Estimating Energy Savings for a Commercial Market Transformation Initiative

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ABSTRACT

This paper describes a unique methodology for estimating energy savings associated with the Northwest Energy Efficiency Alliance's (NEEA) BetterBricks Initiative, a market transformation approach to achieving long term energy savings in the Northwest. The BetterBricks Initiative is not a traditional, utility-style energy efficiency program, and it is not amenable to a typical impact evaluation approach. Accordingly, and as described further in this paper, the BetterBricks Initiative needs an insightful and innovative approach to estimating energy savings. The paper describes the overall methodological framework, the protocol for establishing energy savings estimates, and the challenges with estimating market transformation energy savings.

BetterBricks seeks to influence the business practices of those who design and operate commercial buildings with the long-term goal of delivering high performance (energy efficient) buildings to the market, increasing market demand for these buildings and achieving larger and more cost-effective long-term energy savings than would be possible through resource-acquisition programs.

While planning estimates were developed as part of the BetterBricks Board-approval process, this project represents the first attempt to use actual Initiative data as the source for savings estimates that are directly linked to Initiative activities. The ultimate goal of this project is to develop "per unit" energy savings impacts from all BetterBricks activity that can be extrapolated to the entire commercial market. NEEA views this as a long-term approach that will take several years to be fully functional. The results and lessons learned in the early stages of the process are presented at the end of the paper.

The fundamental challenge is to capture energy savings from all buildings affected by BetterBricks when the initiative only directly touches a small percentage of those buildings. In creating the conceptual framework, we defined three different levels of BetterBricks influence: Direct Involvement, Direct Influence and Indirect Influence. Direct Involvement refers to projects that have received direct technical assistance. Indirect influence refers to those buildings where designers, operators or building owners were influenced by the program but did not receive direct technical assistance. Indirect influence refers to the spillover of BetterBricks activity into the rest of the commercial building construction and operation market. The Protocol contains separate methodologies for estimating levels of savings for each type of influence.

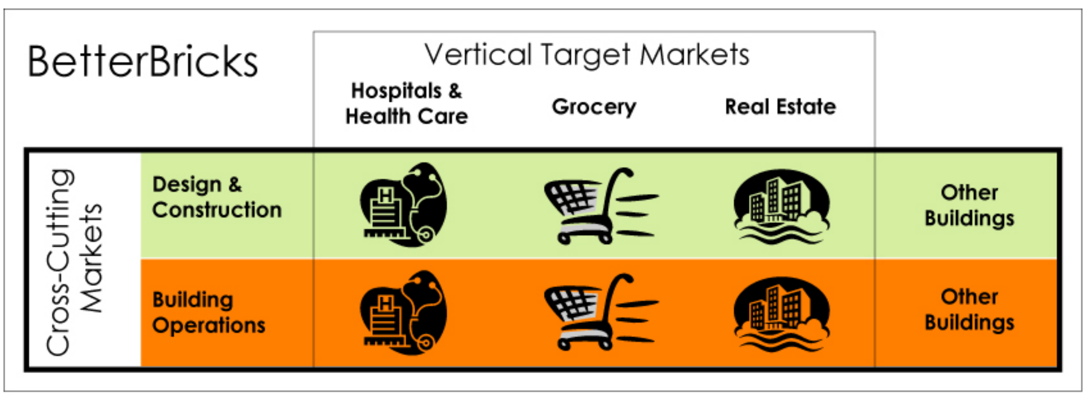
BetterBricks Initiative Overview

BetterBricks comprises all of NEEA's commercial sector activities. It seeks to make energy efficiency an integral part of business decision-making by changing business practices in design and construction and in building and facility operations. Within BetterBricks, an "energy-related business practice" is defined as any consistent policy or action an organization applies that affects energy consumption in its buildings. The changes in business practices that BetterBricks is promoting will result in facilities that reduce energy-related capital and operating costs. In addition, there are potential non-energy benefits, such as occupant comfort and productivity, and an alignment of design and construction projects with industry best practices.

BetterBricks overall budget is approximately $7.5M per year. The initiative is implemented across the four Northwest states – Idaho, Montana, Washington, Oregon – and is expected to save over 200,000 MWh for the period 2005-09, with significantly higher savings beyond that as market transformation effects spread more broadly.

