Commercial Sector Initiative: Schools Target Market

Market Progress Evaluation Report
Executive Summary

prepared by

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Evaluation of the Northwest Energy Efficiency Alliance's Commercial Sector Initiative: Schools Target Market

Evaluation of Program and
Analysis of Opportunities and Barriers
Final Report

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EXECUTIVE SUMMARY

In January 2003, the Alliance Board approved a one-year, $260,000 budget for a New Schools Target Market effort under the Commercial Sector Initiative (CSI). While CSI supports the entire commercial sector, three "target markets," including schools, received additional, dedicated funding for the development of more targeted market transformation strategies. This report evaluates the success of the resulting effort and makes recommendations for next steps.

The relatively small budget (compared to the other two designated target markets, hospitals and grocery stores) reflected the limited role desired by the Board in the schools market. The major difference between the schools and other target market budgets was that no dedicated outreach effort was included for schools. Also, staff members, as opposed to contractors, played a much larger role in implementation than is typical for the Alliance.

Activities were targeted at state agencies, school district officials, and school architects and engineers in the four Northwest states. After an initial assessment, the Alliance's work in the new schools target market for this time period was focused on three specific initiatives:

1. Facilitating the development of the Washington Sustainable Schools Protocol
2. Providing design guidance and quantitative energy modeling data for a new prototype school in Nampa, Idaho
3. Presentations at various workshops, roundtables and other presentations to introduce school district staff, utility staff, engineers, architects and other stakeholders to energy efficiency options and rationales for K-12 schools.

The evaluation, structured according to these three primary activities, had a number of broad goals:

- Develop an overall picture of the schools market and key players in the Northwest.
- Evaluate the perception of various participants about the success of the program activities, and describe how they perceive it might be more effective.
- Recommend potential improvements to the "high performance schools" element of the Commercial Sector Initiative
- Provide information and assessment to the Alliance Board so that they can make an informed decision about re-funding.

In support of these goals, the evaluation activities included 1) reviewing documentation surrounding the Alliance's activities in the new schools target market; 2) interviewing Alliance staff, contractors and partners who had worked in the new schools target market; 3) interviewing school district decision-makers, architects, engineers and others who had taken part in Alliance-funded activities in the new schools target market; 4) conducting technical reviews of the

Alliance's Cost Effectiveness (ACE) model and the energy saving potential of the Washington Sustainable Schools Protocol.

1.1 Washington Sustainable Schools Protocol

In Washington, unlike the other three NW states, there is a state-wide agency, the Office of the Superintendent of Public Instruction (OSPI), which plays a major role in school construction decisions. In the spring of 2003, OSPI secured $1.5M in the State Board of Education's capital budget for the development of a protocol, technical manual and support for five pilot projects to evaluate innovative and sustainable school construction practices. The Alliance, with the encouragement of OSPI and others, selected this opportunity as it's primary school market intervention for Washington state and helped spearhead the drive to develop voluntary green building criteria for Washington schools.

The Washington Sustainable Schools Protocol (WSSP) Committee was formed and charged with developing a locally appropriate protocol for high performance schools. The broad-based committee included state education officials, architects and engineers, utility program managers, and school district administrators. Several committee members had non-energy related aspects of school performance as their primary concerns, such as the learning environment, water conservation, or materials use. In this context, part of the Alliance's intention was to help strengthen the role of energy efficiency within the protocol.

The WSSP criteria were derived from California's "Collaborative for High Performance Schools" (CHPS) rating system, which in turn was originally derived from the US Green Buildings Council's Leadership in Energy and Environmental Design (LEED) system. The Alliance facilitated the meetings, and provided technical analysis and editorial services in support of the committee's work.

In order to assess the effectiveness of the Alliance's effort, we interviewed members of the Committee in summer 2004 and asked about the Protocol and the process as it related directly to the Alliance participation.

How applicable is the Protocol as a state-wide design tool and what factors might prevent the protocol from becoming widely used?

A number of interviewees stressed that the Protocol had specifically been designed to maximize its ease of use and widespread applicability. The WSSP advisory committee had an explicit intention to keep the costs of compliance low, especially the cost of documentation. At the time the interviews were conducted in the summer of 2004, several committee members mentioned favoring inclusion of a prescriptive approach as an alternative to performance-based compliance because prescriptive measures do not require expensive energy modeling as proof of compliance. However, in follow-up research conducted in February 2005 it was found that (1) all of the five pilot projects had opted for the performance rather than prescriptive path and (2) in February 2005, the advisory committee voted to recommend dropping the prescriptive approach.

Do you think that following the Protocol will actually save energy compared to the Washington State Energy Code or compared to typical schools new construction practice?

The Protocol's performance path requires schools to exceed Washington State Energy Code by 10% to 50% . While this requirement suggests an improvement over the code, few of the committee members interviewed in summer 2004 believed the savings would actually be achieved in practice. The main reason given for this was that the Washington Code itself is already quite stringent; therefore, it was unlikely that schools would be able to exceed it by a wide margin.

Consistent with the belief that few schools would use the performance approach, interviewees stated their feeling that the prescriptive approach, which targets a 10% improvement in whole building efficiency above code, was more likely to be implemented. However, some critics believed that the prescriptive measures could be easily "gamed" to avoid increasing overall building efficiency above code minimums. A technical analysis by HMG (described in Section 4) confirmed this possibility.

