experience in the more sophisticated ID techniques. However, related marketing benefits and strategies appear to be well understood by marketing specialists at only one of the three firms.

Recommendation: The Business Advisor should help facilitate communication between the design and marketing functions within the individual FF firms, as well as among the Business Advisor, IDLs and BetterBricks Marketing functions.

Conclusion: LEED is a successful sustainable building initiative that appears to raise awareness of efficient design, but does not necessarily reward load reduction and may result in buildings that do not meet the initiative goal of using at least 25% less energy than code.

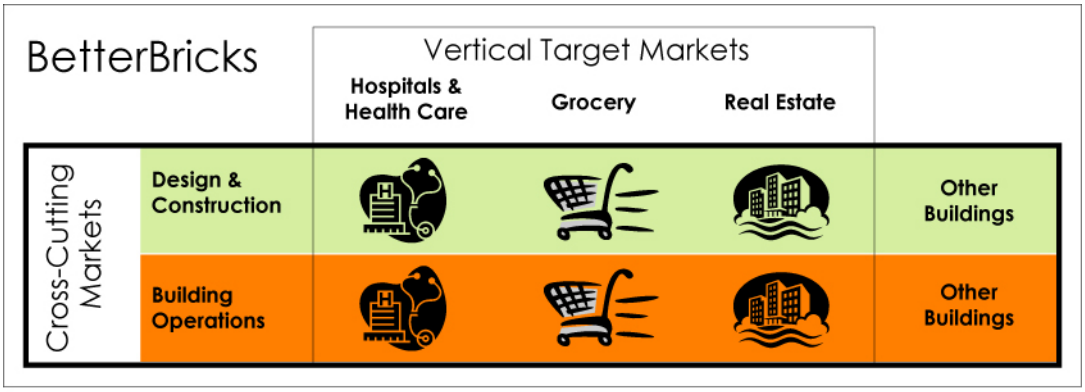
Recommendation: BetterBricks should develop a strategy for working with LEED projects to maximize their energy efficiency and should also continue to try to influence LEED standards and implementation to increase the energy efficiency levels of LEED buildings, particularly with regard to giving points for designs that reduce load**.**

1. Introduction

The Northwest Energy Efficiency Alliance (NEEA) is a non-profit corporation supported by Bonneville Power Administration, electric utilities, public benefits administrators, state governments, public interest groups and energy efficiency industry representatives. These entities work together to make affordable, energy-efficient products and services available in the marketplace.

This first Market Progress Evaluation Report[1] presents the results of PWP Inc.'s (PWP's) evaluation of NEEA's BetterBricks Design and Construction Initiative activities between January and October 2006. This period represents the first ten months of a three-year funding cycle which began January 1, 2006. Research in support of this report was conducted in September and October 2006.

BetterBricks comprises all NEEA commercial activities. BetterBricks currently addresses three 'vertical' markets (hospitals and health care, groceries, and commercial real estate), and two 'cross-cutting' markets (design and construction, and building operations). As shown in the figure below, vertical and cross-cutting markets overlap, representing the relationship between the demand (vertical) and supply (cross-cutting) sides of a given market.



The long-term goals of BetterBricks are to transform specific components of the commercial market and, specifically, to:

- Make energy efficiency an integral part of business decision-making. Within targeted vertical markets change energy related business practices to achieve energy efficiency in design and construction and in building and facility operations. Create natural market demand for products and services offered to the targeted market by its suppliers – also referred to as trade allies.

- Transform trade ally products and service offerings within the cross-cutting design and construction and building operations markets to deliver high performance (energy

[1] NEEA has run programs targeted to commercial new construction since its inception in 1997. This is described as MPER #1 because the current initiative that began January 1, 2006 represents a substantial shift in the focus and strategy of past years.

efficient) buildings. Align trade ally business resources and build market capabilities to meet and increase market demand[2].

The changes in business practices will result in facilities that achieve reductions in energy-related capital and operating costs, as well as potential non-energy benefits, such as occupant comfort and productivity, and an alignment of design and construction projects with industry best practices. This evaluation does not address the vertical target market, owner-focused efforts.

INITIATIVE DESCRIPTION

The goal of the Design and Construction Initiative is to transform the commercial new construction market so that a set of design approach and practices collectively known as Integrated Design (ID) becomes standard practice. The Design and Construction Initiative uses the following energy-focused definition which was created by the integrated design labs (IDLs) that provide technical support for the initiative[3]:

> In the creation of the built environment, integrated design is the synthesis of climate, use loads, and systems resulting in a comfortable and productive environment and a building that is more energy-efficient than current best practices[4].

The five potential benefits of ID are reduced operating expense; reduced construction cost; increased staff productivity, retention and morale; positive community image; and continuous improvement. A major emphasis in the initiative's ID process is to encourage its application early in the design process. The entire ID approach is premised on being able to make far-reaching decisions about all aspects of a building's design, including siting, occupancy, and morphology – all of which require fundamental design decisions during the programming or conceptual design stages. If such decisions have been made before the process begins, its impact will be limited.

Although the strategy by which the Initiative hopes to begin a market transformation to integrated design is a complex set of interrelated approaches, including technical assistance, education and training and marketing, a primary strategy is the Firm Focus (FF) approach – working with a few selected architecture firms to influence their business practices and increase their technical capabilities to deliver ID, particularly to the vertical markets targeted by BetterBricks. Firm focus relationships are formal in the sense that a memorandum of understanding (MOU) is signed by both parties. The MOUs state that, "The long term goal of our working relationship is to design and build buildings that achieve energy performance of at least 25% better than current code." BetterBricks agrees to provide design assistance on mutually selected projects, supported by education, training and research and business planning assistance,

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2 Northwest Energy Efficiency Alliance. 2006. *Commercial Sector Initiative 2006-2008 Project Description (July 5, 2005).* Portland, Oreg.: Northwest Energy Efficiency Alliance.

3 The term "Integrated Design" is already in common use but has a wide variety of definitions. The implications of using this term are discussed in Chapter 6.

4 "Rethinking the Design Process". From a presentation prepared by the Energy Studies in Buildings Laboratory, University of Oregon and Konstrukt. May 18, 2006. The two paragraphs following this definition are also taken directly from or draw heavily on materials in this presentation.

including strategic planning and marketing. BetterBricks also agrees try to publicize successful projects to encourage greater awareness of the benefits associated with energy efficiency. The architectural firms agree to provide an opportunity for BetterBricks contractors to help prepare proposals, to collaborate on architectural design and business practices to incorporate energy efficiency, and to increase efforts, with BetterBricks support, to pursue projects in the vertical markets.

While BetterBricks is providing significant resources to the FF firms, the intent is not to provide a permanent source of assistance but rather to build the firms' capability to do ID work on their own. Equally important is the creation of success stories that can be publicized, based on the ID projects that the FF firms complete with the technical advisors. The assumption behind the D&C initiative is that as the FF firms gain visibility, build their reputation, and increase their market share of the target markets through their expertise in and commitment to ID, other architecture firms serving those markets will have to follow suit to remain competitive. Similarly, in-house design departments within the target markets are expected to see the success enjoyed by FF firms with their ID approach and adopt a similar approach for their own hospital, grocery store, or commercial real estate projects.

Architecture firms were chosen as the firm focus audience based on the current standard design process in which architects are hired first and design engineers come in later to support them. At the same time, design engineers, as the creators of the mechanical and (sometimes) lighting systems, are critical participants in an integrated design process and the initiative understands that their practices need to change if initiative goals are to be achieved. The initiative currently works with engineers only through projects when they are part of the design team. A baseline study of design engineers was therefore conducted for this report and is described in Chapter 4.

The initiative offers both technical and business assistance to firm focus firms and technical assistance to non-firm focus firms. Additionally, there are education and training opportunities offered to the broader design and construction market.

Technical Assistance is provided by a network of five integrated design labs (IDLs) under contract to BetterBricks. The current IDLs evolved from two labs that pre-dated BetterBricks: the Lighting Design Lab, established more than a decade ago in Seattle, and the Energy Studies in Buildings Laboratory (ESBL) of the University of Oregon which had its original office in Eugene but has added a Portland location under the BetterBricks contract. These labs worked with architects, lighting designers, engineers and others on a project-by-project basis. The Seattle lab (also known as the Puget Sound lab) provided expertise in daylighting and more efficient use of electric lighting but did not address mechanical systems; ESBL was one of the country's early implementers of design projects that considered all energy-using systems in a building. The labs are now funded specifically to provide comprehensive ID services including daylighting, lighting and mechanical systems[5]. The various types of expertise required may be provided by in-house staff or contractors. Seattle does not currently have dedicated mechanical engineering services available but is in negotiations with a major contractor to provide them on a permanent basis.

[5] Ideally, all projects would include all energy-consuming systems in their design process. In practice, clients may choose not to address various systems for a variety of reasons. The Labs' job is to promote the ideal version of ID but to work with clients at whatever level they are ready for. Preference, though is given to projects which apply the ideal version.

In addition to broadening the scope of the existing Seattle and Portland/Eugene labs, BetterBricks also opened three new labs as part of the design and construction initiative. While the design labs in Seattle and Oregon had been providing design support to projects across the region, it was felt that a broader network of regional labs would bring this resource closer to markets outside Portland and Seattle. As a result, IDLs were established in Boise in 2004 and in Spokane and Bozeman in 2006.

The five IDLs operate independently but have a strong collaborative relationship. They hold regular conference calls to share information, assess progress and coordinate their activities. In addition, there are extensive informal ties and interactions between the labs. For example, the Director of the Boise lab formerly worked at the Seattle Daylighting Lab, and the Directors of the Portland/Eugene and Seattle labs have been collaborating on projects for decades. One of the key joint activities over the past year has been the development of the ID definition along with ideas on the appropriate way to present that definition. Methodologies to identify savings and estimate costs were also developed. Creation of an ID curriculum to be used to train architects is an on-going collaborative venture.

The Seattle lab has one firm focus relationship and Portland/Eugene has two; the other three labs have no firm focus relationships but may be adding them in 2007. Approximately 40% of the overall lab budget are currently spent on FF-related activities, the rest goes to other architecture firms, with priority to those that serve the BetterBricks vertical markets.

In addition to providing direct assistance on individual projects, all of the labs use a "project-based education" approach, where the IDL stages a one- or two-day workshop to interact with multiple design teams for individual projects and by providing firm-wide training for ID. The labs are also involved in developing and delivering training and informational material for the broader market.

Business Assistance, available exclusively to Firm Focus firms, is provided through a contracted Business Advisor expert in the planning, positioning, and marketing of architecture firms. The Business Advisor helps FF firms to develop a statement of corporate commitment to energy efficiency and ID and shows them how to use ID as a tool to position and market the firm relative to its competition. In addition, the Business Advisor assists in the selection and recruitment of FF firms, using his knowledge of the architecture market both to identify appropriate firms and to make the case for participation to those firms.

The D&C Business Advisor also will interact with Business Advisors to the vertical markets targeted by BetterBricks: hospital, grocery stores, and commercial real estate. As these vertical markets are influenced to pursue more efficient designs for their new construction projects, the strategy for the FF firms to succeed in each market will also change.

The Business Advisor assists FF firms in marketing by providing advice related to target markets as well as sales strategies for pursuing specific projects identified by the firms themselves. The Business Advisor also reviews existing business collateral materials and supports the revision or updating of such collateral; identifies potential organization conferences where speaking opportunities for FF personnel would advance their position in the sector. In addition, they draw on the capabilities of the BetterBricks marketing team, including outside PR firms, for preparation and placement of success stories in appropriate media, and advice related to

collateral and speaking opportunities.

Education & Training (E&T.) The BetterBricks E&T initiative is a separate resource from the integrated design labs. It offers public education and training sessions -- sometimes in partnership with the IDLs, and frequently in partnership with related market associations such as the Cascadia Green Building Council, the American Institute of Architects (AIA), and the American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE). E&T is not directly involved with professional education at Firm Focus firms, but labs with Firm Focus relationships can use curriculum developed by E&T for those purposes.

Marketing. BetterBricks Marketing for D&C operates on several levels: developing and maintaining the BetterBricks website, providing one-on-one assistance to FF firms in the areas of marketing collateral and public relations and organizing public events such as the BetterBricks awards. Marketing also provides limited assistance to the lab network for their collateral needs. Most important in terms of market transformation, marketing is responsible for the dissemination of success stories to the broader D&C market to raise awareness of integrated design and its benefits

PROGRAM THEORY

The Design and Construction Initiative's market transformation theory is expressed in the hypotheses and long-term goals given in the project description approved by the NEEA Board in July 2005 and summarized in Table 1. The assumption inherent in the market transformation playing out as shown is that the necessary methods and products to design and construct energy efficient buildings will be available in the marketplace.