BetterBricks currently addresses three specific "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 Figure 1. In broad terms, the distinction is between companies that have a demand for services (vertical) and companies that supply services (cross-cutting). Services provided to these markets include both technical support and business advice. Technical support can be provided for either specific projects or whole organizations, while business advice is always at the organizational level. The majority of these services are provided to a few selected partners within each market with whom NEEA has established a formal memorandum of understanding, and who have the potential to influence other organizations in those markets.

Figure 1. BetterBricks Targets



Challenges with Estimating Market Transformation Energy Savings

A multitude of well-established energy savings estimation techniques has been developed by the energy efficiency industry over the past twenty years. However, few of these approaches can be directly applied to BetterBricks because its emphasis on changing business practices means that there are no prescriptive lists of energy efficiency measures from which savings will be derived. Further, complete records are often not available for affected buildings. Existing estimation techniques are being adapted and new ones are being developed for this project. Several difficulties specific to BetterBricks itself make this a challenging project.

First is the sheer scope of BetterBricks. Savings must be estimated for both the new construction and existing building markets, for different market segments, for different climate zones, and, ultimately, must account for commissioning and operational changes in addition to building system efficiencies.

Second, the result of the non-prescriptive nature of BetterBricks is that, while certain measures and practices are being emphasized (e.g. daylighting), any one building may have an entirely different set of efficiency improvements than another building in the same vertical market. This is especially true in existing buildings where the focus is on operational improvements.

Third, and by far most challenging, the vast majority of the buildings affected by BetterBricks will have no contact with initiative staff or contractors. While initial activities are focusing on business owners and trade allies with whom BetterBricks has direct relationships, a fundamental part of the market transformation theory is that documented successes will inspire other businesses who do not have direct contact with BetterBricks to adopt the same business practice changes.

The Framework was completed in 2006. Based on the Framework, protocols were developed to provide clear and explicit procedures for collecting the necessary data on measures and bundles. The protocols also specify the necessary levels of precision in the data collection and measurement, so as to avoid the problem of poor data quality that can compromise savings estimate accuracy. In the context of this effort, we use the term "Protocols" to refer to the process used to estimate energy savings in buildings impacted by BetterBricks. The Protocols were started in 2007 and continue to evolve.

Of necessity, the development of energy savings estimates follows the implementation of the program. For the first few years, BetterBricks implementers have been focusing on laying the groundwork for changing business practices and completing individual projects that can be used as success stories and validation of the benefits that will result from adopting the business practices BetterBricks is promoting. During this first phase, evaluators generate savings estimates based on information collected from individual buildings. Ultimately, however, the evaluation goal is to relate the changes in business practices directly to savings. For example, if an organization adopts integrated design as a policy, we would like to be able to say, without examining or analyzing each building that this will save some deemed percent of energy relative to baseline buildings. For such an approach to be credible it must be based on large amounts of empirical data; gathering such data will take several years, as both significant numbers of buildings and significant numbers of organizations adopting the new business practices will be needed to discern the quantitative relationship between the two.

Framework Development

The initial task for this project was to create a conceptual framework that could be used to develop the analytical approaches for estimating savings. The first step was to use the BetterBricks initiative description to define three levels of program influence:

- Direct Involvement. Meaning that BetterBricks has provided services directly to an individual project, and documentation exists that specifically identifies what changes were recommended. The data and documentation are entered into the tracking system.
- Direct Influence. Refers to organizations or buildings where a specific BetterBricks activity can be identified as having influenced a project, even though no direct BetterBricks technical or business service was received. One example of direct influence would be when a successful direct involvement project leads an organization to implement other energy efficiency practices or apply those practices that were

recommended to other buildings where no direct help is received. Another example of direct influence would be when a customer attends a BetterBricks training session or talks to a colleague at a direct involvement firm, which leads to implementation of some energy efficient practice or technology. The fundamental assumption is that a causal link can be established between BetterBricks activities and actions taken, and a reasonable estimate of the impact can be made (even though direct documentation may not be available).