Initial experience in the pilot project suggests that the interviewees were incorrect since all five schools that participated used the performance path. Furthermore, a January 2005 report on the pilot project shows possible energy savings of 25-30% in at least three of the five schools[1]. The report stresses, however, that these estimates are based on theoretical studies (software modeling, calculations, etc.) rather than installed systems. It remains to be seen whether the systems analyzed in the report will be used in the constructed/remodeled buildings and what actual energy savings are achieved.

Has the Alliance's activity been effective? What else could the Alliance be doing?

All of the interviewees who expressed a view said that they thought that the Alliance and its subcontractors did an excellent job of facilitating the committee's work and maintaining momentum and focus. The Alliance's support was deemed essential to meeting the project timeline. None of the interviewees thought that there was anything different that the Alliance should have done, or should do next to support sustainable schools in Washington. They believed that the process of developing the Protocol and encouraging sustainable schools should wait on the results of the pilot projects. One interviewee said that the Alliance should continue to "be out there, to be a voice" to convince school districts that sustainability is a mainstream concern and not a risky venture. A common theme of comments was that a long term presence is essential for influence in the schools market.

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[1] The report is currently available at http://www.obrienandco.com/. It is supposed to be permanently available at the Washington Office of Superintendent of Instruction website (http://www.k12.wa.us/SchFacilities/SustainableSchools.aspx) starting in late March 2005.

1.2 Idaho Schools Prototype

In Idaho, it was determined that almost all decision-making about school design is made at the local, district level. Districts are highly constrained in their construction budgets, and tend to build very inexpensive school buildings, repeating the same prototype many times. Thus, the Alliance team chose to focus on one or two districts where they might be able to influence a change in the local prototype design. The hope was that a successful experience would subsequently spread to other districts.

A series of events were held in Idaho to promote high performance schools. A workshop was held in Boise to discuss the concepts involved in high performance schools among a wide audience of stakeholders. The Nampa School District agreed to allow Alliance-sponsored energy consultants to work with their design team on a new school design. Two follow-up meetings were held (one in Boise, one in Pocatello) to allow further discussion, and to allow the design team from Nampa to discuss the process and present the results of their work. The discussions resulted in the identification of a number of overlapping themes about how to best develop support for high performance schools in Idaho.

The Nampa design team was presented with a number of energy efficiency recommendations, based on cost/benefit analysis that could be used to improve the energy performance of their basic school design. Ultimately, a small portion of these measures were adopted into the final design. In addition to the specific design advice, members of the Nampa School District design team felt that the process that the Alliance had facilitated (discussions about energy efficient design options) was in itself useful, and would lead to Nampa making better and more informed decisions about energy efficiency in the future.

The evaluation interviews asked whether the Alliance's peer-to-peer (between superintendents) model for disseminating information about high performance schools was (or would) work effectively and if there was anything else could the Alliance could be doing to promote high performance schools.

Almost without exception, interviewees believed that superintendents are the key decision makers in new school construction, and that they should be the primary target for market transformation activities. Almost every interviewee told us that early involvement in the school construction process is crucial to success: not just in the design process, but as importantly in the budgeting and programming process. Most of the suggestions revolved around supporting materials that the Alliance could provide to help make the case for why a district should commit to building high performance schools.

Thus, there was strong support for this approach in theory. However, there was little evidence that the approach had actually been implemented during the period studied. While materials were pulled together to support outreach to districts, there was little actual outreach done outside of the Alliance-sponsored Idaho events during the time period studied. There were many missed opportunities to interface with school superintendents, and many other opportunities identified where the Alliance could provide useful information and support in the future. At the end of the time period studied, the two staff most involved in the school program were no longer employed by the Alliance, thus further outreach opportunities were not being pursued.

1.3 Recommendations & Other Opportunities

- The Alliance should continue to support the WSSP, and look for opportunities to engage other programs already underway, such as the Washington Department of Health IAQ initiative. The Alliance and its contractors should continue to push for more stringent energy efficiency measures in any revised WSSP, and undertake efforts to raise the stature of WSSP within the schools construction community.
- The Alliance should also collaborate with the Oregon Department of Energy (ODOE) to create Oregon-specific school designs. Staff at ODOE believes that their LEED-based program for new construction is effective, although we did not attempt to verify this since ODOE's programs are outside the scope of this evaluation.
- We recommend that the Alliance continue to interface with the targeted Idaho school districts and their design teams and publicize efforts to introduce more energy efficiency measures into school design. The Alliance is generally respected for the quality of its outreach material and technical advisors, and there were many suggestions that additional technical support would be welcomed, especially in Oregon and Idaho.
- We also recommend that the Alliance support direct outreach to school superintendents in the four states. The Alliance could attend the local, state and regional school board and superintendent conferences and speak directly to them about energy efficiency and "high performance" or "sustainable" schools.
- It would be beneficial for the Alliance to identify key conferences and events that should be targeted per year, and get speakers lined up to present at these events. Whenever possible, the Alliance should support the creation and publishing of case studies and back-up materials that provide the "credible evidence" requested by architects and superintendents. These could form the basis for articles placed in journals and newsletters read by superintendents. Finalizing any such analysis or case studies into permanent, published materials will help reinforce the presence of the program beyond one-time speaking engagements and "events".

