

Collaborating with Architecture Firms to Influence Design of High Performance Buildings

John Jennings, Northwest Energy Efficiency Alliance
Joel Loveland, IDL Puget Sound, School of Architecture, University of Washington
Margaret Montgomery, NBBJ

ABSTRACT

A regional long-term multi-pronged effort has been conducted in the Northwest to achieve significant and persistent energy efficiency in new commercial buildings through influencing design practice among architecture firms. This effort involves business planning assistance, in-depth project-based education (also known as technical assistance), research and development on design strategies and tools, and professional staff development with a few targeted early adopter firms. Intervention has been provided via Integrated Design Labs and a consulting Business Advisor. The experience and successes of the few firms receiving direct intervention are then strategically promoted in the broader market through marketing and education activities leading to inspiration and motivation of others. The effort advocates using a core set of best practices as a means of delivering high performance buildings that meet the 2030 Challenge targets for energy and carbon reduction. These include:

- Use of integrated design and a team approach to address energy use
- Setting project energy performance targets significantly better than code
- Use of enabling design tools and approaches to achieve synergies between climate, use, loads and systems
- Commissioning the building, systems and equipment
- Help structure a hand-off to operators, educate occupants & monitor start-up
- Enable and support post-occupancy evaluations.

The stages of practice change for targeted firms evolve through the following sequence: Engaged, Committed, Practicing, and Sustaining.

The first five years of this program show that notable successes in energy efficiency on the order of 50% or better over local code can be achieved through this approach. It remains to be seen how extensive the transformative impact will be beyond the targeted partner firms.

Introduction

A unique approach to market transformation of the commercial new construction market is being deployed by the Northwest Energy Efficiency Alliance (NEEA) through its BetterBricks initiative. NEEA is a non-profit organization funded by Northwest utilities, the Bonneville Power Administration, and the Energy Trust of Oregon. NEEA works in collaboration with stakeholders and strategic market partners to accelerate the market adoption of energy-efficient products, technologies and practices within homes, business and industry.

The overall BetterBricks theory for market change is that helping a few leaders/early adopters be successful and then publicizing that success will motivate the near majority to begin

to copy the practices. Owners will demand more energy efficient buildings and the related products and services needed to achieve them. If firms that provide these products and services build market capacity to meet client demand, they will continue to advance their offerings, further increasing market adoption. The BetterBricks initiative simultaneously and systematically drives the demand for, and supply of, energy efficient products and services in the market. This means that:

- Developers/owners/tenants understand and request building performance linked to their interests.
- Architects learn to reduce loads in new building designs.
- Engineers design and specify efficient systems and equipment that meet those loads.
- Architects and engineers effectively market integrated design services and high performance buildings to their owners/developers/clients.
- Builders deliver projects that are built and perform as designed.
- Buildings are operated to achieve design intent.

Overview of Firm Focus Strategy

Through business and technical advisory assistance the BetterBricks Design and Construction (D&C) team helps selected leading architecture and engineering firms adopt best practices. This focus on a limited number of targeted firms, called Firm Focus, aims to help these firms advance their practices so they become market leaders, and their progress influences others within the market to adopt best practices. If the participating firms are large enough, than a significant number of projects (and related floor area) will be directly impacted. These market dynamics, combined with key elements of the diffusion strategy such as education, training and marketing, help spread best practices.

One of the goals of the BetterBricks D&C initiative is to promote a set of approaches and practices collectively known as *integrated design* (ID) so that it becomes standard practice and significant energy efficiency is achieved. It is expected that being able to deliver high performance energy-efficient buildings using integrated design will be a differentiation in services that firms will need to be competitive in the market. BetterBricks defines ID as the synthesis across climate, use, loads (i.e. envelope design), and systems resulting in high-performance buildings that are far more energy-efficient than current best practices (BetterBricks 2007).

The D&C initiative efficiency targets have been aligned with those of the *2030 Challenge (Architecture 2030)* and the American Institute for Architects 2030 Commitment (AIA). For the current program cycle (2010 through 2014) that target is 60% better than the 2030 baseline.

The strategy includes the following elements:

- Promote the business case for high performance buildings and provide business planning assistance to leading and early adopter A&E firms. Build awareness of the business advantages of offering integrated energy design services to achieve high performance buildings with design firm decision makers.
- Provide assistance on business planning which includes market assessment activity, assessments of organizational needs and current capabilities, business plans and sales

strategies. Encourage A&E firms to market integrated energy design services and high performance buildings to their clients.