- Indirect Influence. Accounts for the remaining influence that all BetterBricks' activities will have on the rest of the market. This is the essence of the market transformation theory, in which organizations that change business practices, on both the demand- and supply-sides of the market, achieve success, leading other organizations to mimic them. These secondary effects cannot directly be linked to BetterBricks activities, because the people who implement them do not realize the origin of the change was BetterBricks. They are simply adopting a successful practice or technology they see in the market that makes sense to them.

After establishing these three levels of influence, we reviewed logic models of the individual BetterBricks vertical market initiatives and noted that BetterBricks can have influence at the project level, the business practice level, and the organizational level. For purposes of the savings framework and protocols, we use the following definitions:

- ***Project:*** Building-specific activity consisting of one or more measures.
- ***Measure:*** Any action resulting in measurable energy savings. Measures can include specific equipment, a procurement policy or a facility energy management plan.
- ***Business Practice Area:*** The four areas within a vertical markets organization that BetterBricks can influence to attain energy savings: design and construction, building operations, procurement, and system upgrades.
- ***Organization:*** Business entity operating in a BetterBricks market. Broadly split into demand-side (requiring products and services) and supply-side (supplying products and services). All have business practice areas and projects that can be influenced (directly or indirectly) by BetterBricks.
- ***Market:*** A BetterBricks-defined piece of the commercial market.

When we combine these with the levels of influence we get the overall framework shown in Table 1. The arrows in the figure indicate that, in general, BetterBricks activities and results move from individual projects to the entire market. For example, an organization receives direct help on an individual project; if the measures implemented in the project are successful it leads to them being implemented in other projects; if they are successful in a few of these other projects they are incorporated into a consistent business practice policy. Success with one or more measures can lead to comprehensive business practice changes that address all energy consumption. Through word-of-mouth, marketing, competitive pressures, and BetterBricks' supply-side efforts, these changes ultimately flow to the rest of the market on the far right of the figure. Organizations do not need to follow this entire sequence. They may take what they have learned (either directly or second-hand) and immediately change individual business practices and proceed from there. Rarely, if ever, would we expect a company to start by adopting a comprehensive, organization-wide policy without previous experience.

These areas are common to all vertical markets, though implementation strategies need to vary significantly to address the specifics of a given market. For instance, hospitals tend to have large, well-trained facilities staff that does most O&M work. Affecting O&M practices therefore requires working directly with staff. Offices, on the other hand, tend to contract out most facility work so a different, two-fold strategy is required – first, educate the building owners on what to require from service providers to achieve a high performance building; second, provide training to service providers to increase their capability to provide high performance services. Energy savings estimates will account for activities in all four business practice areas.

Table 1. Theoretical Framework for Overall BetterBricks Influence

Influence Type	Individual Measures &Projects	Individual Business Practice Policies	Comprehensive Organization-wide Policy	Market
Direct Involvement				
Direct Influence				
Indirect Influence				

Another layer of the conceptual framework addresses the BetterBricks' goal of influencing energy-related decision-making in targeted vertical markets. Initiative implementers have defined four business practice areas within the vertical markets where changes could result in reduced energy consumption: Design & Construction (D&C), Building Operations, Procurement, and Systems Upgrades. BetterBricks works directly in the first three business practice areas. The last, Systems Upgrades, are retrofit activities currently supported by utility efficiency programs throughout the Northwest. Table 2 presents the framework as it applies to these business practice areas. Energy savings estimates will account for activities in all four business practice areas. Each cell represents a separate section of the energy savings protocol. There will be similarities for each column and to a lesser extent across each row.

Table 2. Theoretical Framework for BetterBricks Influence on Business Practices

	Business Practice Area			
Project Type	Design & Construction	Building Operations	Procurement	Systems Upgrade
Direct Involvement				
Direct Influence				
Indirect Influence				

Each cell in the table represents a different protocol. The different protocols may share features

Taken together, Tables 1 and 2 indicate all of the vectors through which impacts can result and all of the areas in which they can result. Defining this theoretical framework allows us to move more efficiently to the next step of quantifying savings.