1. INTRODUCTION

This report describes an evaluation of the Northwest Energy Efficiency Alliance (Alliance)'s work in the New Schools Target Market. The Alliance's work in the new schools target market through summer 2004 was focused in three main areas:

- Facilitating the development of the Washington Sustainable Schools Protocol
- Providing design guidance and quantitative energy modeling data for a new prototype school in Nampa, Idaho
- Using various workshops, roundtables and other presentations to introduce school district staff, utility staff, engineers, architects and other stakeholders to the concept of high performance schools.

The activities undertaken by the Alliance and its contractors in these three areas are described in Section 2.

The New Schools Target Market is a component of the Commercial Sector Initiative (CSI) that comprises all commercial sector activities for the Alliance. This includes over forty separate elements spread across three broad categories: Product & Service Development, Support Services for Targeted Markets, and Codes and Standards.

While CSI supports the entire commercial sector, three "target markets" under the Support Services for Targeted Markets category received additional, dedicated funding for the development of more targeted market transformation strategies: schools (new construction and major renovations), hospitals (new and existing), and groceries (new and existing). These target markets were chosen through extensive research and a ranking approach that applied the following criteria to select those with the most potential for market transformation.

- Market interest/readiness – the speed with which market transformation might be achieved, motivation of market actors, already available support tools, etc.
- Market leverage – decision making concentration, degree of market competitiveness
- Market package – the likely effectiveness of marketing messages given existing business practices
- Market size – savings potential now and over time
- Spillover potential – influence in other markets
- Geographic spread within the Pacific Northwest
- Current efforts – alignment with Northwest utilities activities, current work of the Alliance, and nationally-based efforts in the market

The Board approved $260,000 for new schools for the period 2003-2004. In practice, this funding is augmented substantially through the availability of the

BetterBricks technical support services (Seattle Lighting Design Lab, BetterBricks Daylighting Labs, BetterBricks Advisors) which provide approximately half their services to the three target markets but are funded separately within CSI. BetterBricks is the name used for all of the Alliance commercial sector technical support and training services. Detailed information on these services and BetterBricks is available at www.betterbricks.com. A timeline of events and Alliance activities in the schools target market is provided in Appendix A.

This New Schools Target Market evaluation is structured according to the three primary activities listed above. The evaluation has a number of broad goals:

- Develop an overall picture of the schools market.
- Evaluate the perception of key players in the new schools construction market of the Commercial Sector Initiative (CSI) , and describe how they perceive CSI could be most effective.
- Review the applicability and validity of the logic model for the new schools construction market in each of the four states.
- Use the results of the evaluation to suggest improvements to the "high performance schools" element of the Commercial Sector Initiative
- Provide information and assessment to the Board so that they can make an informed decision about re-funding.

The findings, conclusions and recommendations are intended to address the five evaluation goals listed above. The work toward these goals included a number of specific evaluation activities, including:

- A review of the documentation surrounding the Alliance's activities in the new schools target market
- Interviews with Alliance staff, contractors and partners who had worked in the new schools target market, to construct a history of the Alliance's activities
- Interviews with school district decision-makers, architects, engineers and others who had taken part in Alliance-funded activities in the new schools target market, to gather both facts and opinions about the Alliance's work.
- A review of interview transcripts to produce a detailed picture of the Alliance's work, and an overview of responses among target groups.
- A technical review of the energy saving potential of the Washington Sustainable Schools Protocol.
- A technical review of the Alliance's Cost Effectiveness (ACE) model.
- In the light of this information, a review of the logic model and progress indicators for the new schools target market. (The logic models are presented in Appendix H).

2. PROJECT HISTORY

2.1 Background

In January 2003, the Alliance Board approved a one-year, $260,000 budget for a New Schools Target Market effort under the Commercial Sector Initiative. The relatively small budget (compared to the other two target markets) reflects the limited role desired by the Board in this market. The major difference between the schools and other target market budgets was that no dedicated outreach staff was included for schools. In light of this, program goals were set to promote rating systems, guidelines and prototypes, rather than count specific district adoptions or implementation. Also, staff played a much larger role in implementation than is typical for the Alliance.

Activities were targeted at school district construction planners, managers, and decision-makers and school architects and engineers. In Washington, the Office of the Superintendent of Public Instruction (OSPI) also plays a major role in school construction decisions. The Alliance's work so far has focused on the following key elements:

- Facilitate development of a model high energy efficiency standard for new schools that is tailored to the two climate zones, codes and regulatory conditions, and funding processes in Washington.
- Work through existing channels (especially the Council of Educational Facility Planners), state agencies involved with school construction, and the top one to three high growth school districts per state to obtain formal adoption of high energy efficiency standards by school districts.
- Support high performance school design and implementation capability of leading A/E firms via the Alliance-sponsored Design Labs and the BetterBricks advisors. This effort focused on a limited number of influential players.
- Work with state-specific leverage points, where appropriate, to adopt high energy efficiency standards, in particular state agencies charged with overseeing school construction and providing financial/technical assistance.