- Develop technical capabilities associated with critical design strategies Provide information, tools and professional development opportunities to architects, designers and others within the A&E firms. Provide technical advisory resources, including the design labs and technical advisors, to help evolve A&E firm design practices.
- Provide project-specific technical support to build experience and develop successful projects.

This “Firm Focus” effort advocates for, and assists, firms to evolve their service offerings and enhance their capabilities to deliver high performance buildings that achieve significant energy savings. This is accomplished by advancing “best practices” within service offerings, and further developing professional skills and capabilities. Application of these best practices on a regular basis within each firm’s project work is the indicator of change expected. Best practices being promoted by the initiative include:

- Use an integrated design process and a team approach to address energy use
- Set project energy performance targets (significantly better than code)
- Apply enabling design tools and approaches to achieve synergies between climate, use, loads and systems
- Commission the building, systems and equipment
- Help structure a hand-off to operators, educate occupants & monitor start-up
- Help enable and support post-occupancy evaluation(s)

Firm Focus complements utility/public benefits administrator programs where available, leveraging incentive programs related to encouraging energy efficient design and construction.

Technical Advisory Support

A key delivery mechanism is a regional network of Integrated Design Labs (IDLs or labs) operated by Schools of Architecture at universities in the four states. BetterBricks funds five Integrated Design Labs – located in Portland (Oregon), Seattle and Spokane (Washington), Boise (Idaho), and Bozeman (Montana) – to provide technical support for the overall D&C initiative and specifically for the Firm Focus effort. The University of Washington IDL has been serving the Puget Sound area since 1976. From 1999 to the present the Lab has been largely funded by NEEA. The Oregon lab (Energy Studies in Buildings Lab) has a similarly long history. Other labs were formed in response to NEEA’s needs over the last 6 years.

These labs provide advisory services, as well as, research and analysis. Facilities include digital and analog simulation tools for lighting and daylighting, energy modeling, performance analysis tools, and equipment testing. Typical project technical advisory support provided by the labs includes:

- Analysis of baseline conditions and comparative baselines
- Goal and metric setting
- Strategy setting to meet goals and metrics

- Early, iterative and persistent energy modeling
- Integrated systems bundling
- Analysis of different strategies such as daylighting, natural ventilation, hybrid HVAC,
- Integrated system selection
- Post-construction M&V planning
- Design review
- Construction submittal review
- Post-occupancy assessment of performance

The labs help designers learn how to deliver building projects that perform at the highest levels of energy efficiency and interior quality, with little or no additional capital cost through integrated design team problem solving. In addition to creating and using case studies of working examples, the Labs use real building projects as educational vehicles, i.e. active learning by doing. These projects inevitably bring up questions around which the lab will provide research support.

The lessons learned by architects working directly with the IDL on projects spread throughout the firm and are incorporated into standard practice by the rest of the design staff through formal in-house seminars, informal brown-bag lunches, project review sessions, and other training events for those not directly involved on a project receiving advisory support.

Business Advisory Support

In addition to the technical support from the Labs, the initiative deploys a Business Advisor to work with the firms. The Business Advisor is a national consulting firm specializing in architecture and engineering business and strategic planning. The Business Advisor works with senior members of each Firm Focus firm to:

- Define and document their corporate commitment to energy efficiency and identify internal champions for ID
- Track implementation goals
- Suggest potential external partners (such as engineering firms) to help advance ID at the firm
- Assist in strategic positioning of their ID practice
- Help develop and disseminate ID success stories through article placement, speaking engagements, and preparation of proposal materials

The initiative also seeks continuous innovation to meet changing 2030 Challenge targets on the pathway to net zero energy buildings. The degree of practice commitment evolves through the following sequence or stages:

- Engaged: Management is engaged.
- Committed: A firm has stated goals and strategies with visible executive commitment.
- Practicing: A certain number of best practices are being applied with regularity.
- Sustaining: A firm exhibits continuous improvement and innovation on an ongoing basis

The experience and successes of the few firms receiving direct intervention activities are strategically promoted in the broader market through marketing and education activities leading to inspiration and motivation of others.