Energy Savings Protocol Overview

With the framework established, the next step was to develop protocols for estimating actual energy savings based on BetterBricks involvement and influence. In the context of this project, a protocol is defined as a process that includes sufficient detail on all the techniques, strategies, definitions and descriptions required to produce overall energy savings estimates for each aspect of a specific target market. Protocols will be developed for each vertical market: Hospitals & Healthcare, Grocery, and Real Estate, with separate sections that address each of the four business practice areas: design and construction, building operations, procurement and systems upgrades. The completed protocols will also separately address each level of BetterBricks influence: Direct Involvement, Direct Influence, Indirect Influence. A protocol will, of necessity, change over time to reflect additions and deletions in the energy savings activities of the BetterBricks market it addresses.

Project efforts to date represent the first attempt to use actual Initiative data as the source for savings estimates. The primary tasks that have been completed for this initial effort were:

- develop protocols describing the steps to collect, validate and analyze the data, and
- apply the savings protocols to as many completed projects as possible to determine if defensible savings estimates at the project level could be generated.

No attempt has yet been made to determine how many completed projects are necessary to develop the appropriate savings estimate. Ultimately (2-3 years down the road), we will apply the results to generate Initiative-wide savings estimates. The basic metric for energy savings estimates is whole building energy use intensities (EUIs) using saved kilowatt-hours per square foot per year (kWh/sf/yr) and normalized for factors appropriate to each market.

While it was noted above that BetterBricks is not a prescriptive program, a fundamental assumption of our approach is that we can determine representative bundles of measures with aggregate EUIs that reflect the projects that have been completed at any given time. Identifying measure bundles allow us to calculate deemed energy savings that can then be applied to other projects. As we conduct our on-going project-specific review and analysis, we will examine and track the measures installed in individual projects, generating energy savings and identifying common measure bundles. The contents of the bundles may change over time as the Initiative emphasizes different technical strategies for saving energy. We will continue until sufficient confidence is gained that the savings of the tracked buildings are representative of what BetterBricks is expected to generate in all buildings over time. The term “sufficient confidence” has not been specifically defined but as we track the variance in the measures installed over time we believe it will become obvious when a specific market coalesces around and then stabilizes in its use of a relatively consistent package of technologies and practices that meets its needs. When that level of confidence is gained, the EUIs will be applied, going forward, as deemed savings.

The protocols provide clear procedures for collecting the data necessary to estimate savings, and specify the necessary precision in the data collection and measurement to result in acceptable levels of accuracy in the resulting savings estimates. The protocol defines what “acceptable level of accuracy” means, and will likely vary among the various elements and over time based on the BetterBricks priorities. In broad terms, the protocols are intended to answer the following questions:

- What data are available for baseline and post-treatment conditions?
- How will data be collected?
- Who is responsible for collecting the data?
- What does the existing data tell us and how can it be used to estimate savings?
- What activities are needed to validate or calculate energy savings?
- What tools are required for in-field data collection?
- How will data be analyzed including methods, tools and expected outputs?
- What are the final savings?

Energy Savings Protocol

For the *Direct Involvement* and *Direct Influence* levels[1] we have defined a four-step process as follows:

- Step One - Project Information Tracking and Gathering. Provide the data for determining baseline and post-treatment conditions and outline how data are collected, by whom and when. Step One is based on the fundamental assumption that there is project data for us to review.
- Step Two - Project Information Review. Review existing data and determine how it can be used to estimate savings or define additional data collection procedures.
- Step Three – Validation and Site Visits. Define the validation and calculation activities.
- Step Four – Data Analysis. Define the analysis methods and tools and develop the final savings estimates.

Step 1 - Project Information Tracking/Gathering Use

Project information is collected by the implementation team and entered into the Commercial Tracking System (CTS). The data in the tracking system is the starting place for reviewing existing projects and identifying appropriate contacts to gather additional energy performance data. From the CTS data, we developed a list of potential completed projects. Since most commercial new construction projects take a minimum of 18 months to reach this stage, we were largely limited to projects the contractors worked on prior to 2006. We pursued projects that we thought would have documented energy savings and would be complete enough for us to visit and verify savings estimates. This entire process ultimately led to ten documented projects, which we were able to visit by early October 2007. The ten projects (and the resulting savings) are summarized in Figure 2 at the end of this section. Ten was deemed to provide sufficient diversity to test the application of the protocol to real-life situations while maintaining costs at a reasonable level. Additional information came from interviews with one or more of the following: NEEA staff, technical advisors, market specialists, business advisors, building owners, service providers and designers.