These elements were applied in different ways, in different orders and at different rates within each of the four Northwest states because each state has a unique way in which it funds and constructs new schools. To date almost all Alliance efforts have been in Washington and Idaho because of opportunities that arose to develop and participate in important processes in those states. Activities were limited in Oregon, in deference to a state-sponsored program aimed at new school efficiency, and in Montana, due to very limited school construction.

Several months after the Board approval, a baseline study of the schools market was conducted by the Alliance[1]. The study concluded that:

- Those in the school district charged with working with architects and making decisions about the design of new schools are aware of the impact of building design on students and teachers in principle.
- School construction decision-makers are aware of many energy-efficient technologies, and say they will consider using them in new schools.
- Decision-makers believe that highly energy-efficient schools may not be cost effective, because:
  - Decision-makers believe they are prohibitively expensive to build.
  - Decision-makers are uncertain of whether energy-efficient schools really save substantial sums of money over time.
- Decision-makers say it's likely their district would adopt an energy-efficient building policy, especially if evidence of cost-effective examples were available to support their efforts.

In addition, the baseline study validated that the groups targeted by the program play the key roles in determining the energy efficiency characteristics of new schools. It also provided program implementers with a list of potential high-growth school districts throughout the Northwest.

The baseline study proposed that five types of progress indicators could be tracked among the target market of school decision-makers:

- Impact of building design
- Awareness and use of efficiency measures
- Design / construction costs
- Awareness of energy savings
- Willingness to adopt an energy-efficient building policy

Details of the proposed indicators, the baseline value for each indicator, and RIA's expectation of whether each indicator should be expected to increase or decrease as a consequence of program success are shown in Appendix B.

2.2 Project Activities

The first two sections below discuss activities conducted in individual states. The third section describes a separate activity aimed at developing new prototype buildings for schools.

[1] Commercial Sector Initiative Baseline Study: Schools, by Research Into Action, Inc. for the Northwest Energy Efficiency Alliance, May 2004. (The text of the summary conclusions has been changed slightly from the original for conciseness)

Washington: Support for the Development of the Washington Sustainable Schools Protocol (WSSP)

At the same time that the Alliance Board was considering funding the Schools Target Market effort, the Washington state legislature considered, but did not pass, a bill that would have required any new school in receipt of state funds to achieve a silver "LEED" (Leadership in Energy and Environmental Design) rating[1]. Opposition to this bill, led by school districts, arose mainly because of the high cost of LEED compliance and the required documentation for demonstrating compliance. Another reason why the bill was rejected was that the LEED standard was not specific to schools, and was not specific to Washington's climatic conditions. In addition, school districts had reviewed the voluntary Collaborative for High Performance Schools (CHPS) program and found it far superior to LEED.

In the spring of 2003, the Washington State Office of Superintendent of Public Instruction (OSPI), which provides some level of state funding to more than three-quarters of the new school construction projects in the state, subsequently pursued a more limited agenda in the legislature and successfully secured $1.5M in the State Board of Education's capital budget for the development of a technical manual and for five pilot projects to evaluate innovative and sustainable school construction practices.

The Alliance was aware of the pilot bill and, with the encouragement of OSPI and others, spearheaded a drive to develop voluntary green building criteria for Washington schools. The Alliance was urged to proceed with this effort by member utility commercial program managers and a collaborative effort was subsequently established. The Alliance asked the Council of Educational Facility Planners (CEFPI), an organization consisting of most of the trades involved with schools planning and design, to convene an advisory committee which would be in charge of developing a protocol for high performance schools. The broad-based committee includes state education officials, including OSPI, school facility designers including architects and engineers, many of whom are Green Building Council members, utility program managers, school districts and school facility planners.

The Alliance hosted monthly meetings and hired consultants to advise the committee. The New Buildings Institute (NBI) was hired to conduct ongoing analysis, and to prepare the criteria guide and planning guide. O'Brien and Company were hired to facilitate the process and to edit protocol documents.

The criteria were modified from California's "Collaborative for High Performance Schools" (CHPS) rating system which in turn was originally derived from the US Green Buildings Council's Leadership in Energy and Environmental Design (LEED) system. The criteria were significantly revised, intending to reflect

[1] LEED is a trademark of the US Green Building Council, which writes and maintains the LEED protocols. The LEED protocols are a means of rating the environmental impact of a building. Applications for LEED accreditation must be submitted by a LEED accredited professional.

conditions in Washington state schools and to enhance the energy portion of the criteria, per the approach taken by the Advanced Buildings Benchmark Criteria. The tool was adopted by the committee as the "Washington Sustainable Schools Protocol" (the Protocol).The pilot program was officially announced to school districts in June 2004 and over 30 submitted proposals. The five following districts were selected to participate:

- Bethel (3 existing elementary schools)
- Northshore (one new elementary school)
- Olympia (one middle school modernization and addition)
- Spokane (one new elementary school)
- Tacoma (one high school retrofit/modernization)

For the energy portion of the Protocol, both a prescriptive option and a performance option were available. All of the projects selected chose to employ the performance approach.

At the moment, all Alliance work in Washington schools is through the BetterBricks advisors. There are no special target market activities being conducted pending the results of the pilot.

Idaho Schools Prototype

At the start of the schools target market program, various BetterBricks contractors had been providing advice for Idaho schools on an ad hoc basis for two years, by sponsoring charrettes or design reviews of prototype school plans.