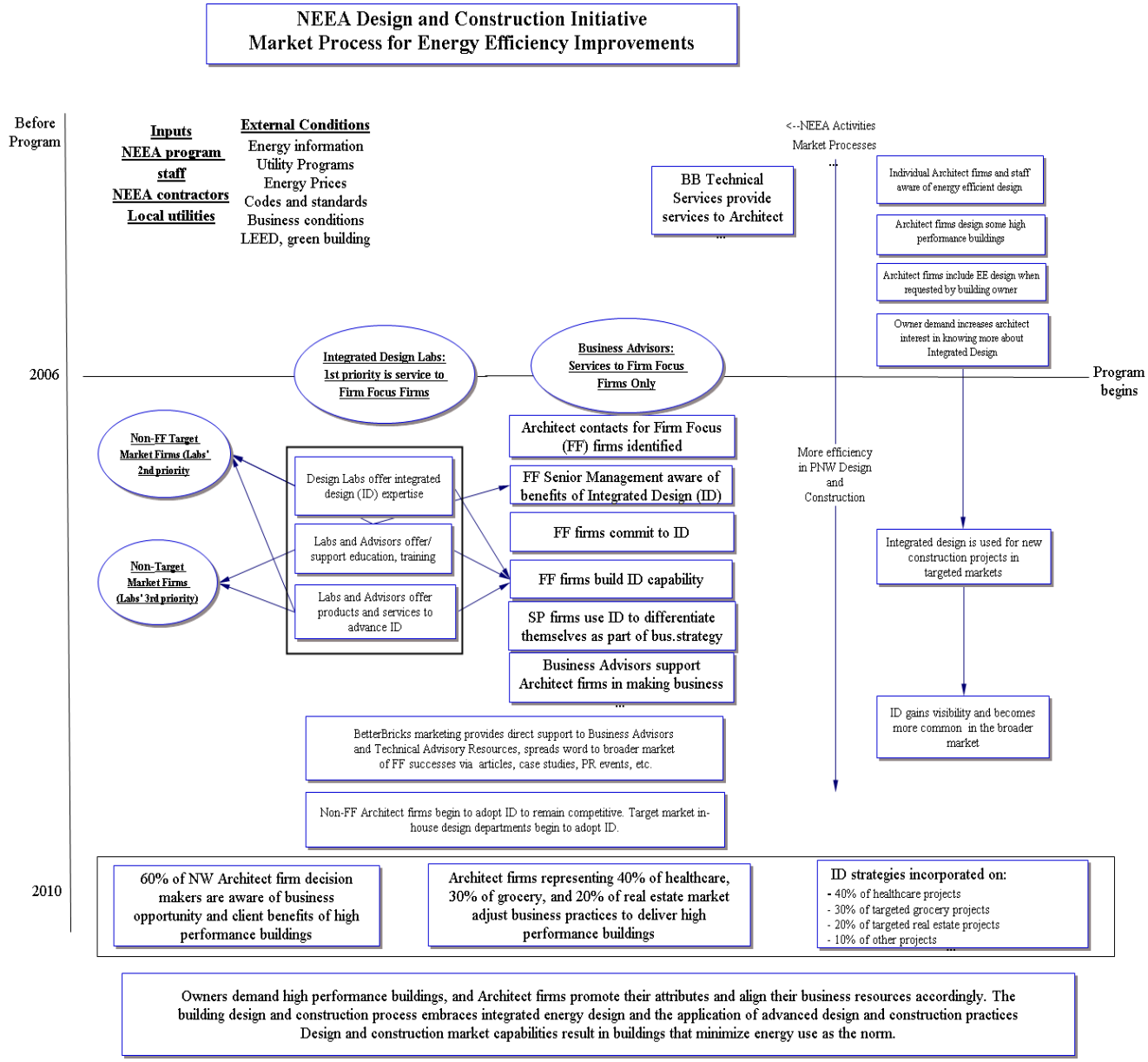
Table 1.: D&C Initiative Hypotheses and Long-Term Goals

HYPOTHESES	LONG-TERM GOALS
If owners (and their agents) are aware of the benefits of high performance buildings and how they align with their business interests, then they will demand high performance buildings.	Owners demand energy efficient (high performance) buildings, with A&E firms promoting their attributes and aligning their business resources accordingly.
If A&E firms are aware of the benefits of high performance buildings and how they relate to their clients' business interests, then they will promote high performance buildings to their clients. If architects and design engineers are encouraged by their firms and clients to apply integrated design and advanced design and construction practices, then they will do so to the extent of their abilities.	The building design and construction process embraces integrated design and the application of advanced design and construction practices.

If architects and design engineers gain further experience with integrated design and advanced design and construction practices, then capabilities will increase and these practices will become common practice.	Design and construction market capabilities result in buildings that minimize energy use as the norm.

Figure 1 graphically depicts the activity flow and outcomes for the program. This is followed by a text description of the elements in the figure.

Figure 1. Market Process for Energy Efficiency Improvements with BETTERBRICKS Design and Construction Initiative



The initiative theory is that the market will be transformed in a way that makes Integrated Design (ID) common practice in the design and construction of new commercial and institutional buildings. The beginning of initiative interventions is symbolized by the horizontal line in the middle of Figure 1. Above that line, design firms implement integrated design projects and receive technical assistance on a project-by-project basis. Where these projects are successful, some firms come to recognize the value that has been added to their organizations and are receptive to the message from the Business Advisors that these benefits can be expanded in scope and duration. This is shown in the ovals on the horizontal line, where Business Advisors and Technical Advisors (the five Integrated Design Labs) identify a limited number of design firms that that have a significant role in the vertical markets targeted by BetterBricks as well as an interest in building their ID capability.

- The series of boxes under the Business Advisors oval describe the process through which the business advisors make Firm Focus firms aware of the benefits of ID and then help these firms formally state their commitment to ID in company planning documents.

- The boxes under the Integrated Design Labs oval describe the services the technical advisors offer that help the Firm Focus architects build ID capability throughout the firms. This new-found capability then allows the firm to differentiate itself in the market. Technical Advisors also provide these services to some owners that do not work in the BetterBricks vertical markets and to design firms that are not Firm Focus partners – particularly for those Labs that have not yet established Firm Focus relationships.

- The goal of working with Firm Focus firms – as with any firm -- is to develop case studies and success stories that can be used to market the benefits of ID to other design firms who then begin to adopt the ID process. As more firms adopt the market is transformed over time. This is shown in the two widest rectangles lower down in the figure.

- By 2010, BetterBricks is expected to attain a number of quantified goals from these efforts, as shown in the three side-by-side rectangles near the bottom of Figure 1. The bottom row of the figure shows how the supply and demand sides of the market come together to complete the market transformation.

While Figure 1 adequately presents the theory of the initiative, it became clear during PWP's research for this MPER that it would be improved by the addition of the specific market barriers and opportunities faced by the initiative and the specific methods and approaches that are being used to address them. The initiative team should expand the model to convey market barrier and opportunity knowledge and describe key activities that will be undertaken to address or take advantage of them.

MARKET PROGRESS INDICATORS

As the D&C initiative moves forward, a series of indicators will be used to track progress in the market, as reflected in the knowledge and awareness of market actors and their efforts to incorporate that knowledge into building designs. These are the changes we would expect to see

slowly spreading throughout the market if the initiative theory is correct. Not surprisingly, these largely overlap with the changes we expect to see at FF firms in the relatively near term as those firms are intended to serve as the models and catalyst for broader market change. The indicators include:

- Percentage of Architecture firm principals who can
  - define integrated design (as defined by the D&C initiative) and describe specific benefits to their clients
  - describe the specific benefits of integrated design to their business
- Percentage of architectural firms using ID in their marketing materials; on their website
- Percentage of proposals from architectural firms submitted that describe and promote ID
- Percentage of mechanical design engineer firm principals who can define integrated design and describe specific benefits to their clients
- Percentage of projects
  - with design documents offering integrated design as "base case" rather than an extra cost alternative
  - for which design engineers are involved during programming, conceptual design, schematic development, design development
  - with energy design charettes.
  - designed to use at least 25% less energy than code
  - on which energy modeling is done 1) overall 2) during pre-design or early design (i.e., through schematics)
  - using specific ID strategies (e.g., downsized HVAC through daylighting, natural ventilation; evaporative cooling; night ventilation of mass; DDC for HVAC; task lighting; roof configurations for daylighting, etc.)

2. Evaluation Methodology

This MPER #1 is the first of three planned for the Design and Construction initiative. Evaluation research focused on documenting the background and activities of the integrated design labs and firm focus firms and conducting a baseline survey of design engineers.

An overview of components planned for the entire 2006-2008 evaluation period is presented in Table 2.

Table 2. – Design and Construction Evaluation Overview

COMPONENT	MPER #1 Q207	MPER #2 Q108	MPER #3 Q109
Market Characterization	X	X	X
Assess Logic Model	X	X	X
Assess Market Progress		X	X
Assess Progress Towards Goals	X	X	X
Process Evaluation	X	X	X
Estimate/Validate Savings Impact		X	X
ACE Model Review		X	X

Table 3 shows the specific activities that will be conducted and the data sources that have been or will be used for each MPER.

Table 3. – Design and Construction Evaluation Overview

Task	Data Sources	MPER #1 Mar 2007	MPER #2 Jan 2008	MPER # 3 Q109
Review Program Approach, Theory	Program Documents	x	x	x
	BetterBricks staff	x	x	x
Document Initiative Activities				
Firm Focus firms	A&E firm staff	x	x	x
Technical Resources	IDL Directors	x	x	x
Business Advisors	Business Advisor	x	x	x
Education and Training	BetterBricks staff	x	x	x
Marketing	BetterBricks contractors	x	x	x
Market Assessment				
Market Characterization	Literature review	x	x	x
Market Progress				
Firm Focus Firms	A&E firm staff	x	x	x
	A&E firm documents	x	x	x
	IDL staff	x	x	x
	Business Advisors	x	x	x
Architects	Architect Survey		x	
Engineers	Engineer Survey	x		x
Process Evaluation				
Initiative Activities	All sources above	x	x	x
Coordination and Communication	All sources above	x	x	x
ACE Model Review	Program documents		x	x

The evaluation was conducted through analysis of data collected through a combination of secondary data and program document review; on-site and telephone interviews with BetterBricks staff, contractors, and Firm Focus partners; and surveys of HVAC design engineers. Each of these data sources is discussed below.

DOCUMENT REVIEW AND SECONDARY DATA

Program descriptions, letters of agreement, progress reports, and other program documents were reviewed and analyzed, first to state and illustrate the program theory, and second to provide a basis for comparing these documents against expectations and experience to date. Secondary data also helped provide a picture of the industry structure to support an overview of the market, including a comparison to national trends or developments. Specifically, the market characterization was drawn largely from secondary sources, including U.S. Census Bureau statistics, trade associations, and regional and national industry publications and websites.

PRIMARY DATA

Primary data were collected directly from the Integrated Design Labs, the Design and Construction Business Advisors, other contractors and program staff, FF participants, and other market actors. The number of interviews completed is presented in Table 3. Mechanical design engineers were surveyed to provide a baseline assessment of their involvement in the design process and their knowledge and use of efficient design techniques before the full implementation of the current BetterBricks Design and Construction initiative.

Table 4. – Completed Interviews

BetterBricks Staff	2
Integrated Design Labs	5
Business Advisors	2
Other Contractors	2
Firm Focus Architecture Firms	10
Mechanical Design Engineers	24

3. Market Characterization

Market Size and Distribution

The challenge faced by the BetterBricks Design and Construction initiative can be summed up in the relative sizes of the initiative's budget and the region's commercial new construction market. While the D&C initiative has an average annual budget of about $3 million over the 2006-2008 funding cycle, the market for commercial and institutional new construction in the Pacific Northwest is valued at nearly $10 billion annually, according to the 2002 Economic Census, with an additional $4.6 billion spent on commercial additions and alterations. Table 5 presents both the distribution of the value of construction across the four states and across several of the most prominent market segments.

Table 5.: Value of New Construction – 2002 Economic Census

(in millions of dollars)

	% of PNW	PNW	Wash.	Oregon	Idaho	Montana
TOTAL NEW CONSTRUCTION	100.0%	**9,804.7**	**5,450.9**	**2,753.0**	**1,069.3**	**531.5**
Lodging	4.6%	455.1	241.8	152.9	28.3	32.2
Office	26.6%	2,607.1	1,623.3	671.0	178.5	134.4
Retail	21.6%	2,115.3	1,115.1	528.0	329.1	143.1
Commercial Warehouses	6.0%	591.1	287.9	204.1	76.6	22.5
Educational	17.6%	1,723.7	934.4	598.0	142.2	49.2
Health care and institutional	8.3%	813.1	469.5	194.4	76.0	73.2
Religious, public safety, recreational, other	15.3%	1,499.1	778.9	404.7	238.5	77.0
TOTAL ADDITIONS/ALTERATIONS		**4,626.0**	**2,767.1**	**1,315.6**	**305.6**	**237.7**
ARCHITECTURAL SERVICES		**1,248.6**	**761.7**	**325.3**	**88.3**	**73.3**

Note that office and retail together represented almost half the 2002 commercial new construction market, followed by education (18%) and health care (8%). Warehouses, hotels/motels, and miscellaneous other buildings such as churches, prisons, and other public buildings accounted for the remainder.

Geographically, 55% of new construction was accounted for by Washington, which had almost twice as much construction as Oregon (28% of the total), which had more than twice as much as Idaho (11%), which in turn had twice as much as Montana (5.4%).

Another indication of the size of the market BetterBricks is targeting with the Design and Construction cross-cutting program is the volume of business reported by architectural firms in the same census. According to state level data on professional services and as shown in the Table above, architects in the four states of the PNW reported revenues of some $1.25 billion in 2002. While some of that business represents residential and industrial design work, the bulk of architecture work done by these firms is design of commercial and institutional buildings. (The

assumption is also that work done by PNW firms outside the region roughly offsets work done in the region by outside firms.)