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[1] Indirect Influence projects are much less tied to specific Initiative activities. An approach has not yet been developed for Indirect Influence projects

Step 2 - Project Information Review

In reviewing projects we gained an understanding of the approach adopted for each project toward accomplishing the BetterBricks goals. Through file reviews and interviews we were able to identify specific measures, and to determine the likelihood that the measure was installed as proposed and was achieving the estimated savings. The types of measures applied in each building type are summarized in Table 3. They represent the initial step in gathering data that will eventually be used to create the representative bundles of measures.

Table 3. Summary of Measures

Bldg Type	Refrigeration/HVAC	Lighting/Daylighting
Grocery	Upgraded Refrigeration Controls	Skylights
	Upgraded HVAC Controls	Lighting controls
	Upgraded Refrigeration System	
	Efficient Rooftop Units	
	Efficient Display Case Fan Motors	
	Domestic Water Heat Reclaim	
	Added Roof Insulation	
Office	High efficiency HVAC system	Natural lighting: skylights/sidelighting
	Underfloor ventilation system	Daylighting controls
	Night flush ventilation	High efficiency lighting
	Increased insulation	
	High efficiency windows with shading	
Classroom/ Office	High thermal mass	T-8 lamps with high efficiency ballasts
	Energy management system	Direct/Indirect suspended fixtures
	ERV's controlled by occupancy sensors	Automated window shades
	Manually operated classroom louvers	Occupancy sensors
	Groundsource heat pump	Daylighting: sidelighting/clerestories
	Heat recovery through ERV's	Daylighting controls
	High efficiency glazing	Skylights (w/ operable blinds)
		Exterior and interior light shelves
Office/Whse	High efficiency glazing	Daylight Controls
		Skylights

We initially expected that BetterBricks staff and contractors would have relatively easy access to the project documentation of recommended energy savings strategies and measures, and the initial estimate of energy savings. This expectation turned out not to be true in many cases leading to additional effort to collect the documentation before going on-site, resulting in delays. In some instances where the original energy savings reports did not exist or no energy simulation analysis was conducted to predict energy savings, we needed to collect supporting data such as 'as-designed' and 'as-built' plans and equipment specification sheets before and after the site visits in order to develop the energy savings analysis. While we were able to eventually gather enough documentation to complete our analysis, this is not a sustainable procedure for the longer-term evaluation effort because of the high cost.

Step 3 - Validation/Site Visit

In this first phase of protocol testing, we conducted on-site surveys of all ten sites to confirm information from CTS and other documentation. Prior to the site visit we reviewed the project files, to identify the recommended measures and to identify the original analysis approach. From a protocol perspective this approach is too labor-intensive to be sustainable. However, the detailed data collection and verification at this stage allows us to fully understand the BetterBricks initiative process, which will ultimately lead us to a less labor-intensive approach. On-site data collection included:

- Equipment and building characteristics surveys
- Interviews with building operators
- Installation of data loggers for end-use metering

We used the survey and interviews to understand how the building is structured and to identify energy efficiency components including characteristics, services, practices, etc. We made use of existing energy management system (EMS) or other metered data to the extent possible. We reviewed existing monitored energy performance data as available to verify and update the energy savings estimates. For a majority of the projects, existing monitored energy usage data was not available, so we installed our own data logging equipment to monitor the HVAC, lighting and/or ventilation systems. The intent of the data monitoring is to develop operational schedules for these systems as well as gather as-operated energy use data on these systems.

Step 4 - Data Analysis

To estimate actual energy savings we used a direct, engineering-based approach based on specific measures. The intent was to provide an estimate of the energy savings due to the 'as-built' (construction specs) or 'as-operated' (schedules, manual operation or overrides) conditions and compare these against the original savings estimates or relevant baselines.

For six (6) of the ten (10) buildings we analyzed in this round, we were successful in getting copies of the original energy simulation input and output files for both the building 'as-designed' as well as the 'code-base' building. For these six projects, we updated the models to reflect the 'as-built' or 'as-operated' conditions based on the data collected from the file review and the site visit, or supplied later by the project contact. Thus we conducted our analysis following the original estimation approach described in the available documentation and energy models.