Introductions provided by the contractors and other Alliance partners led to the Alliance approaching two Idaho school districts – Nampa and Meridian – and offering assistance in the design of new school buildings they were planning to build. Meridian school district declined, but Nampa accepted. It was hoped that peer-to-peer transfer of information between school district superintendents and maintenance staff, based on one or two successful examples, would be the primary means of promoting the idea of high performance schools to more districts in Idaho.

In December 2003, the Nampa school district design team held a day-long meeting at the offices of CSHQA Architects, the project architects, to discuss energy efficient design options for the new schools. Several BetterBricks advisors attended the meeting. A large number of efficiency measures were discussed and the team agreed to include them as alternative design options, but many were subsequently dropped from the final design.

There was also a day-long workshop held on February 20, 2004, to review a prototype school design used by the Meridian school district. Prior to the meeting, BetterBricks Advisors were provided with various documents about the prototype. Enough design review and analysis was performed to comment on potential improvements. The school district ensured that district staff, architects and engineers that they regularly employed, and even a few contractors, were present at the meeting. Although BetterBricks suggested a number of ways to improve the prototype design, the conclusion of the school district was that their prototype was “efficient enough.”

The Alliance wanted to capitalize on the discussion and the experience gained in Nampa school district (as well as the Meridian school district even though the district did not implement any of the BetterBricks recommendations). To facilitate this spread of information, the Alliance sponsored three events in Idaho: the first was the Idaho High Performance Schools Workshop, which brought together a large, diverse group of stakeholders to discuss high performance school concepts; the second and third were roundtables to disseminate results from the first meeting along with discussion of contextual issues such as school lighting, the school bond process and additional issues related to high-performance from a superintendent’s perspective. One roundtable was held in Boise, and one in Pocatello. The number of attendees at these three events is shown in Figure 1.

		Number of Attendees*						
Date	**Event**	**School District Staff**	**Utility Staff**	**Better-Bricks Staff**	**Engr**	**Arch**	**Others**	**Total**
3/9/04	High Performance Schools Workshop (Boise)	8(5)	6(3)	9	23(19)	17(12)	7	70
5/26/04	Nampa Project Roundtable (Boise)	No itemized data available						26
7/28/04	Nampa Project Roundtable (Pocatello)	12(7)	1	0	1	9(5)	1	24
Total		20(12)	7(4)	9	24(20)	26(17)	8	120
* (the figure in parentheses shows the number of different organizations represented)								

Figure 1 – Breakdown of Attendees at Idaho Events

Idaho High Performance Schools Workshop

On March 9th, 2004, Rebuild Idaho hosted a one-day workshop facilitated by the Alliance. Invitations were sent out to six targeted K-12 districts (Nampa, Meridian, Boise, Jerome, Pocatello, and Coeur d’ Alene) and the architectural and engineering firms that they frequently work with in new school design. There were over 65 attendees including approximately 20 architects, 20 engineers, and eight school district representatives, along with school facilities managers.

The purpose of the meeting was to:

- Develop a group understanding of the benefits of high performance schools
- Explore various strategies for defining high performance schools
- Review current school construction in Idaho
- Identify resources available to assist in the construction of high performance schools
- Identify next steps for high performance schools in Idaho

Attendees discussed the best ways to integrate high performance school features into the design process, and to create permanent and widespread change in Idaho school building practices. The discussions resulted in the identification of a number of overlapping themes that were later researched to further develop understanding of high performance schools, including:

- Better-communicated goals and policies are needed from policy makers, school boards and administrators. These policy makers need to be given support and guidance to the high performance process.
- Consumer education for the community at large is needed so that the general public is more aware of the potential benefits of high performing schools.
- Adequate funding is a barrier.
- The design team needs an opportunity to communicate early in the design process, but will need additional fees to do so. Also, the low-bid process for design team selection doesn't work well and needs to be changed to reflect more of a qualification approach.
- The schools group focused on building and system performance. Key to this group was lower maintenance and operations costs.
- Building contractors should be asked to participate in future seminars to broaden communication and expectations among the owners, designer and trades.

(See Appendix C for more details provided in the workshop report.) The attendees agreed to hold a follow-up roundtable to discuss these in the light of expected further progress with the Nampa schools design.

Follow-up Roundtables

On May 26th 2004, a roundtable was held in Boise to follow up on the March 9, 2004 workshop. Another roundtable was held in Pocatello on July 28th. In both meetings, a group of panelists discussed, among other topics, their experiences with the Nampa School project in front of an audience of local architects and engineers, and representatives from the Idaho Power Company, the Idaho Energy Division, and the Alliance. The panelists discussed the merits of the design alternatives process and the energy efficiency options that were discussed during the design team meeting and subsequent workshop. The

Pocatello meeting also was attended by representatives of Idaho school districts and faculty of Boise State University.

Prior to this follow-up roundtable, it had become clear that the recommendations made by the BetterBricks design team were not going to be adopted in the final design of the Nampa school, so the roundtable was formatted as an open discussion of the design team's communication process and the issues encountered in the effort to provide cost-efficient high performance features.

Pooling the experience of all those involved in not only the design of the new Nampa schools, but the policy making and construction phases of the project, three key strategies emerged which were documented in a report (See Appendix C for more details).