Firm Selection and Engagement

Firms were selected for participation using a rigorous process with specific criteria including:

1. Influence within the design community (market share/peer recognition)
2. Significant relationship to targeted vertical markets in the region (hospitals and healthcare/ office real estate)
3. Commitment to high performance buildings and related integrated energy design service offerings (e.g. prior participation with BetterBricks)
4. Current ability to deliver energy efficient design
5. Likelihood of success, i.e. interest/willingness to partner to further build capabilities and expand business opportunities, as well as internal conditions appropriate for change to occur

The first step was to perform a market assessment of design firms in the Northwest to identify firms active in the two markets targeted by BetterBricks. Then, contacts were made to high priority firms to introduce the concept and outline elements of a Firm Focus relationship and also to discern the level of interest. For the top choices, the expected firm commitment was defined:

1. To use an integrated design process on a majority of projects within 3 years.
2. Setting significant energy efficiency performance goals on each project (at least 25% better than code).
3. Provide access for the BetterBricks team to all Northwest projects at the firm.
4. Significant commitment of staff time to training and project-specific technical assistance.
5. Use of high performance and integrated design concepts and capabilities in marketing efforts.
6. Willingness to obtain tools and services needed to provide fully integrated design.

Once general agreement was reached, then a specific relationship was negotiated with each firm. A letter of agreement was prepared and an Activity Plan developed for specific work, identifying responsible parties and expected outcomes. Activity Plans are reviewed and updated annually.

Three firms signed on as a Firm Focus partner in 2005; two firms joined in the second half of 2007. Firms 1 and 2 are both medium-sized firms with offices in Portland and Seattle. Firm 3 is a large national firm headquartered in Portland with an office in Seattle. Firm 4, based in Seattle, is the second largest firm in the U.S. with offices around the world. Firm 5 is a medium-sized regional A+E firm based in Billings, Montana with offices throughout Montana, and in Boise and Seattle.

A breakout of the types and numbers of projects receiving technical assistance at the firms is shown in Table 1.

Table 1. Number of Projects Receiving Technical Assistance in 2009

Firm	College/Univ.	Grocery	Healthcare	School (K-12)	Other	Total
1	7		1		4	12
2	3		2	8	1	14
3	3		3		1	7
4			5			5
5	2	2	2		1	7
	15	2	13	8	7	45

As an illustration of the energy savings potential, one of the firms, SRG Partnership, working closely with the ESBL, achieved a 62% reduction over Oregon Energy Code on the Mount Angel Seminary Education Building. Another firm, working with the IDL-Puget Sound, achieved savings on 5 projects totaling one million square feet ranging from 27% to 49% over local code, translating to about 19 million kWh/yr.

One Firm's Experience and Related Impacts

NBBJ is one of the largest architecture firms, not only in the Pacific Northwest, but in the country, and is one of the leading firms serving the healthcare and commercial real estate markets. Initially, due to the firm's size, the Firm Focus relationship was intentionally limited to the firm's healthcare practice, although some work has begun with the commercial office building practice as well. The partnership with the healthcare practice and technical and educational assistance has provided leverage with firm-wide impacts.

2030 Challenge: Impetus for Change

NBBJ's partnership with BetterBricks began just as the firm had identified a systematic approach to the 2030 Challenge: investigation and education, commitment, leadership projects and finally setting targets and achieving performance across the entire practice. The Firm Focus partnership has provided support enabling and accelerating each phase of this approach.

The first year of investigation into the impacts and feasibility of meeting the 2030 Challenge goals was bolstered with IDL technical and educational assistance, leading to a formal commitment to the Challenge in 2008, and subsequently to early adoption of the AIA 2030 Commitment. The next steps included identifying a key project in each studio, setting energy performance targets and sharing design experiences. The firm conducted a firm-wide (international) critique of these exemplary sustainable projects from each studio, with the Seattle IDL director participating. In 2009, a firm-wide energy target and design performance reporting protocol was implemented that now includes all active US projects (excluding interiors and minor remodels).

Because most NBBJ projects are large and complex, none of these projects have moved completely through design, construction and into operations. It is anticipated that key projects will be followed through post occupancy evaluation as part of the ongoing evolution of the practice. Projected savings for these key projects ranges from 30% to over 50% better than Seattle Energy Code, one of the most stringent in the country. Most meet the 2030 target

threshold. As an example, one large office project achieved a projected EUI of 43 kBtU/ft², or about a 40% savings over Seattle Code baseline and a savings of 1.6 million kWh/yr. Figure 1 below shows the modeled savings for a number of recent hospital projects.