For the remaining four buildings, we had to develop an energy simulation model from scratch. For these buildings, we followed a similar approach of using energy simulation analysis to predict 'as-built' or 'as-operated' savings. Since there was no original energy savings analysis report or energy model, we generated both the 'as-built' or 'as-operated' models as well as the ‘code-base’ model based on data collected through our site surveys, and follow-up data collection on ‘as-built’ and ‘as-operated’ conditions through architect interviews and plan reviews.

Thus our final energy savings used the original approach (where available) with enhanced information from updated on-site data, monitored data and/or billing data. In future revisions, we may be able to make greater use of billing data or benchmarking data but it was more important here to validate project-specific data.

Figure 2 provides a summary of the projects, including building type, BetterBricks project type, location (state), building size, baseline energy use (kWh and therms) and energy savings (kWh and therms), both the original predicted energy savings and as-built or as operated energy savings.

Figure 2. Summary of Projects

				Baseline Energy Use		Original Prediction of Savings				Revised Onsite Savings			
Bldg Type	Project Type	State	Size (sf)	kWh/ sf/yr	therms/ sf/yr	kWh	kWh/sf	therm	therm/ sf	kWh	kWh/sf	therm	therm/ sf
Grocery	BOPS	OR	26,000	65.75	-	154,507	5.94						
Grocery	D&C	WA	22,800	44.89	1.23	295,765	12.97	18,915	0.83	129,429	5.68	(7,797)	(0.34)
Classroom/office	D&C	OR	113,199	12.05	0.22	606,860	5.36	-	-	609,980	5.39	(8,698)	(0.08)
Classroom/office	D&C	OR	21,141	8.41	0.44	100,300	4.74	6292	0.30	100,170	4.74	6,224	0.29
Classroom/office	D&C	ID	3,435	9.82	0.03	-	-	0	-	5,260	1.53	-	-
Office	D&C	WA	117,681	19.56	0.23	621,533	5.28	3082	0.03	696,700	5.92	5,116	0.04
Office	D&C	ID	1,664	9.76	0.01	2,740	1.65	0	-	6,220*	3.74	0	0.00
Office	D&C	ID	155,254	6.23	0.18	379,020	2.44	11850	0.08	345,420*	2.22	12,082	0.08
Office/Whse	D&C	ID	54,000	0.88	0.02	24,230	0.45	-445	(0.01)	32,780	0.61	(414)	(0.01)
Office/Whse	D&C	ID	108,000	0.82	0.01					31,600	0.29	(335)	(0.00)

* As operated conditions

Next Steps

By the end of 2008 we expect to have a good understanding of the specific strategies, actions taken and specific measures implemented by the BetterBricks initiative so that we can finalize the analysis approaches and data collection plans in the protocol, including:

- existing project-related data - validated data that doesn’t need to be re-measured
- existing project-related data - that may need to be verified or recalculated
- data from other evaluation teams
- market data from other studies
- new data requirements
- additional assumptions on energy savings, lacking specific data

This project is a long-term, on-going effort that will take several years to test and complete. There is no attempt at this stage to determine savings for BetterBricks overall and it would be inappropriate at this time to attempt to extrapolate the savings reported to any other projects. Future efforts will expand on what has been learned here and will develop more broadly applicable and automated energy savings estimates.

Lessons Learned

In all cases energy savings are presented as a percent of total building energy use by fuel type, electric or gas. Baseline unit energy consumption values are shown to provide a reference for the relative energy savings. The electric (kWh) energy use and savings are comprised primarily of the lighting, HVAC (cooling, fans and pumps) and refrigeration end-uses. The gas (therms) energy is comprised of space heating and water heating end-uses.

While broad conclusions cannot be drawn from the small sample of projects, the results show that:

- Energy savings are being achieved in these BetterBricks-influenced projects.
- The protocol approach is able to calculate actual energy savings.
- Electric energy savings tend to result in an increase in gas usage.
- There is a wide range of energy savings by project type and location (as anticipated).

We do not yet have enough data to identify common features by building type or NEEA influence. While we were moderately successful in selecting sites, conducting site visits and developing savings estimates, the process did not go completely as planned. The lessons learned are:

- The BetterBricks Commercial Tracking System (CTS) needs to be fully populated with critical data to make it useful to this process and make our approach cost-effective.
- Implementers need to collect required project data for this approach to be cost-effective.
- BetterBricks may need to be more involved in each project through completion to verify installed recommendations. Project owners will need to see a value in the BetterBricks involvement.
- Determination of building energy savings is dependent on the baseline definition and approach. NEEA will need to make a policy-level decision on how/which baselines should be used before our protocols can be finalized.