1. *Educate the decision makers such as district superintendents and school boards of the complete cost/benefit picture so that there is support for adequate budgets to make high performance schools achievable.*

2. *Continue to provide technical assistance to districts to assist them in the implementation of the integrated design process, bringing together the full construction team including architects and engineers, contractors, subs and other key stakeholders.*

3. *Market both potential and documented success and benefits of high performance schools to the community.*

Development of Prototype High Performance Classroom

In the course of planning and implementing the schools project, it became clear that a major barrier to districts and architects adopting more efficient school designs was a lack of clear alternatives. To alleviate this situation, two project teams were formed to investigate high performance classroom prototypes; one team worked on incremental improvements to existing school designs, and one worked on a radically different design.

Design development for the first project was carried out by Ecotope and for the second project by the University of Oregon Energy Studies in Buildings Laboratory (ESBL), BOORA Architects, and SOLARC Architects and Engineers in conjunction with the Portland Daylighting Lab. Both projects were overseen by BetterBricks contractor Jeff Cole. Ecotope has produced a final report and the ESBL report is expected in spring 2005.

At the request of the Alliance, Ecotope provided an analysis of three energy efficiency options to improve upon the basic elementary school classroom wing prototype. The three specific attributes were: energy efficiency, daylighting and ventilation.

The purpose of Ecotope's analysis was to identify the merits of each option in terms of energy savings, and to use the analysis to help justify the incremental cost of design improvements in future design projects. The building description and characteristics closely followed the typical Nampa school district elementary school classroom. The analysis worked within the typical building description to incrementally improve the energy performance of the structure. DOE2.2 simulations were used to predict the energy savings from the design options relative to the base case. The ventilation system was modeled as a heat recovery ventilator. The energy costs and savings from the Ecotope report are provided in Figure 2. Based on these results, the Ecotope report makes the following conclusions:

- The energy savings and cost effective integration of the energy recovery ventilator (ERV) argue for greater promotion of heat recovery ventilation in schools.
- In terms of electrical energy savings, daylighting does a very good job. However, due to the heating dominated nature of schools in Idaho, the savings in electricity are offset by an increase in gas use and costs.

	Electric (kWh)			**Gas (therms)**	**Total Utility Bills (savings)**
Option	**Total**	**Lighting**	**Fan/Cool**		
Heat Recovery (HR)	-406	0	-406	307	$220
HR w/ Daylighting	1,304	1,281	23	-48	$ 28

Figure 2 – Ecotope Idaho Prototype Options Savings per Classroom

The second approach considered an integrated classroom design based around passive features such as thermal mass, night cooling and moveable insulation. The ESBL team looked at what comfort criteria have been used by school designers in different countries, and used these to develop target values for temperature, humidity, ventilation rates and daylight factors. The team then attempted to design a school to achieve these targets passively, and only added mechanical and electrical systems as backup during those times when the passive systems could not maintain comfortable conditions. Mechanical systems, when used, utilized heat recovery only, and did not include mechanical cooling.

It appears that the daylighting features of the prototype design have been incorporated into at least one new building – Mount Angel Seminary in St, Benedict, Oregon. This building includes skylights with operable louvers, windows with external shading, and electric light fixtures designed to complement the distribution of daylight from a central pyramidal skylight.

The current design is intended for schools built west of the Cascades. Further development work would be required to adapt the design to climates east of the Cascades, but this is not within the current scope of work. The design team has been looking for a school district that might be willing to use the prototype high performance classroom.

Though final construction costs have not been calculated, the ESBL team believes that the prototype classroom will be no more expensive than typical classrooms in Oregon and Washington, although it is likely to cost more than schools in Idaho and Montana. Modeling-based calculations produced savings estimates of 65-80% over baseline classrooms.

3. PROCESS EVALUATION ACTIVITIES (INTERVIEWS WITH PARTICIPANTS)

Valuable perspectives on the Alliance's work in the new schools target market, as well as additional factual information and ideas for future development were obtained from interviews both with participants and non-participants familiar with the Alliance's work or with the new schools market. The methodology we used to select interviewees and to conduct the interviews is described below, followed by a summary of the interview findings.

3.1 Methodology

Telephone interviews were conducted by HMG staff from July to September 2004. The interviewees represented four groups (detailed in the sections below) that had worked with the Alliance in the new schools target market, had been the recipients of advice, or had attended meetings organized by the Alliance. In addition, a few interviewees had not had any interaction with the Alliance but were identified as important actors in the new schools market.

Interviews followed one of a few standard interview guides (see Appendix D) and typically lasted from 15 to 40 minutes. The interview guides were used to ensure that we asked each interviewee certain key questions. However, the flow of the interview was based on the issues of most interest to the interviewee. Often, additional questions were asked to find specific pieces of factual information which are reported in the market actor summary or project history. In every interview, we asked the interviewee whether they could recommend anyone else for us to contact.

Washington Sustainable Schools Protocol Advisory Committee

We interviewed the primary authors of the Washington Sustainable Schools Protocol and the Committee members to assess the role played by the Alliance, its contractor and subcontractors in developing the protocol, and to determine whether the contributors were satisfied with the Protocol, and the reasons for their satisfaction or dissatisfaction. We interviewed representatives of the New Buildings Institute, O'Brien and Company, and Charles Eley and Associates, the Alliance's contractor and subcontractors.