For architects, revenue was even more geographically concentrated than it was for construction, with Washington representing more than 60% of revenue for architectural services, compared to 26% for Oregon, 7% for Idaho, and 6% for Montana. Architectural activity was further concentrated within states: in Washington, the greater Seattle-Tacoma-Olympia Standard Metropolitan Statistical Area (SMSA) accounted for 81% of architect revenue, compared to 14% for Spokane and 5% for all the rest of the state. In Oregon, Portland accounted for 87%, while Boise accounted for 67% of Idaho's architecture activity and Coeur D'Alene for 10% . Montana, on the other hand, had architecture revenue more widely distributed, with 4 cities together accounting for 80%.

This geographic distribution across and within states is relevant in that it directly affects the ability of the BetterBricks program to reach the architects, and helps explain why the FF strategy appears to be better suited to Washington and Oregon (where more than 80% of architecture activity is concentrated in a single SMSA) than to Idaho and Montana (where the largest SMSAs account for 67% and 40%, respectively of architectural activity.)

In addition to being geographically concentrated, design activities for the specific markets targeted by BetterBricks are concentrated in relatively few architecture firms. This concentration among architects underlies the FF approach, in that changing the practices of a few firms should yield significant changes in the overall market.

Growth in commercial construction in the region has been steady over the past several years, mirroring trends in the national market.

Market Status

It is widely recognized that the PNW is among the most progressive regions in the country in its acceptance of green building and energy efficiency. This can be confirmed by the number of LEED registered and certified new construction projects in the USGBC database, summarized in Table 6. The PNW represents less than 4% of the national new construction market, but accounts for 8.6% of LEED registered (applied for but not completed) projects and more than 15% of LEED certified (i.e., those that have completed the certification process) projects in the U.S.

Table 6. LEED Projects, number by state and as percent of US Totals -- 2006

	Number of Projects					
	US	PNW	WA	OR	ID	MT
LEED Registered	1190	102	51	43	5	3
LEED Certified	429	67	33	31	1	2
	Percentage of US Totals					
LEED Registered		8.6%	4.3%	3.6%	0.4%	0.3%
LEED Certified		15.6%	7.7%	7.2%	0.2%	0.5%
Construction Market		3.9%	2.1%	1.2%	0.4%	0.2%

Source: USGBC LEED database

Despite this relatively high penetration of LEED buildings, the overall role of LEED and sustainable design in the market was still low as of a few years ago. Results of the baseline survey of PNW architects conducted for NEEA by Research Into Action in 2004 found that while 97% of architects had heard of LEED certification, only 12% were LEED accredited and just 15% reported having worked on a LEED-certified project. And while 78% of architects ranked themselves a "4" or a "5" on a one-to-five scale of interest in the sustainable building movement, 59% said they had rarely or never had an opportunity to work on a sustainable building.

While interest in LEED continues to grow, the overall focus on LEED appears to be limited to larger marquee projects. On the other hand, in a number of jurisdictions in the region, all public buildings above a very small size must receive LEED certification, indicating that in the public sector there are many more buildings than marquee projects participating in LEED Most other buildings are still constructed with code as a target, using the same design-bid-build process that tends to relegate decisions affecting energy efficiency to the status of add-ons and afterthoughts that must be weighed against available budgets. Moreover, several sources note that building codes in the PNW tend to be relatively stringent, and some design engineers say that the requirements for mechanical systems lead to efficient buildings even if code is not exceeded.

One of the trends influencing the efficiency of new buildings mentioned by several industry sources is the growth of design-build contracting, especially for relatively simple buildings (e.g., office parks, strip malls, big box retailers.) The design-build process, where a single contractor is responsible for all aspects of both design and construction, tends to be detrimental to energy efficiency, since the focus is typically on meeting broad programmatic goals at minimum cost, and often projects are fast-tracked with little time for design. Since the architects and engineers on design-build projects work for the design-build contractor rather than the owner, there is less emphasis on offering energy efficient or sustainable alternatives, particularly if those alternatives carry any incremental cost. As a result, buildings constructed using a design-build process are less likely to exceed minimum energy code requirements or attempt to meet LEED or other sustainability criteria,. Many owners will, however, opt for higher efficiency HVAC equipment if available utility rebates cover most of the incremental cost.

Converging Trends?

There is some indication, from the perspective of Lab Directors and others familiar with the market, that a number of conditions may now be in place to encourage acceptance of ID. The success of LEED, overall interest in energy efficiency and sustainable design, and rising energy prices appear to be putting high performance design "on the table" for many new commercial construction projects – although energy is only one piece of getting high performance design on the table, and it is usually not the biggest piece.

As cited by the USGBC, a June 2006 article in The Harvard Business Review, for example, notes that energy efficient, sustainable buildings are rapidly becoming a necessity for Fortune 500 firms who want to remain competitive. In addition to the greater attention being paid to energy efficiency as energy prices soar, several converging forces may be helping to push the commercial construction market toward a "tipping point." These forces include the emergence of consistent building-rating and performance measurement systems for new construction and renovations (such as the USGBC's LEED Rating System.); numerous studies documenting the

financial advantages of going green, from reduced construction costs to lower operating costs; greater awareness of indirect benefits of green buildings, including stronger employee attraction and retention, lower absenteeism, and improved productivity; and reduced costs of constructing green buildings because of lower materials and technologies costs, greater availability of green building products, and greater real estate industry experience in planning and constructing green buildings.[6]

Similarly, the American Institute of Architects (AIA) has adopted position statements to promote sustainable design and resource conservation to achieve a minimum reduction of fifty percent of the current consumption level of fossil fuels used to construct and operate buildings by the year 2010, and to make all new buildings carbon neutral by 2030. In order to accomplish this goal, AIA will collaborate with other national and international organizations, the scientific research community, and the public health community. One recently announced collaboration is AIA's partnership with the U.S. Conference of Mayors, which passed a similar policy statement and is partnering with the AIA to promote this 2030 goal to mayors across the country by providing a tool kit for elected leaders that will help them develop local programs and regulations resulting in carbon neutral buildings as commonplace in their communities.[7]

As one observer has pointed out, it will take much more than the most common energy efficiency measures to meet these AIA goals, including many elements being promoted by BetterBricks as part of Integrated design. Some of these less common approaches that will have to be addressed include siting the building for heating and cooling advantage; incorporating technologies such as chilled-beams cooling, underfloor air and radiant heating, and ground-coupled heat pumps; daylighting; and, perhaps most important, the cooperation of professionals from different fields to produce the best overall energy savings.[8]

Perhaps the most important potential development is an announcement by the American Society of Heating, Refrigerating and Air-Conditioning Engineers that their 2010 90.1 Standard will be 30% more efficient than the 2007 version that is currently being developed. The 90.1 Standard is the *de facto* mechanical code for most of the country, so a significant increase in its stringency will have a large effect on the entire commercial new construction market if it is adopted.

In addition, a number of other programs are helping to institutionalize the awareness of sustainability and energy efficiency. In Washington, the Washington State legislature now requires sustainability and high-performance in the design of public buildings. The Office of the Supervisor of Public Instruction is implementing a legislated mandate that requires sustainability and high-performance in the design the state's schools. According to one architect, it appears that for a two or three percent higher initial cost (made up quickly by efficiency savings), schools can meet the requirement.[9]

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6 "Green Buildings Are Going Mainstream, says Harvard Business Review," US Green Building Council press release, June 21, 2006

7 "Former Vice President Gore Expresses Support for AIA Policy to Reduce Energy Usage in Buildings," AIA press release, September 22, 2006

8 Llona, Joe, "Tips for Designing an Energy-Efficient Building," Seattle Daily Journal of Commerce, Building Green Section, March 30, 2006, at www.djc.com/news/en/11177168.html

9 Paget, Steven, "What Does a Sustainable School Cost? – 2% More Than a Conventional School, but the Extra Cost Can Pay Off," Seattle Daily Journal of Commerce, Building Green Section, March 30, 2006, at

In Oregon, Portland has an office of sustainable development, while the state continues to offer the Business Energy Tax Credit (BETC) in support of new buildings that meet specific efficiency criteria. While there is less of an emphasis on sustainable building overall in Montana and Idaho, Idaho Power continues to offer prescriptive incentives for mechanical equipment.

The net effect of all these factors is that FF architects report that sustainable design is at least considered for most of the projects they undertake. It should be noted, however, that these projects represent the higher end of the new construction market, particularly marquee projects that have high visibility in the marketplace for their owners and the design team. And even for most of these projects, energy efficiency is still treated as an "add alternate" design option that can be value engineered out of the design later in the design and construction process, rather than as an integral part of the building design. The majority of projects – by number if not by square footage -- throughout the region are designed using a standard design process, where first cost is a prime concern and the primary performance goal is to meet the state code. Options for increased efficiency in these projects, as noted above, are typically limited to consideration of higher than required equipment efficiency that is partly funded by utility rebates.

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www.djc.com/news/en/11177214.html.

4. D&C Initiative Activities

This chapter summarizes the activities undertaken by BetterBricks in 2006 as part of the D&C initiative. The information here is drawn from reviews of progress reports and other documents, as well as from interviews with program staff, contractors and employees at firm focus firms.

TECHNICAL RESOURCES – INTEGRATED DESIGN LABS

Design Assistance

The number of current active projects cited in recent progress reports for the IDLs ranges from about 5 to about 20 at each lab. Table 6 lists the projects mentioned in the progress reports submitted to NEEA for December 2006. The Seattle and – to a lesser extent – the Portland/Eugene labs have a higher level of activity because they have long-term relationships with a number of architects, engineers, and utilities, as well as their Firm Focus relationships. Moreover, they serve urban markets where most of the architectural activity in the region is located (see Market Characterization chapter above) and, consequently, they have larger budgets than the other labs.

Neither the Portland/Eugene nor Seattle (Puget Sound) Lab Director was certain exactly how many projects they will be working on with each FF firm, saying they would have to wait and see how the relationships develop and how many FF firms they are working with. As the newer labs lack Firm Focus relationships, most of the design assistance they have provided has been opportunistic; when an opportunity presents itself, the Lab Directors provided whatever support they could in light of the circumstances of the project. However, as they step beyond the start-up phase, they are becoming more proactive and more focused on the target markets.

So far the Spokane and Bozeman IDLs have had relatively few projects that they can assist in depth. Instead, they have focused on building relationships with architecture firms and seeking projects to work on. And while they have succeeded in finding some projects where the design team is receptive to assistance, the challenge has been to get involved early enough to significantly influence the design. According to the Director of the Bozeman IDL, when owners or architects do have a project on which they would like the lab's assistance, they are typically already in the construction documents phase of design.

In Idaho, the Boise lab has the benefit of a vibrant new construction market to help generate demand for its services. In addition, Idaho has an advisory committee of individuals from Idaho Power, the Energy Division of the Idaho Department of Water Resources, universities and other IDLs that has been instrumental in channeling new projects to the lab. Seeking projects has never been an issue for the Boise lab, in part because the Boise IDL Director had been working with the Idaho market from the Puget Sound lab for a year and had a number of projects to work on as soon as the Boise lab opened.

As suggested by the monthly progress reports summarized below, IDL resources are committed to a number of projects both within and outside the BetterBricks vertical markets. Schools continue to offer opportunities for all the labs, particularly in Idaho where several new K-12 schools are being built annually. The Boise IDL director and directors of other labs say they are

disappointed that schools are no longer considered a target market. They say this market is far from fully transformed and that there are numerous opportunities to influence the design of prototype schools and classrooms in ways that incorporate daylighting, natural ventilation, and other elements of ID[10].