Internal Training, Education and Commitment

NBBJ's multi-office, studio-based structure and culture encourage individual leadership and studio autonomy. This culture presents both advantages and disadvantages. Directives and mandates that would help implement rapid change are rare, but when change happens it sticks. To pursue a design process that enables aggressively high energy performance, it has been critical not only to have visible and vocal leadership from the firm partners but also to bring each collegial leadership group and project team along as well, creating ownership and commitment across the entire practice.

Building expertise and changing project processes has required a multi-pronged education, training and communication approach addressing multiple constituencies. Primary activities have included:

- The firm-wide 2008 Internal Education curriculum (22 one-hour sessions) was dedicated to energy efficiency topics ranging from the Integrated Design Process (co-delivered by the Seattle IDL Director) to Post-Occupancy Evaluation. Lunchtime education sessions are delivered twice via Webex on both East coast and west coast time zones, attracting an average of 125 – 150 attendees to each topic. Several sessions were either delivered or co-delivered by BetterBricks team members. Sessions are available for later viewing on the firm's internal network.
- The Delivery/Design Leaders monthly firm-wide Webex videoconferences regularly include project case studies of high performance projects, highlighting various aspects of their execution from process to technologies to design. Twice-yearly practice reviews include energy performance status reports and education. This group represents studio design and technical leaders whose commitment is critical to project and studio success. The exemplary projects were then reviewed in the annual firm-wide (worldwide) meeting of this collegial group.
- BetterBricks periodically sponsors national and international thought leaders as guest lecturers that tour the region. BetterBricks brings these leading design professionals to meet with NBBJ during their time in town. The greatest leverage from these visitors is team-focused critique sessions where one or two project teams interact with the visiting expert to explore aspects of project performance.
- An internal sustainability e-newsletter published 8-12 times per year highlights project successes and other stories of interest, many of which have come from Firm Focus activities.

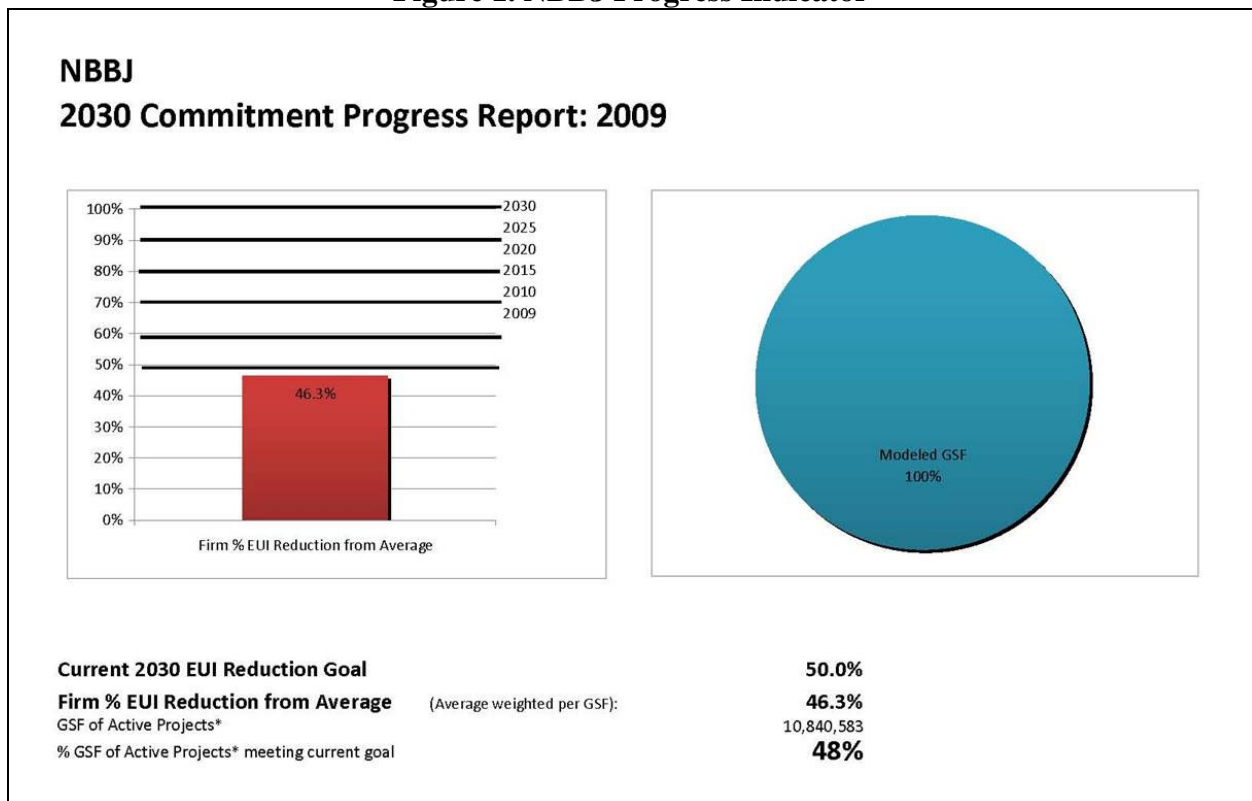
In addition to being committed to the 2030 Challenge as a firm, NBBJ is undertaking its own internal 2030 Challenge, specifically in its healthcare practice – the Sustainable Healthcare Energy Challenge - bringing in consultants, contractors, and clients, as well as their own internal team. The initial exploration into the feasibility of the 2030 Challenge in healthcare has led to a longer term research collaboration with BetterBricks and the IDL. This collaboration has identified a set of strategies to achieve the energy goals in hospitals including: a target Energy