We attempted to contact at least one representative from every organization represented in the Washington Sustainable Schools Protocol Advisory Committee, and eventually interviewed 12 of the 23 committee members.

Design Team for New Schools in Nampa, Idaho

We interviewed the design team and school district staff to assess the support services provided by the Alliance specifically in connection with the CSI New

Schools Target Market effort, as distinct from the regular services provided by the Alliance via the BetterBricks advisors.

We interviewed ten people including the architect, contractor, construction manager, mechanical engineer, BetterBricks advisor, energy analyst, school district operations manager and school district construction manager. We also spoke to two architects and one other district operations manager to ask which features of the Nampa project could be applied in other projects in the state, and to understand how a new prototype high performance school in Idaho might influence the direction of that construction market.

Attendees of Workshops and Roundtable Meetings in Idaho

As described previously, a workshop was held in Boise to discuss the concepts involved in high performance schools among a wide audience of stakeholders. Two follow-up meetings were held (one in Boise, one in Pocatello) to allow further discussion, and to allow the design team from Nampa to discuss the process and present the results of their work.

We obtained lists of attendees from Ken Baker, the Alliance subcontractor who organized the meetings. He did not have a list of attendees for the Boise roundtable, so we were not able to contact attendees at that meeting. The numbers of attendees at each meeting, and the number interviewed for this report, are shown in Figure 3.

Date	Event	Number of attendees	Number relevant to the evaluation*	Number interviewed
3/9/04	Boise High Performance Schools Workshop	70	44	7
5/26/04	Boise Nampa Project Roundtable	26	unknown	0
7/28/04	Pocatello Nampa Project Roundtable	24	23	4
* "Relevant" refers to people that the Alliance was trying to reach with information about high performance schools, i.e., school district staff and designers. Some of the attendees were energy efficiency advocates, Alliance staff, and others who were not the target audience.				

Figure 3 – Idaho workshop and roundtables: number of attendees and number of interviewees

Other Market Actors

We contacted other market actors to get a more complete picture of school construction in the Northwest and to determine whether any other obvious opportunities exist for the Alliance to leverage programs run by others.

From our knowledge of energy efficiency organizations and other stakeholders in the Northwest, and following advice from Alliance staff, we compiled a list of market actors. Many of our interviewees also provided us with additional contacts for other individuals who were involved in the process. For example, we followed up on the work of school bond consultants after talking to the Idaho Energy Division, and contacted educational organizations recommended by energy advocates who had previously worked collaboratively with them. These interviewees included state energy agencies, utilities, Rebuild America, BetterBricks advisors, state departments of education, school construction consultants and education organizations.

Breakdown of Interviewees

The final breakdown of the role and location of the 53 interviewees is shown in Figure 4. The high number of interviewees from Idaho reflects that fact that the Alliance undertook two different activities in that state (the design of the new Nampa schools, and the roundtable meetings) which provided us with very specific participant lists. The two interviewees from outside the Northwest are consultants to the Washington Sustainable Schools Protocol. The category “government” includes state energy agencies, state Departments of Education, and the offices of State Superintendents (including OSPI and DGS in Washington). “Alliance staff” includes both program managers and BetterBricks advisors. Approximately three quarters of the interviewees had been directly involved with the Alliance’s work in the new schools target market.

	Washington	Oregon	Idaho	Montana	Outside the NW
Architects and Engineers	5	1	10	1	
School District Staff			3		
Government	3	3	3	2	1
Utilities	3	2	2	3	
Alliance	4	1	1		
Other	2		2		1
Total	17	7	21	6	2

Figure 4 – Breakdown of the role and location of interviewees

3.2 Summary of Interview Responses

This section assembles the answers given by each of the respondents into a series of compiled answers. In the text, we indicate roughly how many people expressed each particular view, and their roles. Where possible, we have quoted directly from the record of each interview.

Questions Regarding the Alliance Approach to High Performance Schools

The following questions were asked of all interviewees.

1. *Do you think that the Alliance's peer-to-peer (between superintendents) model for disseminating information about high performance schools will work effectively?*

Almost without exception, interviewees believed that superintendents are the key decision makers in new school construction, and that they should be the primary target for market transformation activities. Interviewees (including superintendents) also said that school district superintendents are a skeptical audience, and take advice most readily when it's given by their peers (several non-superintendents had had first hand experience of this). For this reason, those same interviewees agreed that the "peer-to-peer" (i.e., from one superintendent to another) model for disseminating information would be necessary for widespread adoption of more energy-efficient practices.

Furthermore, superintendents are very effective at communicating amongst one another, so if a core of superintendents with positive experiences of high performance schools can be established; it seems likely that the peer-to-peer transfer of information will be highly effective. Many interviewees (not just school district staff) said that superintendents hold frequent conferences and workshops to exchange experiences and information, and that these forums could be very effective in encouraging the adoption of high performance school construction.

One superintendent who had been involved with the Nampa school projects said that the peer-to-peer roundtables organized by the Alliance were an effective way to spread word of the benefits of high performance schools to other districts.

As part of this question, we also probed to see what other methods are used (or could be used) to disseminate information.