Further details of some of these issues are described below.

Program Data Tracking

For the protocol approach to work it is critical that project data are available in the tracking system. In practice, this turned out not to be true in many cases, leading to a time-consuming process of identifying and obtaining project documentation. If the tracking system is not consistently and fully populated with project data, the energy savings analysis approach requires more time for collecting and reviewing documentation than we initially anticipated. The end result is that significantly more money is spent for the additional evaluation time. While real time data entry is often delayed or ignored by most program implementation staff (not unique to NEEA), implementers have more knowledge of the projects and are thus better qualified to do the data entry. If data entry is not done on an on-going basis, as projects are designed and completed, then the cost of generating savings estimates will be higher and the quality slightly lower than originally assumed and may undermine the basis of the protocol.

Data Availability

Several of our assumptions regarding the availability of detailed project-specific energy analysis reports were wrong, primarily that they would be available at the start of the process.

For many projects, reports and detailed energy savings calculations were not readily available for our review prior to the site visits. Lack of up-front documentation resulted in additional efforts by the evaluation staff to collect alternate sources of information from project designers, engineers, consultants and owners. While the staff was able to collect all needed data, the time and effort involved in getting the information from these sources make it an inefficient strategy. The implementers need to play a greater role in collecting this documentation on an on-going basis and storing it for future use.

BetterBricks technical advisors state that it would be extremely difficult to require the project contacts (typically building owners) to provide documented energy savings even if they were given an incentive. In the current market structure, the majority of building owners do not see the benefit of this additional step, which they perceive as costing them time, even if they are not paying for the analysis. If BetterBricks needs documented energy savings (which they do for this protocol approach) it will probably have to provide a mechanism to encourage project owners to require it from their designers.

NEEA, through its BetterBricks initiative, has been extremely hesitant to require anything in return for the services being provided, services which have a very real value to both designers and owners. The project owner needs to see a value in the BetterBricks involvement. The initiative should consider what they require when providing their services. There is a good chance modest requirements would be accepted provided they are tightly defined and presented in advance. There is also a possibility that requiring some 'payment' will add to the perceived value of what the initiative is offering.

An alternative is for BetterBricks implementers to complete the analysis on their own (even if they don't provide the owners with the documentation) but this runs counter to the goals of the initiative. The key point is that if documented energy savings are not going to be routinely developed then the basis for our energy savings protocol disappears.

BetterBricks Implementation Challenges

BetterBricks staff and contractors also face challenges in knowing whether what they recommend is ultimately installed. Even with Direct Involvement projects, they are generally unaware of the ultimate influence or implementation of their recommendations. The problem is even more pronounced for Direct Influence projects, where their involvement is limited to informal meetings or training. There is also no way of knowing whether their recommendations have influenced other projects.

The challenges faced by the Building Operations component of BetterBricks are even greater. Building Operations relies on service provider partners to promote, support and implement the Initiative. The service provider influence points are limited by the access and time given them by the building owners and operators and they need to be cognizant of the customers needs. Because of this business relationship, the service providers will always defer to the requests of the clients at the expense of BetterBricks requests. The issue of energy savings documentation is a good example. The NEEA logic model states that customers will be willing to pay for the additional documentation because it validates the proposed energy savings. In reality, the customers often do not feel the documentation is worth the additional time and expense, and therefore do not want the service. In the interest of customer service, the service provider will follow the customers' request and provide recommendations without providing detailed energy savings documentation.

Persistence of Savings

The protocols calculate savings at a specific point in time which may not always represent an ideal, average, "steady-state" operation. Building consumption, and therefore savings, can shift over time for reasons connected to persistence, commissioning and normal variation in consumption over time due to changing number of occupants, building use, etc. There is no single correct solution to this problem but the protocol needs to use a consistent way/time to measure energy use and estimate saving. The protocol will ultimately have to detail an approach for identifying and defining steady-state, or we will have to develop a strategy for addressing non-steady-state conditions.