Table 7.: December 2006 Project Involvement – by IDL

Eugene-Portland IDL (ESBL)	Puget Sound IDL
Healthcare	**Healthcare**
FF: Shriner's Hospital for Children, Portland, Oregon	Tannesborne Medical Office Building, Hillsboro, OR
Providence Hospital, Hood River, Oregon	FF: St Joseph's Orthopedic Rehabilitation Center, Spokane
Offices	FF: Seattle Veterans Hospital Lab Addition,
FF: Port of Portland Office Building and Parking Garage	FF: Providence Medical Office Building, Happy Valley, OR;
Crescent Village Office Building, Eugene, Oregon	FF: School of Ophthalmology, Pacific University, Hillsboro, OR
Other	**Grocery**
FF: Clatsop Community College	Puget Consumer's Cooperatve, Redmond
FF: Da Vinci Arts Middle School, Portland, Oregon	Town and Country Central Market, Poulsbo and Mill Creek WA
FF: Mt Angel Theological Studies	Bellingham Food Coop
FF: Reed College Residential Housing, Portland, Oregon	Hagen's Top Foods, Tumwater - renovation:
FF: Shattuck Hall, Portland State University, Portland, Oregon	**Offices**
FF: Tualatin Library, Tualatin, Oregon. ,	Ganz Office Building, Portland:
Canby High School, Canby, Oregon	Edmonds School District Operations Center:
Happy Valley Elementary and Middle School School	University of Washington, Clark Hall, Seattle:
Boise IDL	Puyallup City Hall:
St. Luke's Hospital Twin Falls	Whatcom County Employees Credit Union, Ferndale and Sunset
St. Alphonsus Regional Medical Center - South Tower Renovation	**K-12 Schools**
Center for Advanced Energy Studies (CAES)	FF: schools projects in WA:
Nampa School District Two Classroom Prototype (Endeavor)	Issaquah, Edmonds, Redmond and Bainbridge Island school districts
Insight Architects Offices - Monitoring and Design Assistance	FF: schools projects in OR:
Assisted Living Center - Boise/Meridian	Hillsboro, Medford, McMinnville and North Clackamas School Districts
Donnelly Elementary School	First Prebyterian Church of Bellevue, Wa., K-12 School
Boise Rescue Tower - Front & Fifth	Other Schools in early occupancy:
LDS Temple west façade shading study	Wilson High School, Tacoma
Lake Ridge Elementary School	Washington Middle School, Olympia
Lone Star Middle School	Thompson Elementary School, Spanaway
Bozeman IDL	Lincoln Heights, Ridgeview, Lidgerwood Elementary, Spokane
Benefis Hospital, Great Falls	**Washington State Projects Where High-Perf. Goals Are Mandated**
St. Vincent Hospital, Billings	Cascadia Community College, Bothell, WA
Bozeman Middle School	Skagit Valley Community College Science Building, Mt. Vernon, WA
Three story office building, Helena	Tacoma Community College Early Learning Center.
Cardinal Distributing Center, Bozeman	South Seattle Community College Horticulture Building.
Meineke Car Care Center, Bozeman	**University of Washington New Construction Capital Projects**
Spokane IDL	University of Washington Clark Hall remodel.
Mount Carmel Hospital, Colville, WA (Providence System)	University of Washington Savery Hall.
St. Joseph's Center / Sacred Heart (Providence System)	**Other Washington State New Construction Capital Projects**
Whitworth Art Gallery	Centralia College Science Center
Aerospace Museum	**Other Projects**
Pasco Dust Devils Stadium	Rainier Valley Boys and Girls Club:
	Bellingham Children's Museum:

Education and Training offered by IDLs

In addition to providing direct assistance on individual projects, all of the labs use a "project-based education" approach, where the IDL stages a one- or two-day workshop to interact with multiple design teams for individual projects and identify opportunities for ID. In addition, all interaction between the Labs and designers on specific projects – whether in the context of a Firm Focus relationship or not – can be considered project-based education. In 2006, the labs

[10] Schools were approved as a vertical market in 2001 but stopped receiving dedicated funding in 2005. The Labs are still free to do school-related work but as a secondary priority after the current three BetterBricks' vertical markets.

were also involved in developing and delivering training and informational material for the broader market. The Portland/Eugene lab, in particular, has taken a leading role in helping to define and refine the concept of ID so that it can be more readily explained and implemented, with all the IDLs involved in reviewing and refining the material. This work led to the development of a presentation that will serve as the core source material for the BetterBricks Education & Training and Marketing teams to develop materials on ID.

BUSINESS ADVISOR SERVICES

Specific tasks undertaken by the Design and Construction Market Business Advisor in 2006 were limited by the relatively late start date of the FF activities, but included:

- Assistance in advancing the development of the FF strategy and planning for implementation, including reviewing and refining introductory presentations and assisting in firm selection and coordination.

- Assistance to the FF firms in aspects of their Strategic Plan and Business Plan to assure that the firm's overall vision, goals and objectives integrate high performance and energy efficient design and to help identify strategies and activities that will advance the firm's broader vision of leadership in Integrated Design.

- Evaluation of each firm's culture and processes and suggesting ways to improve practices to more effectively deliver ID.

- Advising selected firms in marketing plans, marketing strategies, proposal language and marketing materials to use concepts of high performance and integrated design to the firms' advantage.

The review of existing practices at the FF firms was initiated in late summer and early fall and was being completed at the first of the three FF firms in late fall 2006.

FIRM FOCUS APPROACH

For this first MPER, the evaluation examined the process by which Firm Focus (FF) firms were chosen and assessed the perceptions and expectations of key individuals at the FF firms.

Evaluation interviews were conducted with key members of each participating firm to assess their understanding of the FF approach and their expectations of the benefits participation will provide. Separate interviews were conducted with the partner with overall responsibility for the FF relationship, the individual with primary responsibility for marketing at each firm, and the person with primary responsibility for interacting with the IDLs for technical design assistance.

The original intent of the initiative was to work with four to six FF firms during 2006. This has since been scaled back, and three firms were selected and signed up by summer of 2006: Zimmer Gunsul Frasca Partnership (ZGF) and SRG Partnership (SRG) are working primarily with the Portland IDL and Mahlum Architects is working with the Seattle IDL, although each firm has offices in both Seattle and Portland. The other three labs have not yet established firm focus

relationships. The selection of firms was both systematic and qualitative. Criteria established earlier in the year included the following elements:

- Influence within the design community, as measured by market share, peer recognition, and the number of architects in the region
- Significant relationship to BetterBricks vertical markets (hospitals and healthcare, grocery stores, office real estate)
- Commitment to high performance buildings and related integrated design service offerings, as reflected in prior participation with BetterBricks
- Current ability to deliver energy efficient design
- Likelihood of success, as indicated by interest/willingness to partner to further build capabilities and expand business opportunities, internal conditions appropriate for change.

Considered in terms of size, ZGF is by far the largest of the three with more than 200 architects (including offices outside the PNW); Mahlum and SRG are smaller, with about 50 and 30 architects, respectively, but have consistently focused on high performance buildings and have a track record of working with the IDLs.

Senior level staff at the FF A&E firms said they had few reservations and concerns about establishing the relationship with BetterBricks. Since all the FF candidates had done at least some work with the Labs, they saw this relationship as an opportunity to have more of a good thing. The only concern expressed was regarding intellectual property: "a general proprietary sense of what we do and how we approach potential work that we're not inclined to share with anybody."

Any such concerns were apparently allayed by discussions between the A&E firms, BetterBricks, the Labs and the Business Advisor, and kickoff meetings were subsequently held with each of the firms. Since then, the Business Advisor has conducted a series of meetings and project reviews to help assess the current status of ID in the marketing strategy of each firm and to develop a set of recommendations for moving forward. That process has been nearly completed at one of the three firms, with the Business Advisor scheduled to present results in the late fall.

Participant Perceptions and Expectations

The individuals at the Firm Focus firms who have overall responsibility for the BetterBricks' relationship all have an understanding of the program that appears to closely match BetterBricks' understanding as laid out in the letters signed by both parties. In line with the initiative's strategy for the FF approach, the senior level partners at the firms see the relationship as an opportunity to build their firms' technical capability in Integrated design and then to market that capability as a way to differentiate themselves from other A&E firms. Several people at FF firms suggested that they understood that if they did not pursue the relationship their opportunity to continue to work with the IDL might be at risk, although all of them framed the benefits of participation in a very

positive light. The overall expectation among participating firms is that this relationship will help them to "design better buildings," and they will judge the success or failure of their participation by the extent to which they achieve that goal.

From a design perspective, the firms all hope to build their capability by working on individual projects with the design labs. The understanding among all of them appears to be that they will "learn by doing" -- that is, by working with IDL specialists on new and innovative ID approaches. The knowledge gained and capability built in this manner are then expected to be diffused through the organization by architects who take what they learn on one project and use it on projects with other design studios in the firm. Respondents clearly envision hands-on project involvement by the IDL directors and staff, and all of them readily admit they have much to learn about ID – particularly as applied to specific building types or markets. As the firm builds capability, they expect the part played by the IDLs to shift to more of a review/advisory role. Some tasks, however, will still be carried out by the labs (or perhaps by a third party). Daylight modeling for example, is done at facilities that are available at the labs but not at the firms; firms design and build the models, then bring them to a Lab, which does the daylighting analysis and provides results to the firm. This approach is not expected to change. Similarly, detailed energy modeling is expected to be done by third party vendors or by the firms themselves.

The issue of how much time the labs will be able to devote to assisting the individual FF firms and how many projects they will be able to work on is still somewhat vague in the minds of most of the A&E firm staff, with an expectation that it will be clarified as time goes on. Estimates of the number of projects the IDLs will work on per year were typically in the 5-10 range. As one respondent pointed out, this is both where limitations on available resources come into play and where the issue of training takes on greater importance. In fact, all the partners in charge of the FF relationship said they anticipated there would be more structured training on specific elements of ID that might be offered by someone from the IDL, either through whole- or half-day seminars or through lunch time brown bag seminars or other meetings.

As far as the goal of achieving 25% energy savings, all the design partners said this seemed like a reasonable target. They also said that they already achieve this level of savings (and sometimes more) on a few of their projects, but would like to make it the standard for most of their design efforts. Several design-oriented respondents said that if a truly integrated design approach were used, actual savings should be well above 25%.

On the other hand, several architects and marketers noted that all the estimates of savings from alternate designs to date have been theoretical or based on modeling results. As a result they are very interested in seeing post-occupancy verification of actual energy usage, with one of the marketing specialists emphasizing that she thought this was critical to the credibility of marketing efforts.

There seems to be somewhat less clarity regarding expectations for the broader marketing support that will be available to the A&E firms through the FF relationship. While one of the marketing contacts had a clear understanding of the relationship between NEEA, BetterBricks, and the marketing activities of their own firm, the two others were less certain. One respondent clearly had not thought much about the kind of support that might be available, but was able to come up with several ideas during the conversation – specifically the use of the BetterBricks'

marketing contractor to assist in placing stories about the firm's activities with ID and scheduling of speaking engagements. This respondent emphasized that responding to RFPs was a quick turnaround proposition, which would make it difficult for the firm to work with the Business Advisor to incorporate the ID message into many proposals. Another marketing lead was aware that marketing assistance was available and clearly expected it to be valuable, but appeared to be more concerned with using marketing materials to explain the relationship between the A&E firm and BetterBricks than in highlighting the firm's accomplishments with regard to ID.

The expectation among marketing partners was that the FF relationship would be helpful in the following areas:

- Assistance in prioritizing projects to help determine which ones would lend themselves to highlighting ID capabilities

- Assistance in describing the nature of the ID process and how it could be applied to the project in question, with specific examples to build credibility and differentiate the firm. (This would be more technical than purely marketing-driven, but the marketing specialists recognize this as critical to the success of marketing efforts.)

- Public relations support, such as assistance in writing and placing articles, arranging speaking opportunities, and preparing press packets that emphasize ID.

EDUCATION AND TRAINING

During 2006, BetterBricks Education and Training (E&T) staff and contractors have been working with the Integrated Design Labs to develop an ID curriculum for public education based on content from the previously mentioned ID presentation developed by the IDLs. BetterBricks E&T is generally not involved with FF staff development efforts, which are the responsibility of the IDLs and the Business Advisor.

Public education through the E&T initiative has been delivered to the broader market in the region throughout 2006. Most of the education was in partnership with the IDLs; in all cases, efforts were made to partner with other market associations and organizations. Table 7 summarizes the education activities by state and subject matter. While the topics for many of these activities have not been directly about ID, they are related to or components of the new ID concept. Note that the Idaho region has been particularly active in providing training on various aspects of ventilation and natural cooling, while Washington has focused on lighting and daylighting. In addition, all states have had beginner and advanced training sessions on eQuest energy modeling software, while Idaho also offered a session on the Energy Scheming software that was developed by the Energy Studies in Buildings Laboratory in Eugene.

Education and training activities relevant to the D&C cross-cutting initiative will be investigated in greater detail in future MPERs as efforts increase to diffuse the knowledge and successes gained by the FF firms to the broader market.

Table 8.: 2006 D&C Training Activity by State and Topic

Topic / Event	ID	MT	OR	WA (Seattle)	WA (Spokane)	Region
IDL Sponsored / Supported Events						
Lighting / Daylighting	3	2	2	6	2	15
Energy Modeling	3	2	2	2	2	11
Heating / Cooling / Ventilation	10		1	1		12
Other	2		1			3
Non-IDL Events	1		2	2		5
Total	19	4	8	11	4	46

In addition to FF professional development and broader market education, internal IDL education roundtables were held in 2006. Two sessions were held to respectively discuss integrated design in hospital and grocery. E&T brought together a panel of design and business professionals with experience in those two markets to discuss the energy morphology and the design implications of those building types. IDL feedback confirmed that these sessions were useful.

MARKETING

The marketing team has had significant development talks with the FF firms but, because these relationships are in an early stage, no actual marketing activities for FF firms had occurred through October of 2006. We anticipate, however, that a substantial amount of marketing support will be provided to the FF firms in 2007, and this will be addressed in the next Market Progress Evaluation Report.

In addition, marketing support continued to be provided in 2006 to other vertical markets that are not among those currently being targeted and to the IDLs for efforts not related to firm focus. An example of the former is an ongoing effort to reach out to school decision-makers to promote success stories related to energy efficient design for schools; an example of the latter is the work being done on collateral and other materials to create a consistent look for the IDLs.

Marketing organized three BetterBricks Awards events, one each in Seattle, Portland and Boise, to honor the leaders behind the best high performance building projects in the Northwest. Judging criteria included the consideration of substantial energy savings, enhanced productivity of building occupants, local climate and employing early design decision-making. Each of the events included winners for design and construction.

Marketing is in the midst of re-developing the BetterBricks website and D&C will have a large presence on it. It is scheduled to go live in early 2007.