Use Index of 100 kBtU/ft² or less; creating a hypothetical prototype project energy model incorporating the strategy bundles; and thoroughly cost-estimating the impacts of each bundle. At this writing, the prototype is showing performance results of 65% less energy than the average Northwest hospital with a minimum first cost impact around one percent (Burpee, et al, 2009).

Outcomes at NBBJ

Over the past three years NBBJ’s staff energy literacy has grown from a handful who barely understood the term Energy Use Intensity through an education curve that has now permeated every studio and nearly every project, as evidenced by the staff’s contributions to NBBJ’s 2030 database including all significant US projects in the firm with about 11 million square feet in design in 2009. The database development was assisted by the IDL staff and includes basic project information, CBECS baseline comparables, 2030 Target EUI goals for each project, guiding energy code and design EUI reporting phase by phase. In the first year of this tracking, the 2009 portfolio shows collectively a 46% reduction (projected) in energy use from the baseline, and 48% of projects are estimated to achieve or exceed the 2030 goal of 50% savings in 2009.

Figure 1. NBBJ Progress Indicator

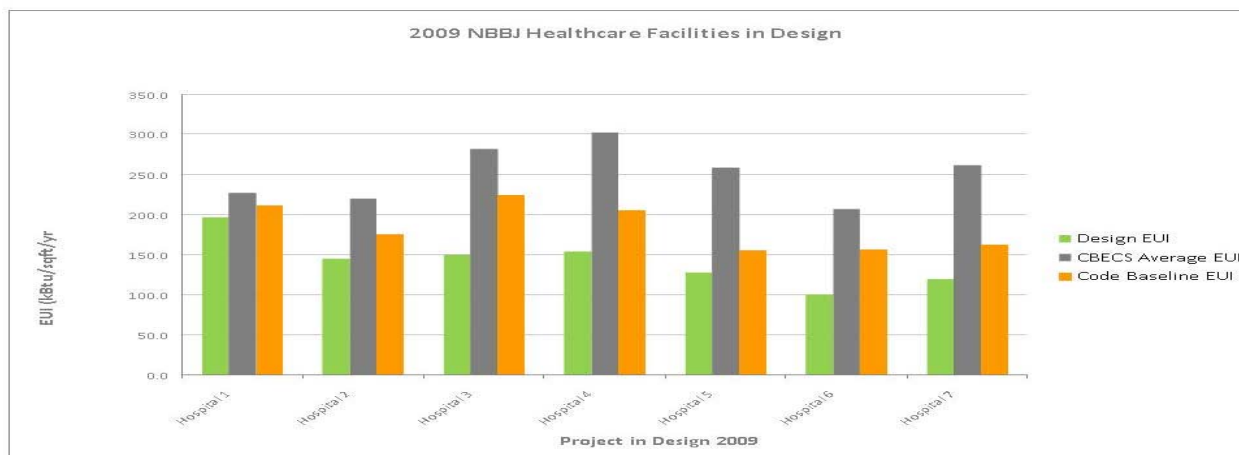


Energy modeling has moved from an option to a core requirement on projects. By anecdotal estimate (prior to the database), three years ago no more than 20-25% of projects included energy modeling. In the 2009 database, 100% of projects implemented energy modeling to some extent in their process.