UTILITY COORDINATION

Several of the IDLs report working closely with the utilities in their region. The Seattle IDL Director emphasizes the importance of linking design projects to available utility programs, noting that "utility relationships (with design teams) fall between the cracks all the time." As a result, the Seattle IDL maintains close relationships with utility representatives, particularly those for Seattle City Light and Puget Sound Energy. In Idaho, utility coordination is also evident in the fact that the Boise IDL has a representative from Idaho Power on its Advisory Committee. Idaho Power also helps fund the Idaho IDL, and monthly reports prepared for NEEA are also sent to Idaho Power. Both the Bozeman and Spokane IDLs are working with their local utilities to help establish relationships with A&E firms, possibly as firm focus candidates. In addition, the Eugene/Portland ESBL has an ongoing relationship with the Eugene Water and Electric Board, providing design assistance to local architects and engineers for 18 years on more than 80 projects.

5. Baseline Surveys

To assess market progress over time, evaluators conduct surveys of target audiences to determine their awareness and knowledge of elements important to the initiative. The initial surveys are considered baselines; the first of these, for architects, was conducted in 2004 by Research Into Action[11]. A brief summary of the results is presented below. The architect survey is scheduled to be repeated in the second half of 2007; results of that work and a comparison to the 2004 results will be included in MPER #2.

For this MPER, a baseline survey of 24 HVAC design engineers was completed in the summer and fall of 2006. Though design engineers are a secondary audience of the initiative they are a critical part of the initiative hypotheses as shown in Table 1 in the Introduction. The methods and results of the engineer baseline follows the summary of the architect survey.

2004 Architect Baseline Summary Results

The 2004 baseline survey of 174 architects found that architects in the Pacific Northwest report being interested in sustainability and energy efficiency. Yet most report that they have had less opportunity to work on such projects, both because owners do not make energy efficiency a priority and because sustainability and energy efficiency are lower priorities for their firms than for them as individuals. As an example, while 97% of the architects had heard of LEED certification, only 12% were LEED accredited and just 15% reported having worked on a LEED-certified project.

The survey also found that the BetterBricks.com website had made substantial inroads into the architecture community, with 74% familiar. Half of the architects (51%) had visited BetterBricks.com and one third (34%) had visited that website more than once.

There appeared to be opportunities for stimulating integrated design, as most architects reported participating in team meetings throughout the course of a project. However, these team meetings occurred less frequently at the conceptual design stage and the bidding and bid review stages.

Only one of the barriers to energy-efficient design that was asked about was reported as important by more than 51% of the architects: a perceived difficulty in achieving occupant comfort with energy-efficient HVAC systems. Sixty percent of the architects reported this was an important barrier.

While architects report that early design discussions for lighting frequently address daylighting, early design discussions for mechanical systems rarely do. Daylighting was familiar to most architects and 45% reported using one of four daylighting approaches and tools in at least one project a year, though software and physical modeling were least used. Passive heating, cooling and ventilation systems were much less commonly used than other energy-efficient solutions.

[11] A full report is available at http://nwalliance.org/research/reportdetail.aspx?ID=146

2006 Engineer Baseline Results

To assess the level of involvement of engineers in the design process and the process by which mechanical systems for new buildings are typically designed and specified, interviews were conducted with mechanical engineers in all four Northwest states.

Identifying engineering firms responsible for HVAC design on new buildings is always difficult, since standard classifications such as SIC code do not distinguish between the various engineering disciplines, while ASHRAE does not make its member lists available. As a result, other sources were used to compile a list of engineering firms engaged in mechanical systems design for new buildings. These sources included:

- Lists compiled by local and regional business newspapers
- Trade publication lists
- The Association of Consulting Engineers website
- The NEEA database
- Referrals from the design labs and the business advisor

Using these sources and refining the names to the extent possible, a total of 75 firms that offer mechanical engineering services were identified, including not only engineering firms, but also several A&E firms and design-build contractors with in-house engineering expertise. In most cases, a senior level engineer (owner, partner, supervising engineer) was identified as the contact name. We specifically sought out such corporate level respondents because the goal was to obtain information on engineering activities and practices at the firm or office level. In those instances where we had no contact name, interviewers asked to speak to the person responsible for the company's mechanical engineering design practice.

In recognition of the fact that we were asking for a significant amount of the respondent's time, an incentive of $100 was offered to qualified respondents who completed the interview. While this certainly helped the response rate, there were nevertheless a number of engineers who said they simply did not have time to respond, even after they were offered the option to schedule the interview outside of normal business hours or to respond via an emailed interview guide.

In all, a total of 24 interviews were completed out of 30 targeted. A complete call disposition is shown in Table 7.

Table 9.-- Engineer Baseline Call Disposition

Disposition	Number
Complete	24
Left messages, calls not returned	23
Don't do mechanical/commercial design	16
Sent email, not returned	11
Refused	6
Referred to other office	2
Phone disconnected/out of business	1
Total	83

Based upon the diverse size, markets served, location and scope of services of those firms that responded, we do not believe there was any systematic response bias, but it must be noted that quantitative results presented in this section represent the mean responses, weighted by the square footage for which HVAC systems were designed, of only 24 firms. The resulting large confidence intervals around estimates of the mean value of responses are tempered somewhat by the fact that the sample was from a finite, relatively small population. For example, the 90% confidence interval around a proportion estimate of 50% is $\pm$ 18% for a sample of 24 and a large population, but $\pm$ 15% for the same sample from a population of 70.

The survey instrument is provided in Appendix A. Note that questions relating to integrated design are all asked using the term Integrated Energy Design (IED), which was the term being used when the surveys were conducted.

Results

The number of mechanical engineers in the offices of respondents ranged from 1 to 30, averaging 9.6. Most respondents worked for single office firms, although about 20% said their firms had other offices, both within the PNW (5) and elsewhere in the U.S. (3).

The number of projects for which the respondent firm had specified HVAC equipment in 2005 ranged from 7 to 800. More important, the square footage of new construction or major renovation for which equipment was specified in the PNW ranged from 500,000 to 20 million per firm, for a total of 68.2 million square feet. If the Census Data indicating a roughly $15 billion market in 2002 reflect average construction costs of some $100 per square foot (well below the average cost in the market over the last year or two), the interviewed architects would very conservatively represent some 40-45% of the PNW new construction market. Since approximately one-third of the HVAC engineering design firms identified were interviewed, the order of magnitude of these results appears consistent with the rough size of the new construction market.

The breakdown of their HVAC design work for the interviewed engineers is shown in Table 8.

Table 10. – Mechanical Engineering Design Market Composition

New vs. Renovation	% of sq. ft.
New construction/expansion	61%
Renovation	39%
By sector	
Hospital/medical	11%
Grocery stores	4%
Other retail	13%
Office buildings	26%
K-12 schools	12%
Colleges and universities	10%
Other	23%
Design-Build vs. Design-Bid-Build	
Design-Build	31%
Design-Bid-Build	69%

The results show a market that is more oriented toward new construction, but also has a significant renovation component. Across sectors, a variety of building types were represented, with office buildings accounting for slightly more than one-fourth of work, while hospitals/ medical buildings, non-grocery retail, K-12 schools, and colleges and universities each accounted for about 11-13%. Grocery stores represented only a small share of the work done by interviewed engineers, while several miscellaneous building types (e.g., warehouses, car dealerships) were important for individual firms.

Despite the increasing popularity of design-build (DB) contracts for new construction, traditional design-bid-build (DBB) arrangements still represent more than two-thirds of the market. Owner-occupied projects also account for well over half of the square footage for which interviewed engineers provided design services. Engineers typically work with architects in projects representing almost two-thirds of the square footage, with contracts directly with owners or with design-build contractors accounting for the other one-third.

Engineers provided a wide range of services on most of the projects they designed in the past year, as shown in Table 9.

Table 11.: Scope of Services

Service	% of sq. ft.
Set performance criteria	80%
Specify system size	90%
Specify system type	84%
Specify system efficiency	89%
Specify the number and types of controls	84%
Run energy models	13%
Run energy models during early design	7%

While the interviewed engineers set performance criteria as well as system size, type, efficiency and number and types of controls on jobs accounting for more than 80% of their work, they provided energy modeling on just 13% of square footage, and did so in the early stages of design only half as frequently, indicating that this aspect of ID is far from common.

Among the 20 respondents who sometimes provide energy modeling, the most frequently cited modeling tools were Trane's Trace 700 hourly load analysis program (11 mentions), eQuest (8), and Carrier's HAP hourly analysis program (4). Less frequently mentioned were DOE2 (2), EnergyPlus (2), and EnergyScheming (1). The Trane and Carrier programs were also cited by more than half of engineers as the primary tool they use to size equipment. (Both these programs have versions that allow extended hour-by-hour analysis as well simpler versions for sizing.)

One respondent commented that his firm prefers to use their own calculations rather than the results of one of the manufacturer sizing packages, because the latter "are biased and generally overestimate the size of equipment needed."

To assess the influence of various people or factors on their design decisions, engineers were asked to compare the importance of a series of paired factors. Results are shown in Table 10, with "somewhat more (or less) important" and "much more (or less) important" responses combined to give a quick indication of the relative importance of each set of factors.

Table 12.: Relative Importance of Design Influences

Factor/Influence A	A More Important	A and B Equal	B More Important	Factor/Influence B
Owner	**50%**	**33%**	**17%**	Architect
Owner	**42%**	**13%**	**46%**	Design-build contractor
Equipment capital cost	**54%**	**25%**	**21%**	Equipment energy efficiency
Equipment energy efficiency	**67%**	**8%**	**25%**	"Safety factor" in equipment sizing
Anticipated energy cost	**25%**	**58%**	**13%**	Anticipated maintenance cost
Design Engineer	**63%**	**29%**	**8%**	Architect
Design Engineer	**50%**	**17%**	**33%**	Owner
Building square footage	**29%**	**17%**	**42%**	Modeling results

While engineers clearly perceive that owners play an important role in influencing the design decision, they see their own role as more significant than either the owner or architect. Design-build contractors, on the other hand, are seen as having somewhat more influence than owners.

First cost continues to play an important role in the design decision, with more than half of interviewed engineers considering it more important than energy efficiency (this result is echoed in the discussion of barriers to energy efficiency below.) Energy efficiency, in turn, is considered more important than the need to build in a safety factor when sizing equipment, while anticipated energy cost appears to be seen as roughly equivalent in importance to anticipated maintenance cost. Finally, engineers generally said they considered modeling results more important than simple square footage in their design decision.

A number of questions were asked to assess the current status of design practices as related to integrated energy design, with particular reference to projects greater than 20,000 square feet, since those represent the part of the market targeted by the BetterBricks Design and Construction initiative.

First, as shown in Table 13, engineers become involved in the design process during the programming stage (when basic building functions and requirements are established) for only about 11% of square footage, and during conceptual design (when alternative building types and solutions can be considered) for about 16% of square footage.

Table 13.: Time of First Involvement

	% of sq. ft. (>20,000 only)
Programming	11%
Conceptual design	16%
Schematic development	33%
Design development	13%
Construction drawings and specification	21%
Bidding and bid review	6%

These results suggest that there are currently limited opportunities for engineers to have meaningful input to basic design decisions that directly affect the range of mechanical system options open to designers later in the process.

Respondents were also asked whether they were familiar with the concept of Integrated Energy Design (IED), and if so, were asked to provide a definition of IED in their own words. More than half of the interviewed engineers said they were familiar with IED, and many of those were able to provide a definition that included such key concepts as: the interaction of systems to optimize energy use (mentioned by 67% of those who said they were familiar with the concept), a multidisciplinary team approach (cited by 40%), early involvement in the design process by the engineer (12%). Several respondents said they thought IED was best illustrated by their approach to LEED buildings.

Because load reduction is a key to achieving the energy efficiency benefits promised by an integrated design approach, engineers were also asked about their familiarity and experience with a variety of measures and techniques, including those associated with load reduction.

Results, shown below, indicate a high degree of familiarity with these techniques but limited use for all but DDC (direct digital controls), EMSs (energy management systems) and LEED (which is not necessarily associated with a high degree of energy efficiency.)

Table 14.: Familiarity With and Use of Load Reduction and Other Techniques

Technique	Aware	Have Used	% of sq ft.
daylighting	100.0%	66.7%	17.3%
natural ventilation	100.0%	70.8%	10.1%
night ventilation of mass	100.0%	62.5%	14.4%
evaporative cooling	100.0%	79.2%	10.1%
downsizing for reduced loads	91.7%	37.5%	12.7%
DDC for HVAC	100.0%	100.0%	58.0%
Energy Management Systems	100.0%	87.5%	66.5%
Life cycle costing	95.8%	79.2%	14.6%
LEED	100.0%	79.2%	165 buildings

Responses to other questions designed as metrics for the baseline usage of energy efficient design practices are presented in Table 13.

Table 15.: Efficiency Practices

Metric	weighted means
Percent of square feet specified more efficient than code	45%
Percent of square footage for which rebates received	15%
Percent of square feet w/ energy efficiency goals or performance benchmarks other than code	18%
Percent of respondents familiar with IED	63%
Percent of square feet accounted for by respondents familiar with IED	79%
Percent of respondents attaining energy efficiency 25% or more greater than code (unweighted)	54%
Average highest efficiency above code for 22 out of 24 who sometimes go above code	31%
Percent of square feet where engineer participated in meetings with all or most of the project team	37%
Percent of square feet where design overruled because of cost	12%
Percent of square feet where design overruled because of equipment availability	5%
Percent of square feet where design overruled because of comfort or noise concerns	2%

While the results indicate that engineers who were responsible for specifying more than three-fourths of square footage are familiar with IED, the effect of that familiarity on how systems are designed appears modest. Projects representing only about one-sixth of square footage had energy efficiency goals or performance benchmarks other than code; most of those were for

LEED projects. However, respondents indicated that 45% of designs were specified more efficient than code (including 14% that received rebates), indicating that engineers often specified more efficient equipment even in the absence of stated goals or benchmarks. Some higher efficiency equipment is subsequently left out of the final design: 12% of designs were overruled because of cost concerns and 5% were overruled because of equipment unavailability. Only 2% of designs were overruled because of occupant concerns, although several respondents pointed out that this was primarily because of equipment noise rather than comfort.

The above results also indicate that engineers participated in meetings that included all or most of the project team on projects representing slightly more than one-third of square footage. Given the relatively late involvement in the design process cited previously, however, these meetings may not lead to extensive input into the design by the mechanical design team.

Engineers were asked to comment on how their involvement in the design process differs for various types of contractual arrangements, owner occupancy, and sector. Comments were as follows:

- As would be expected, most engineers said that Design-Bid-Build (DBB) contracts provide for more input from the design engineer, with Design-Build being driven by the contractor and therefore by cost. While engineers said they are often involved very early in the process with DB contracts, this early involvement focuses on establishing the mechanical equipment requirements at the lowest possible cost, with little regard to energy efficiency and synergies with climate, use or other building elements.

- Responses regarding developer-built vs. owner-occupied projects were roughly evenly split between those who said there was very little difference (or that it depended on the individual developer/owner) and those who said owner-occupied projects were more likely to be receptive to higher first cost to attain lower operating cost. One engineer explained that "the developer-built seems to usually not have any up-front financing so we avoid spending any time on these projects as we usually find that their payments are six months or more late. We wait to make decisions at the last minute and as a result often lose opportunities that could have been available had up-front monies been available for engineering."

- Almost all respondents said that LEED or sustainable building projects involved the engineer earlier in the project and also required more meetings, design time, energy modeling and record keeping. The extra documentation required was said to discourage some owners from applying for LEED certification, although one engineer pointed out that this was "not as much as they say."

- Across sectors, the consensus was that schools and hospitals generally were most receptive to energy efficient designs, primarily because of long-term owner occupancy of these facilities. In addition, engineers noted that these projects typically use a formal DBB process, have budgets that include time for considering design options, and may – in the case of schools – be designed to serve as a prototype for other schools (although it was pointed out that, at least in Idaho, prototype schools have very little time budgeted for design options – this work happens pro bono almost exclusively.) Government and municipal building projects were also said to be increasingly receptive to energy efficient

solutions. At the other extreme, retail and developer-built small offices were said to have the greatest first cost orientation and the least interest in considering more efficient alternatives. To the extent that engineers had experience with grocery stores, these were generally perceived to be similar to other retail projects. One respondent noted that they had seen an increase in engineer involvement in grocery store design, but that this had been more for meeting programmatic requirements for refrigeration or other capacity rather than energy efficiency.

A related question asked engineers whether they had ever been involved in design charettes that devote at least one hour specifically to energy efficiency. While more than half of respondents said they had been involved in no more than three such meetings over the years, a few engineers said they had been involved in many such meetings. One engineer stated he had participated in "hundreds," while three respondents said they had charettes with an energy focus for 15-25% of projects. One engineer specifically mentioned K-12 schools, noting that "A lot of the schools have that, where the school district groups together the A&E team and has them brainstorm."

Using the same questions employed in the baseline survey of architects in 2004, engineers were asked about their interest in sustainable design, their firm's interest, and their opportunity to work on sustainable buildings. As shown in Table 13, design engineers rated their interest 4.0 on a 1 to 5 scale, and rated their firm's interest only slightly lower – which is not surprising since most of these respondents were principals in the engineering firm where they work. Engineers gave a lower rating to their opportunities to work on sustainable projects.

Table 16.: Interest in Sustainable Design

How would you rate yourself in terms of your interest in the sustainable buildings movement?	4.0
How would you rate your firm in terms of your firm's interest in the sustainable buildings movement?	3.8
Where 1 is never and 5 is all the time, how often have you had opportunities to work on sustainable building projects?	2.5
Do you consider sustainable building design and energy efficient design to be:	
The same	8%
Similar	17%
Somewhat different, yet related	63%
Very different	13%
Do your firm's marketing materials discuss your firm's capabilities in energy efficient design practices?	
Yes (most often in the context of LEED)	79%
A little	13%
No	8%

Respondents were also asked to name what they see as the three most significant barriers to energy efficient design. Results are shown in Table 14. Note that cost is overwhelmingly seen as the most important barrier, both because of the added cost of more efficient equipment and because of the extra design and analysis cost.

Table 17.: Barriers to Energy Efficient Design

Barrier	% of respondents mentioning
Added equipment cost	88%
Extra design/analysis cost	50%
Energy efficiency is not an owner priority	50%
Lack of design team experience (including pricing)	21%
Energy efficiency is not an architect priority	17%
Maintenance complexity or cost	17%
Not enough time in project timeline	13%
Lack of mechanical contractor knowledge	13%

One respondent noted that pricing for energy efficient options in particular reflects lack of engineer experience: "Costing is done on what was done in the past. People tend to overestimate sustainable design, where they are razor sharp on traditional." Two engineers also pointed out that lack of expertise among building operators often undermines efficient design strategies that depend on sophisticated controls.

Both in the perception of barriers and in engineer explanations of what is meant by integrated energy design, there is no indication that engineers believe that true integrated design can lead to lower up-front construction costs, which is one of the key rationales behind the IED approach. When asked about the possibility that IED might lead to systems being downsized or eliminated to the point that construction costs would be lower, most engineers said they recognized this as a theoretical possibility, but had never seen it happen and doubted whether it was possible. As downsizing and reducing costs are core components of the Initiative's conception of IED, this indicates a strong need to develop case studies and provide education.

Conclusion

Overall, most engineers appear to be aware of and interested in energy efficiency, as indicated by their awareness of IED, interest in sustainable design, attainment of efficiency levels well above code on some projects and participation early in the design process on a significant percentage of projects, but they are limited in the extent to which they implement efficient designs by a combination of factors. These include: equipment and design cost, lack of architect and owner interest, the timing of their participation in the design process, their lack of experience with the more advanced aspects of IED, and gaps in the knowledge of the contractors who must implement the design and the building staff who must operate it. Therefore, key aspects of the program design seem to be correctly positioned, such as the emphasis on working with owners and architects, efforts to bring all team members in early, and the provision of training on the design process (via the Education and Training effort) for engineers.

6. Assessment of Accomplishments

The D&C Initiative has developed a series of inter-related goals, objectives, activity indicators and market progress indicators to provide guidance and determine progress. The long-term goals and 2010 objectives were approved by the Board in July 2005 as part of the 2006-08 funding renewal. The long-term goals were shown in Table 1 of Chapter 1. As a supplement, the BetterBricks senior manager developed a list of 2006 activity indicators to demonstrate progress toward these goals. The 2010 objectives and these 2006 activity indicators are shown in the first two columns of Table 18. Progress toward achieving the 2006 indicators, shown in the third column, is based on interviews with initiative staff, IDL directors, Business Advisors and Firm Focus firms.

As suggested by the summary of results in the third column, the D&C initiative is in the early stages of moving toward the objectives set out for 2010. Three Firm Focus firms out of a desired 4-5 have been identified and signed on. (We conclude later that three is probably preferable for the time being.) Further, a curriculum for presenting ID has been developed, and both the Business Advisor and IDLs have begun offering services to the FF firms. On the other hand, agreement on a definition of integrated design took much longer than expected and did not allow the initiative to complete the activity indicators for communicating its value to the market beyond the three firm focus firms. Also, not all of the labs have succeeded in developing a complete range of integrated design expertise.

In regard to the longer-range 2010 objectives, the effect of BetterBricks activities on buildings actually designed and constructed will take longer to see in the marketplace. The design and construction process for a large hospital, for example, can span 8-10 years from the development of a pro forma business plan to occupancy, and even the development of completed construction documents can take several years. Influence of prior years' efforts can be seen in two recent significant healthcare projects: Providence Newberg Hospital (26% savings) and OHSU Health and Wellness Center (61% savings). The initiative may want to review its timelines in light of this.

Table 18.: D&C Initiative 2010 Objectives and 2006 Indicators

2010 Objectives	2006 Activity Indicator	Status
60% of NW A&E firm decision makers are aware of the business opportunity and client benefits of high performance buildings[12].	Lab directors and business advisors are adept in messaging and communicating the value of integrated design to A&E firm decision-makers.	Progress has been made but their ability to achieve this indicator was limited because Lab Directors did not come to agreement on a definition of integrated design until the summer of 2006 and thus far no consistent label has been employed to differentiate what BetterBricks promotes from other, similarly named concepts
A&E firms representing a significant percentage of the design and construction market adjust their business practices to deliver high performance buildings[15] ● A&E firms representing 40% of healthcare market share ● A&E firms and in-house designer representing 30% of targeted grocery market share ● A&E firms representing 20% of targeted real estate office market share	● A complete range of integrated design expertise is available through the lab network. ● A formal business relationship with 4-5 high priority architectural firms has been established through the Firm Focus approach. ● Lab and business advisory capability is demonstrated through: - Business planning assistance - Professional development activity - Project technical advisory support ● Identify, develop and begin to implement D&C education and training curriculum.	● IDLs (except Eugene/Portland) have been lacking engineering expertise to address the mechanical aspects of ID. Seattle plans to hire an engineer, Boise is hiring a modeling expert, and other labs are development of relationships with engineers who can provide this service, although this process is still ongoing. ● Agreements were signed with 3 architectural firms. ● The Business Advisor is reviewing current FF business plans in preparation for providing development assistance. The IDLs are providing technical advisory support, although it is difficult to separate "new" FF technical support from that already being provided by the IDLs to the FF firms. ● BB training staff and contractors are working with the Integrated Design Labs to coordinate and deliver this training, with curriculum development currently focusing on ID, using the content developed by the Portland/Eugene lab and agreed upon – after extensive discussion -- by all the BB IDLs.
A significant percentage of projects incorporate integrated design strategies that rely on passive or low-energy solutions for lighting, ventilation, comfort and critical process loads. ● 40% of projects in hospitals/health ● 30% of projects in targeted groceries ● 20% of projects in office real estate ● 10% of projects in other vertical markets	● Provide integrated design assistance to A&E firms on 12 projects region-wide (half or more within target markets). ● Document project outcomes as they are designed (and built) in terms of energy performance and costs compared to standard practice.	● While design assistance has been provided for more than 12 projects region-wide, the process of selecting new projects at Firm Focus firms that will help them build ID capability is still being developed. ● No projects at FF A&E firms have reached this stage in 2006.

[12] The term 'high performance buildings' is not echoed in the 2006 Activity Indicator column which refers to 'integrated energy design. This discrepancy is discussed in Chapter 7, Process Evaluation.

7. Conclusions and Recommendations

The Northwest Energy Alliance's BetterBricks Design and Construction Initiative was launched in January 2006. The initiative is in the early stages of achieving the objectives set out for 2010, which include incorporating low-energy, integrated design solutions in:

- 40% of projects within hospitals and healthcare;
- 30% of projects within targeted (regional) groceries;
- 20% of projects within targeted (revenue producing) real estate office buildings;
- 10% of projects within other vertical markets.

In 2006, the IDL's assisted on dozens of projects with architecture firms throughout the region, the outline of a curriculum for teaching ID was developed, Firm Focus agreements were signed with three firms and both the BetterBricks Business Advisors and Integrated Design Labs (IDLs) began offering services to the FF firms.

In this final section of the report, issues confronting the initiative are discussed and recommendations are presented

NOMENCLATURE ISSUES: WHAT IS THE D&C INITIATIVE PROMOTING?

One of the most fundamental issues is what term or terms should be used to describe the approach to design and construction being advocated by NEEA and BetterBricks. The original term 'Integrated Energy Design', conceived by BetterBricks staff and embedded in the initiative's long-term goals and key objectives, was rejected by the IDLs who argued that the word 'energy' in that context would be interpreted to only mean energy systems (i.e. mechanical systems) by the initiative's audience of architects and engineers. Since the goal is to get the audience to consider all aspects of the design that can impact energy use, including the orientation, materials and morphology of a building, integrated energy design was considered both misleading and limiting. In its place, the IDLs have been using the more general term 'integrated design for energy efficiency' and its short form, just ID.

While this accurately reflects the desire to look beyond mechanical systems, it is a term already widely used in the marketplace – sometimes to describe an approach that integrates the decision making efforts of all those responsible for developing and completing a building project (such as owners, architect, engineers, consultants), and sometimes to describe an approach that encompasses not only energy efficiency, but also other criteria such as water consumption, the use of materials produced using sustainable methods, and plans for recycling at the end of the building's useful life. One contractor for BetterBricks uses the analogy of the blind men and the elephant, with observers and users of the term integrated design having different perceptions and definitions depending on their involvement in the process. The use of 'integrated design' therefore solves the problems associated with 'integrated energy design' but brings with it another – differentiating BetterBricks's definition of the term from its many other definitions. The lack of a consistent terminology can only lead to confusion among those being targeted by the D&C Initiative.

Whatever term BetterBricks opts to use (and it may make sense to come up with a new, third option), guidelines for how and when it should be used should be established by the initiative manager and implemented in a consistent manner. Note that the value of using a consistent term will grow in importance over the next few years as the initiative shifts from working on a relatively small number of projects to disseminating the results of those projects to the broader market.