Knowledge gained through the hospital energy research initiative and the effort to communicate findings internally has borne fruit – incrementally, due to the long timeframe of hospital design projects. A 2009 assessment of healthcare-specific energy performance shows a 42% cumulative reduction from the average hospital with key high performers exceeding the 2030 Challenge efficiency targets.

The Firm Focus partnership was begun at just the right time in NBBJ’s evolution to gain maximum support and exposure. Partner enthusiasm and support were strong and NBBJ’s collaboration with BetterBricks on research, education and training and project-based technical assistance has resulted in a track record of successful energy efficiency design improvement in the first 2 ½ years.

Figure 2. Modeled Performance of Recent NBBJ Hospital Projects



Lessons and Challenges at NBBJ

After several years of Firm Focus activity, a number of key lessons have been identified by NBBJ participants.

- Key to implementation of the ID process was the support and commitment of the firm’s partners. NBBJ has its own version of integrated design process, but the focus on energy performance promoted by BetterBricks necessitated a variation in the process, the activities, and the participants required at the design table. Tuning and acceptance of this new emphasis is ongoing and embraced project by project across the various studios.
- Firm Focus project participation has been successful to mixed degrees over several projects. The most successful ones began with the Seattle IDL director invited to the earliest project meetings, while late intervention and project halts have been the greatest deterrents to success.
- Education is only effective if received at the moment that it is personally relevant for the participant, therefore the project-based learning is the most effective.
- Changing the project process to incorporate BetterBricks’ elements of integrated design requires key decision makers to recognize intervention points that are new, and to continually reconsider habitual ways of working. At the same time, project timelines continue to shorten and put pressure on teams.

- Tools have traditionally been developed in the firm at the studio level, during active project development, with little enthusiasm for a “central office” overhead structure. The speed of change required to achieve the ambitious 2030 goals has required augmenting the development of tools and process guidelines such as “how to” guides for benchmarking, working with energy modelers and engineers, and starting projects on the right foot.
- ID requires working with consultants – engineers particularly – in a different way. Often this means working with the same engineers the firm has teamed with for the same client for a decade and asking them to participate in a different way and with different outcomes. Often the internal teams may be doing this for the first time. Seeding new teams with seasoned high performance design leaders proves less challenging as time goes on.
- The extended duration of projects in healthcare (i.e. about 5 years from programming to occupancy) means that implementing rapid change is especially challenging for teams typically bound to these projects for multiple years.

Among the next steps for NBBJ are gaining a deeper understanding of both baseline and design EUI data and development of more robust protocols and standards for selecting modelers and implementing energy modeling on projects. As current design projects move into construction and then occupancy, more emphasis will be placed on commissioning, operational handoffs and post-occupancy evaluation.

Lessons Learned and Conclusions

NEEA uses independent evaluators to assess its various initiatives on an on-going basis. The most recent BetterBricks evaluation (Research Into Action et al. 2009) was published in October 2009. The evaluation team arrived at a number of lessons learned and conclusions related to the Firm Focus effort.

Lessons Learned

1. Architecture firms vary widely in size and organization and can take time to change. A relationship with an individual studio may not translate immediately or directly into firm-wide acceptance of ID and high performance design practices.
2. Some of the most senior firm members – those with the most decision-making authority – may be most resistant to change, but if they become committed, things can change quickly.
3. Individual internal champions of ID can have a significant impact on how quickly a firm adopts sustainable goals and practices.
4. A publicly-announced commitment to energy efficiency goals, supported by well-placed, qualified champions of sustainability, can lead to a relatively rapid shift in corporate culture.
5. There is value in routine involvement as part of the intervention strategy. One of the keys to effectively influence design practice at the partner firms appears to lie in having

regularly-scheduled meetings between the firm and the IDL. Many active projects are reviewed at these meetings. Regular meetings with the Business Advisor are also key.