IS INTEGRATED DESIGN AN END OR A MEANS TO AN END?

Whether BetterBricks is promoting integrated design as a process, a result or both appears to be a basic point of misunderstanding between the initiative and at least some of the labs. These labs say that integrated design is merely a means to the end of having high-performance buildings designed and constructed. There is clear support for this perspective in various initiative documents, most clearly in the 2010 objective which states, "A&E firms representing a significant percentage of the design and construction market adjust their business practices to deliver high performance buildings", without mentioning integrated design. (A high performance building is elsewhere defined as one that maximizes economic and environmental benefits through significantly reduced energy use.)

The misunderstanding arises from the labs' interpreting this to mean that interim indicators of increasing use of integrated design do not necessarily mean progress toward the ultimate goal of high performance buildings. The initiative, on the other hand, is based on the premise that proper implementation of integrated design will necessarily result in high performance buildings with significantly improved energy efficiency; in other words, integrated design is both an end and a means to that end.

Since the labs all agree that integrated design is the strategy they will use to achieve high performance buildings the disagreement appears on the surface to be more semantic than substantive. However, there were strong sentiments expressed on this topic during discussions with the Lab directors, making it clear that discussions should take place to come to agreement on the relationship between integrated design and high performance buildings. An agreement will help ensure a consistent approach to working with and training architects.

DESIGN LAB ISSUES

Selection of Partners

In determining which firms to choose as Firm Focus firms, both the Seattle and Portland/Eugene labs were somewhat reluctant to work with the largest firms in the target markets -- partly because they have not had extensive interaction with these firms in the past, and partly because they are concerned that a single large architecture firm could easily absorb all their available design assistance resources. The D&C Business Advisor appears to have played a role in persuading the IDLs that relationships with these larger firm were essential, pointing out that it will be impossible to attain the stated goal of having A&E firms representing 40% of the healthcare market and 20% of the targeted real estate market "adjust their business practices to deliver high performance buildings" without their participation. With the help of the Business

Advisor's prior relationships, one of the largest firms signed on as a Firm Focus firm, but there are other large firms that will still need to be added.

Adding some of these firms to the initiative in 2007 and beyond may be more difficult a) because these firms do not have extensive established relationships with the labs, b) the lack of relationship with the labs may reflect a lack of interest on the part of these larger firms, and c) adding the largest firms to the mix is almost certain to strain lab resources, both because of their sheer size and because they have less knowledge of and experience with integrated design.

Given the potential workload issues (see below) we recommend that the initial FF relationships be fully developed before additional, larger firms are brought into the mix, particularly for the Eugene/Portland lab. It is important that the IDLs be able to deliver on the level of marketing and business planning support promised to the first three firms and that the labs be able to provide the level of technical support that the A&E firms have been led to expect. The D&C manager should confirm that those expectations are being met before additional FF firms are added. If necessary, the short-term goal of working with 4-5 firms should be reduced.

IDL Workload

Having been active for a number of years, the Seattle and Oregon IDLs generally have a larger existing constituency for their services than the newer IDLs, and it has been difficult for them to meet the needs of the wide range of projects on which their help is sought. While FF has the effect of allowing those labs to prioritize their activities and focus on relatively fewer projects, it also means that a number of firms with whom the labs have ongoing relationships are being turned away. The directors of both labs expressed concern about this, although they recognize it as inevitable and necessary in the context of the shift to FF.

For the Seattle, Portland/Eugene and Boise labs, resource constraints are a constant source of concern, since there is more demand for design support services than can be provided with available staff. The labs recognize this, and generally appear to be able to prioritize work in a way that balances the demands of various projects against their own availability. Nevertheless, particularly for those labs engaged in FF relationships, the issue of how much time is committed remains a concern, and both the labs and the FF firms will be watching to see how the relationship unfolds.

Long-Term Role of IDLs

One of the perceptions among the IDLs regarding their relationship with NEEA is that in providing technical support to FF architects, the IDLs are meant to ultimately put themselves out of the design support business. First, the FF firms (and ultimately other design firms) will build capability in ID and will integrate it into their business model in a way that makes further intervention by the labs unnecessary. Second, to the extent that design firms still need outside assistance for specific services (for example, energy modeling), the market will provide suppliers who offer the needed services.

The labs, however, do not see themselves as transient players who provide support through BetterBricks and then go quietly away. Instead, they believe – as NEEA does -- that there will be a continuing need to provide education, training, and direct project support to the design

community. The Seattle and Portland/Eugene labs in particular point out that they have been providing these services for a long time (i.e., since before NEEA existed) and expect to continue to providing them after their involvement with BetterBricks ends. This may take the form of the labs providing for-fee services (as they already do in some instances) or of other sources of funding being found. The case made by the Portland/Eugene lab director in particular is that achieving ID is an ongoing process that is continually being refined. In his view, the role of the labs is to provide R&D to continue to advance the state of the art of ID – not to bring buildings to a static concept of energy efficient design. Similarly, the director of the Seattle lab sees that organization's role as the provision of continuing education on energy-related design issues for the architect community – a need that will not disappear with the end of the current BetterBricks initiative.

This latter view is implicitly supported by the fact that all the labs are affiliated with universities, and staff at the labs have university appointments. The newer labs have less of an established user base, and are less certain that they will continue to operate even without BETTERBRICKS support, but they too have the university affiliation and the attendant focus on continuing education.

While this is not an immediate issue, it should be assumed that the labs will continue to be at least somewhat concerned about their own long-term viability. That means they will likely pursue other sources of funding and efforts to become more self-sustaining so that they continue to support efficient design once the BetterBricks program terminates. This may not be an undesirable outcome; the transformed, ID-focused design and construction market that enables BetterBricks to declare victory some time down the road may well include a permanent role for university-affiliated labs that continue to advance the state of the art of design.

COORDINATION ISSUES

While overall coordination among the various parties delivering the Initiative to the D&C market appears to be good, communication will become more complex and more difficult as the Firm Focus effort expands. The Business Advisor, D&C Manager, and multiple IDL staff generally have different points of contact at the FF firms. While this has not been a problem in the early stages of the working relationship between BetterBricks and the partner firms, all parties need to be careful to maintain good communication not only between members of the BetterBricks team, but also between their counterparts within each FF organization. There is some indication that technical relationships between the IDLs and the Design Partners proceed on a separate track from the business and marketing-oriented relationships between the Business Advisor and the Principals and/or Marketing Partners at the same firms – particularly since the design relationship often predates the FF relationship.

In addition, there has been a tendency for some of the IDLs – particularly the long-established Seattle and Portland labs – to resent what they perceive as BetterBricks's micromanagement of their activities. Some of the IDLs believe that they should be given goals and then allowed to attain those in the manner they see fit rather than having their approach dictated by BetterBricks. In addition, they say that administrative overhead and reporting requirements inhibit their ability to work with architects and engineers to influence the design market. This conflict between Lab and BetterBricks goals largely reflects the question raised previously of whether Integrated

Design is an end or a means to an end. How that question is answered (and agreed upon) will help determine how conflicts between the IDLs and BetterBricks regarding goals and metrics are resolved.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion 1: A thorough, detailed definition of integrated design was only agreed to by all the labs during the summer, even as FF firms were being recruited, and no consistent terminology has been employed that differentiates what BetterBricks is promoting from other, similarly named concepts. The lack of a consistent terminology can only lead to confusion among those being targeted by the D&C Initiative.

> **Recommendation 1: Whatever term BetterBricks opts to use, guidelines for how and when it should be used should be established by the initiative manager and implemented in a consistent manner. The importance of using a consistent term will grow in importance over the next few years as the initiative shifts from working on relatively few projects to disseminating the results of those projects to the broader market. Consistent terminology should therefore also be adopted for the BetterBricks website and the BetterBricks Professional Development and Education and Training efforts. This will lay the groundwork for market understanding and acceptance that must be in place before practices can be widely changed.**

Conclusion 2: The ramp-up of the new IDL labs is still ongoing. Spokane and Bozeman are building relationships and finding projects to work on. Idaho is well under way, with plenty of work, a successful advisory committee, and a growing network of relationships with owners, architects, and engineers, as well as utilities, state agencies, and other IDLs. Idaho's advisory committee has been very useful in establishing relationships and bringing new projects to the Boise IDL, as well as in helping shape and adjust its strategies.

> **Recommendation 2: The Spokane and Bozeman IDLs should establish advisory committees similar to the one in place in Boise** .

Conclusion 3: The selection and screening process for Firm Focus firms used an effective combination of quantitative (size, market share) and qualitative (past relationship with IDL) criteria and appears to have resulted in firms that are likely to succeed in both adopting ID and showcasing ID to the broader market. However, the process did not result in the selection of some of the largest architecture firms because of lack of a solid relationship, concerns about the difficulty of influencing a large firm, and fears about the effect on overall resources. Whether within or outside a FF relationship, it will be essential to influence these larger firms if the D&C Initiative is to meet its 2010 market share objectives.

Conclusion 4: While initial indications are that the current Firm Focus relationships are positive, there has not been enough time to prove the theory. At a practical level, it remains to be seen whether the labs can support the three existing FF firms to the extent needed to truly develop their capability and support their marketing.

> **Recommendation 3: Portland/Eugene and possibly Seattle should fully establish**

their initial Firm Focus relationships and determine if they can effectively provide the needed level of support before adding more Firm Focus firms – particularly if the next firms added are large.

Recommendation 4: Subject to Recommendation 3, we recommend that Firm Focus relationships be pursued with one or more of the three largest firms serving the target markets.

Conclusion 5: Firm Focus firms appear to understand and appreciate the overall nature of their relationship with Better Bricks, the IDLs, the Business Advisor, and Marketing staff and contractors. Senior partners at all three Firm Focus firms appear very committed to building ID capability, and recognize the business benefits of ID as well as their own lack of experience in the more sophisticated ID techniques. Related marketing benefits and strategies were well understood by marketing specialists at only one of the three firms.

Recommendation 5: To ensure the effective integration of design and marketing support efforts, it is important to ensure an appropriate level of communication between the design and marketing functions within the individual Firm Focus firms, as well as among the Business Advisor, IDLs and BetterBricks Marketing functions.

Conclusion 6: The Initiative's success in meeting its 2006 Activity Indicator goals was mixed. Three Firm Focus firms out of a desired 4-5 have been identified and signed on. (Though we conclude above that this may have been a good thing.) A curriculum for presenting ID has been developed, and both the Business Advisor and IDLs have begun offering services to the FF firms. On the other hand, agreement on a definition of integrated design took much longer than expected and did not allow the initiative to complete the activity indicators for communicating its value to the market beyond the three firm focus firms. Also, not all of the labs have succeeded in developing a complete range of integrated design expertise. Finally, in the context of achieving actual energy savings for the longer-range 2010 objectives, the timelines seem unrealistic. The design and construction process for a large hospital, for example, can span 8-10 years from the development of a pro forma business plan to occupancy, and even the development of completed construction documents can take several years. The initiative may want to review its timelines in light of this.

Recommendation 6: Both annual activity indicators and long-term objectives should be scrutinized to ensure they are achievable within the required timeframes.

Conclusion 7: HVAC design engineers have a high degree of awareness of ID, load reduction strategies, energy efficient design overall, sustainable design, and LEED, but they report that they typically are not able to put this interest to work on many of their projects because of owner concerns about cost (both added equipment cost and added design time) and lack of interest among owners and architects.

- Engineers responsible for specifying more than three-fourths of square footage in the sample were familiar with Integrated Energy Design, but the effect of that familiarity on how systems are designed appears modest. Projects representing only about one-sixth of square footage had energy efficiency goals or performance benchmarks other than code;

most of those were for LEED projects. However, respondents indicated that 45% of designs were specified more efficient than code (including 14% that received rebates), indicating that engineers often specified more efficient equipment even in the absence of stated goals or benchmarks.

- Similarly, engineers report a high degree of familiarity with techniques associated with load reduction (e.g., daylighting, natural ventilation, night ventilation of mass, equipment downsizing for reduced loads), but limited use of these techniques. Usage was higher for measures/techniques not necessarily associated with a high degree of energy efficiency, such as direct digital control (DDC), energy management systems (EMSs) and LEED certification.

- Engineers become involved in the design process during the programming stage (when basic building functions and requirements are established) for only about 11% of square footage, and during conceptual design (when alternative building types and solutions can be considered) for about 17% of square footage. These results suggest that there are currently limited opportunities for engineers to have meaningful input to basic design decisions that directly affect the range of mechanical system options open to designers later in the process.

- Fewer than half of respondents said they had been involved in three or more design charettes that devote at least one hour specifically to energy efficiency, and only a handful of engineers said they had been involved in many such meetings.

- Other barriers to efficient design reported by engineers include lack of engineer experience in pricing energy efficient options (which leads them to overestimate the cost of sustainable design) lack of expertise among building operators (who may undermine efficient design strategies that depend on sophisticated controls) and growth of design-build contracting (where first cost dominates decision making).

Recommendation 7a: Building on the FF relationships and (for other labs) existing relationships with architecture firms, BetterBricks and the IDLs should integrate engineers more fully into efforts to promote integrated design, including training on pricing of energy efficient options.

Recommendation 7b: BetterBricks, through its marketing efforts and its relationships with target markets, should continue to emphasize the importance of high performance buildings so that owners incorporate characteristics of high performance buildings into their requirements, including some of those built using design-build contracts.