Conclusions

The Firm Focus approach appears to be succeeding at the individual firm level. All of the Firm Focus participants have said that the partnership had exceeded their expectations, with each of them citing the technical support available from the IDLs. Those who use the services of the Business Advisor were equally enthusiastic about that resource. As a gauge of progress, two partner firms were already at the “sustaining” level by the end of 2009.

According to a recent evaluation (Research Into Action et al. 2009), Firm 1, the firm with the longest track record in Firm Focus, “is a striking success among the Firm Focus firms” Actions taken by this firm validate this as illustrated by the following. The firm:

- Uses the buildings it has “on the ground” to prove their ability to deliver designs far more energy-efficient than code and to demonstrate ID concepts.
- Has made a public commitment to the *2030 Challenge*.
- Conducts detailed research on climate and occupancy to look for opportunities to affect the fundamental design of every project, with input from the engineer right from the start.
- Has funded a graduate research position at one IDL that supports ongoing post-occupancy evaluations, with the goal of building a database comparing actual to modeled performance.
- Is developing an ID database and a systematic approach to POE for all the projects it has completed with the IDL.
- Has LEED accreditation for almost all of its design professionals.
- Now contracts directly with the ESBL to be an integral part of virtually every project, combining lessons learned from its recent projects with new research and analysis.
- Actively promotes its sustainable design capabilities in winning work, and is a strong proponent of what it calls a “blue collar approach” to ID, so that it can use ID on projects with more modest budgets.

Some of the high profile projects supported by the Firm Focus relationship have the potential to influence the design of many subsequent buildings within the firms and among other firms.

Although there are a number of characteristics that define the application of ID to an architectural practice, it is rare for all of these characteristics to be universally applied. Large firms, in particular, comprise multiple offices and studios addressing different markets and those studios operate with relative autonomy from the head office or the studio that holds the Firm Focus relationship. One office or studio may be working closely with BetterBricks to implement ID on multiple projects, while another studio in the same firm may – at least initially – barely have heard of ID or BetterBricks.

As more Firm Focus firms complete projects started under the partnership, more new case studies of projects with significant energy savings will be available. Lab directors and Firm Focus staff alike say they cannot overemphasize the importance of having completed buildings that people can see and touch as a tool for both education and marketing. A number of completed

projects (including Mount Angel Abbey, Banner Bank, Oregon Health Sciences University Center for Health & Healing, and a number of elementary schools) have been instrumental in demonstrating the practicality of what initially may have seemed like radical design concepts to some. And many of the projects assisted during the Firm Focus partnerships have achieved estimated performance levels exceeding 50% better than Oregon or Washington Energy Code.

“On one hand, the advantage of the Firm Focus approach is that it has the potential to be truly transforming. In fact, one of the design principals at Firm 1 has described the firm’s experience with the Firm Focus relationship in precisely those terms. And while the number of projects directly affected is much smaller than for a more prescriptive approach, these projects tend to be much larger energy users and the overall effects are more far-reaching. Projects completed by the Firm Focus firms are coming to be seen as exemplary, not just within the region, but nationally and even internationally – an important consideration in a highly competitive industry where such exemplary works help to define best practice and thus promote the firms that deliver it.” (Research Into Action, et al. 2009).

The initiative aims to promote these successes and influence the broader market. There has not been an evaluation of diffusion, and it is yet to be seen what this impact will be, but early indicators are encouraging.

References

[Architecture 2030] 2030 Challenge www.architecture2030.org

[AIA] American Institute of Architects, 2030 Commitment, <http://www.aia.org/about/initiatives/AIAB079458?dvid=&recspec=AIAB079458>

[BetterBricks] BetterBricks Initiative, Northwest Energy Efficiency Alliance, www.betterbricks.com

Burpee, Heather, Hatten, M., Loveland, J., and Price, S. "**High Performance Hospital Partnerships: Reaching the 2030 Challenge and Improving the Health and Healing Environment.**" American Society for Healthcare Engineering (ASHE) Conference on Health Facility Planning, Design and Construction (PDC). Phoenix, AZ, March 8-11, 2009.

Integrated Design Lab Network, <http://betterbricks.com/DetailPage.aspx?ID=253>

Research Into Action, Inc., Tecmarket Works, PWP, Inc., Dethman & Associates and Washington State University, 2008 BetterBricks Overall **Market Progress Evaluation Report**, released October 15, 2009.