Conclusion 8: LEED is a successful, highly visible sustainable building initiative that appears to raise awareness of efficient design, but frequently does not result in buildings that meet the D&C Initiative's goals of using 25% less energy than a standard code building.

> **Recommendation 8: Because of LEED's prominence in the market, BetterBricks should develop a consistent strategy for working with LEED projects to maximize their energy efficiency. BetterBricks should also continue to try to influence LEED standards and implementation to increase the energy efficiency levels of LEED buildings, particularly with regard to giving LEED "points" for designs that reduce load.**

Conclusion 9: The logic model would be improved by the addition of the specific market barriers and opportunities faced by the initiative and the specific methods and approaches that are being used to address them.

> ***Recommendation 9:*** *The initiative staff should expand the logic model to include barriers and opportunities, including the relationship of the initiative to broader market forces and organizations such as LEED and AIA.*

APPENDIX A – ENGINEER BASELINE SURVEY INSTRUMENT

I. INTRODUCTION/SCREENING QUESTIONS

Hi, my name is __ calling from PWP Incorporated on behalf of BetterBricks, the commercial initiative of the Northwest Energy Efficiency Alliance. I am not selling anything. We are talking to HVAC design engineers who provide equipment design or specification services for commercial and institutional buildings in the Pacific Northwest. I would like to talk to (IF CONTACT NAME KNOWN: [Name]) (IF CONTACT NAME NOT KNOWN: the person at this firm who is most familiar with your business in the commercial and institutional markets, such as an owner, principal or senior manager. Who would that be?

Name:

Title:

Phone:

WHEN GET CORRECT PERSON Hi, my name is __ calling from PWP Incorporated on behalf of BetterBricks, the commercial initiative of the Northwest Energy Efficiency Alliance. I am not selling anything. I'm doing a survey on energy efficient design practices, and I am talking to consulting mechanical engineers to better understand the way in which mechanical equipment is designed and specified for commercial and institutional buildings in the Pacific Northwest. The results of this research will be used by the Northwest Energy Efficiency Alliance (NEEA) to improve its Better Bricks Program. All information you give us will remain confidential.

We realize that your time is exceptionally valuable and, to compensate you for your time, NEEA authorizes us to give you $100, which we will do upon completion of the survey.

Can you confirm that you are responsible for making decisions regarding your company's design and specification of mechanical systems for new commercial and institutional buildings? IF NOT, GET REFERRAL TO APPROPRIATE RESPONDENT.

The conversation will take about 40 minutes. Is now a good time? [IF YES, CONTINUE. IF NO:] What would be a good time to get together? Appointment day, date, time:

I'd like to start with a few questions about your business. In answering these questions, please consider all of your company's business in the four states of the Pacific Northwest (Washington, Oregon, Idaho, Montana), including work done by other locations of your company.

1. About how many new, renovated, or remodeled commercial and institutional buildings in the Pacific Northwest has your **firm** been involved in the HVAC design or specification of in 2005?

2. And how many square feet did those new, renovated, or remodeled buildings represent?

3. Thinking about all those projects in which your firm was involved in 2005, please tell me the percentage of projects for which you played each of the following roles:
    a. personally designed/specified
    b. supervised or approved the design and specification
    c. had no personal role
    d. other(specify)

II. NATURE, SIZE OF FIRM

1. How many employees are in your **office**? And how many of those are mechanical design engineers?

2. How many mechanical engineers at other offices in the state?

3. How many mechanical engineers at offices in the other three states of the Pacific Northwest (Washington, Oregon, Idaho, Montana)?

4. And how many offices elsewhere in the U.S.?

5. *If More Than One Office*: Where are your firm's corporate headquarters?

6. Percentage-wise, how would you break down the value of work done in 2005 by **your firm** in the four states of the Pacific Northwest across the following:
    a. Mechanical engineering design
    b. Other mechanical engineering
    c. Other engineering
    d. Architecture
    e. Other (specify)

7. About what percentage of your engineering design work, **as measured by square footage**, is done for each of the following types of clients:
    a. Architects at your firm
    b. Architects at other firms
    c. Directly for building owners
    d. Prime contractors/design-build contractors
    e. Other (specify)

8. Approximately how many different architecture firms did you work with in 2005?

9. You mentioned earlier that your firm did the mechanical engineering design for about (XXX from Section 1, Q2) square feet of buildings in the four-state area in 2005. I'm going to ask you to give me your best estimate of the percentage breakdown of that square footage for several criteria:
    - By new construction/expansion vs. renovation
    - By sector
        i. Hospital/medical
        ii. grocery stores

iii. other retail
iv. office buildings
v. K-12 schools
vi. Colleges and universities
vii. Other 1 (specify)
viii. Other 2 (specify)

– By types of projects
  i. Owner occupied vs. developer-built
  ii. Design-build vs. design-bid-build

III. ENGINEER INVOLVEMENT IN DESIGN PROCESS

Next I would like to talk about the interaction between the design engineer and other members of the design and construction team during the design and construction process. I'd like you to think specifically about the process for commercial and institutional buildings that are at least 20,000 square feet, plus all K-12 schools.

1. First of all, what percentage of your firms work in the Pacific Northwest was accounted for by projects that met the above criteria (i.e., at least 20,000 square feet plus any K-12 schools less than 20,000 square feet)

2. Thinking about the timing of your firm's initial involvement in the design process, please estimate the percentage of projects for which you first became involved at each of the following stages in the process.

   For what percent of projects (as defined by square feet) did you **first** become involved during:
   a. Programming
   b. Conceptual design
   c. Schematic development
   d. Design development
   e. Construction drawings and specification
   f. Bidding and bid review
   g. If total is less than 100%: Other (specify)

3. Regarding the scope of the services you provide, on what percentage of 2005 projects (as defined by square feet) did you do each of the following:
   a. Set performance criteria (e.g. temperature, ACH)
   b. Specify system size
   c. Specify system type (e.g, central plant vs packaged)
   d. Specify system efficiency
   e. Specify the number and types of controls
   f. Run energy models

4. IF ENERGY MODELS >0: On what percent of project, if any, did you run baseline energy models during pre-design or early design (i.e., through schematics)?

5. What modeling tools did you use? (do not read, check all that apply)
    a. eQuest (DOE 2.2)
    b. Visual DOE (DOE2.1e)
    c. Trace 700 (hourly analysis)
    d. Energy Scheming
    e. Energy-10
    f. Energy Plus
    g. Other (specify)

6. Again thinking about buildings that are at least 20,000 square feet, what tools or methods do you typically use to size and specify HVAC equipment (do not read; check all that apply)
    a. Professional judgment
    b. Look-up tables
    c. Rule of thumb
    d. Manual J
    e. DOE2
    f. Manufacturer software
    g. Energy modeling software to calculate load
    h. Other software (specify)
    i. It depends: (Specify what it depends on and enter comments verbatim)

7. For projects your firm worked on in 2005, did you or another engineer from your firm ever participate in project meetings where all or most of the members of the project design and construction team were present to discuss energy related aspects of project design? (By 'all members' I mean at a minimum the owner/developer, architects, yourself, lighting designers, and contractors, including both internal and external designers.) IF YES, For how many of the projects you worked on did you attend such meetings?

8. How much of the total floor area you worked on in 2005 was associated with projects where you participated in meetings with all or most of the project design team? (That would be X out of Y (from above)).

9. Thinking about the projects you worked on in 2005, what percentage of floor area was accounted for by projects that had energy efficiency goals or performance benchmarks other than meeting code.

10. Can you briefly describe how, if at all, your involvement in the design process differs across the following kinds of projects:
    a. Design-build vs. Design-bid-build
    b. Developer-built vs. owner occupied
    c. LEED/other energy efficient or green buildings vs. standard
    d. Across segments (hospitals, groceries, schools, commercial real estate)

11. Next I'm going to ask you the relative importance of two different factors influencing your decision regarding HVAC design and specification for buildings 20,000 square feet and larger. For each of the following pairs of factors, please tell me if A is a much more

important influence than B, A is somewhat more important than B, A and B are equally important, B is somewhat more important than A, or B is much more important than A..

i.	A: Owner	B: Architect
ii.	A: Owner	B: Design-build contractor
iii.	A: Equipment capital cost	B: Equipment energy efficiency
iv.	A: Equipment energy efficiency	B: A "safety factor" in equipment sizing
v.	A: Anticipated energy cost	B: Anticipated maintenance cost
vi.	A: Design Engineer (you)	B: Architect
vii.	A: Design Engineer (you)	B: Owner
viii.	A: Building square footage	B: Modeling results

Now thinking about the post-design phase of projects you have worked on and what was actually installed...

12. On what percent of floor area you worked on in 2005 were your design decisions or specifications overruled by owner or contractor decisions due to the belief that a less costly approach would work as well?

13. On what percent of floor area you worked on in 2005 were your design decisions or specifications overruled by owner or contractor decisions due to difficulty obtaining specified equipment?

14. How about the percent of floor area where your design decisions or specifications were overruled due to concerns that the design idea would cause occupant complaints?

IV. AWARENESS OF ENERGY EFFICIENT DESIGN ELEMENTS

Next I would like to ask you about your firm's awareness of and interest in a number of techniques and trends related to designing high performance buildings.

1. Are you familiar with the concept of Integrated design? IF YES, Please tell me in your own words how you would define Integrated design. Enter verbatim:

2. And what would you perceive to be the benefits, if any, of Integrated design to the project's owner? Enter verbatim:

3. Do you specify equipment that is more efficient than the state Energy Code?
    a. If so, how often did you do so in 2005 (percent of square feet).
    b. Did any of the projects you worked on attain an efficiency level 25% or more above code? If so, what percent were at least 25% above code?
    c. What is the highest level of efficiency (relative to code) attained on a project?
    d. Under what conditions and on what kinds of projects were you able to attain the highest levels of efficiency?

4. For each of the following, please tell me whether you are familiar with the technique and, if so, whether you have worked with it on projects you have designed. (For each ask: Are you aware of (X). IF YES, Have you worked with (X) on projects you have designed? IF YES, About what percentage of the square footage you have designed in the past year do those projects represent?)

	Aware	Have used	% of sqft.
a. Daylighting that allows you to reduce the size of the HVAC system.			
b. Natural ventilation as a supplement to or replacement of mechanical cooling			
c. Night ventilation of mass			
d. Evaporative cooling			
e. System downsizing for reduced loads How much were you able to downsize? (%)			
f. Direct digital control for HVAC systems			
g. Energy Management System for HVAC			
h. Life cycle costing analysis			
i. LEED (if aware, how many LEED buildings total) Include those in process. How many: certified, silver, gold, platinum			

5. How many times (ever, not just in 2005) have you attended a design charette that devoted at least an hour to the energy aspects of a building design? (A charette is a design group meeting to develop new ideas for a project.)

V. ATTITUDES AND BARRIERS TO ENERGY EFFICIENT DESIGN

1. On a scale of 1 to 5, where 1 is not at all interested and 5 is very interested, how would you rank yourself in terms of your interest in the sustainable buildings movement?

2. On a scale of 1 to 5, how would you rate your firm in terms of your firm's interest in the sustainable buildings movement?

3. On a scale of 1 to 5, where 1 is never and 5 is all the time, how often you had opportunities to work on sustainable building projects?

4. Do you consider sustainable building design and energy efficient design to be:
   - The same
   - Similar
   - Somewhat different, yet related
   - Very different
   - Don't know, never thought about it.

5. Do your firm's marketing materials discuss your firm's capabilities in energy efficient design practices?

6. I would also like to ask you about barriers that may make it more difficult to design and specify efficient HVAC solutions. Please tell me what you see as the three most important barriers to more efficient design (DO NOT READ; CHECK ALL THAT APPLY).
    a. added equipment cost
    b. extra design/analysis cost
    c. lack of access to HVAC analysis tools
    d. specified equipment is not available
    e. not enough time in project timeline
    f. lack of mechanical contractor knowledge
    g. design engineer gets involved in the design process too late
    h. it is difficult to find information on energy efficient designs
    i. energy efficiency is not an owner priority
    j. energy efficiency is not an architect priority
    k. occupant comfort requirements are too difficult to achieve
    l. Other 1 (enter verbatim)
    m. Other 2 (enter verbatim)

VI. INFORMATION SOURCES, INDUSTRY TRENDS

We have just a few more questions. Now I would like to go over some sources of information and assistance that you may have used in designing HVAC systems.

1. For each of the following, please tell me whether you have heard of this information source, whether you have used it, and if so, how useful you found it. (For each ask: Are you aware of (X). IF YES, Have you used (X) for information or assistance on energy efficient design? IF YES, How useful did you find this information source, again using a 1 to 5 scale, where 1 means not at all useful and 5 means very useful.)

	Aware	Have used	Rating
a. Integrated design/daylighting lab at U. of (XXX)			
b. The Better Bricks program			
c. The BetterBricks website			

2. What percentage of the square footage for which you designed or specified HVAC equipment in the four states in the PNW in 2005 received utility rebates or funding from organizations like the Energy Trust of Oregon or BPA?

Finally, I would like to get your impression of major trends in HVAC design and specification in the Northwest and nationally.

4. What would you say are the most important trends or pressures facing your industry today?

5. How do you think those trends will influence the way you design and specify HVAC equipment for commercial buildings over the next several years?

Those are all the questions I have. Thank you very much for your time and your help.