Several architects said that they have close relationships with particular school districts, which provide a conduit through which the benefits of high performance schools could also be conveyed. Where these close relationships exist, the architects suggested that they are in a good position to influence school designs and perhaps school budgets at an early stage. These close contacts between the architect and the school district exist only when a particular district is procuring new buildings frequently.

To investigate what opportunities these architects might have to influence the process, we asked what kind of work the architect does for the school district at the very beginning of a project. Architects are commonly asked to prepare a rendering of the proposed school at the outset of a project, as an aid to convincing school district staff, school board members and the local population that a new school is desirable. At this stage, the design is already somewhat developed, and can include specific energy efficiency measures, but the budget has not yet been negotiated. The architects we spoke to believe that they could exert a positive influence over the project at this stage if they had quantitative analyses of energy savings, costs and payback periods.

In addition to peer-to-peer transfer, one interviewee from the Oregon Department of Energy (ODOE) believed that the important factor is the long-term continuity of involvement with school districts, rather than the specific mechanism of communication with superintendents. The interviewee mentioned that ODOE had given a seminar on energy efficiency at a continuing education class for school administrators; in the five years following the seminar, three quarters of the attendees had eventually contacted ODOE for advice on energy efficiency.

2. *What further work should be done by the Alliance to support high performance schools?*

   Almost every interviewee told us that early involvement in the procurement process is crucial to success. They had various suggestions about how early involvement might be achieved. Most of the suggestions revolved around supporting materials that the Alliance could provide to help make the case for why a district should commit to building high performance schools.

   To support the peer-to-peer transfer of information among school district staff, most interviewees believed that the Alliance can play a useful role in disseminating factual information about high performance schools such as case studies, energy analyses and cost analyses. The Alliance's objectivity was cited by several respondents as a significant asset in conveying factual information to superintendents. One architect said that "school districts listen better when they hear [information about high performance schools] from [Alliance staff] than when they hear it from architects."

   One superintendent who had previously worked as a school bond consultant said that the Alliance should provide resources to help districts prepare "persuasive brochures" about the benefits of the proposed high performance schools, to convince parents and the public about their benefits, and to maximize the chances of passage of a bond that includes sufficient funding.

3. *Do any other opportunities exist, for instance, to leverage other local or regional programs?*

   Many respondents said that superintendents' professional organizations have a very vigorous program of annual conferences and monthly or quarterly workshops already in place, and that these represent the best opportunity to reach superintendents. These respondents, which included architects, energy agency staff and school superintendents, said that the Alliance could leverage these meetings to support the peer-to-peer transfer of information between school districts. Most said that Alliance staff has enough credibility to speak at these events, and one said that it's important to have a "champion", i.e. one or more superintendents who would corroborate the Alliance's message to their peers. One interviewee, an architect, said that conferences may be the *only* place to reach superintendents, since in his experience they are unwilling to travel to see mock-ups or to get other information about school construction.

   A respondent from the Oregon Department of Energy said that when ODOE becomes involved with a project, they have a scoping meeting with the district and design team to discuss what resources and incentives are available. Such meetings might be useful in Washington where there are several possible sources of state funding, and also in Idaho where the utilities are intending to start nonresidential new construction incentive programs.

4. *Are there any barriers that act against high performance schools?*

The capital and installation cost of energy efficiency measures was cited by almost every interviewee as being the biggest barrier to high performance schools. Especially in Idaho and Montana, school construction budgets are very tight, and the fixed budget constraints imposed by bond funding mean that energy efficiency measures are difficult to implement. Even if an energy efficiency measure has a short payback period, it may be impossible to fund the additional initial costs.

One architect mentioned that school districts often require very short payback periods of three to five years, in order to demonstrate that they are “responsible stewards” of public money. In Idaho and Montana there is no mechanism by which the state could require school districts to use longer payback periods, however the upcoming Idaho utility incentive programs may provide some assistance and alternatives.

The architects we spoke to had all carried out cost/benefit analyses on energy efficiency measures (mainly efficient HVAC and lighting systems) and had found that the additional cost was rarely justifiable within a three-year or five-year payback period, although in most cases the costs could be justified within the expected life of the equipment.

Several architects in Idaho said that their fee structures are a barrier against innovation. They work on a fixed fee that does not include any design development time. There is only enough money to carry out rudimentary design work and then develop construction drawings. Any additional design options must be done on the architect’s own time, so the architect has no incentive to produce innovative design features. One interviewee in Montana said that the problem of fee structures is particularly acute in that state because of the very limited budgets and the demand from school districts that their schools be unique in design, rather than being designed according to a template as is typically done in Idaho.

One interviewee from a utility said that the fee structure of mechanical engineers also presents a barrier to energy efficiency, since engineers’ fees are calculated as a percentage of the capital cost of the mechanical systems; this gives engineers an incentive to design large air conditioning systems, rather than to use strategies to reduce energy use such as natural ventilation.

Questions Regarding the Washington Sustainable Schools Protocol

These questions were asked of members of the Washington Sustainable Schools Protocol Advisory Committee.

1. *How applicable is the Protocol as a state-wide design tool?*

   Several interviewees described the efforts that the committee made to ensure that the Protocol would be equally appropriate wherever it was applied in the state. Schools need to achieve a total of 38 points within the Protocol in order to comply, so the Committee's intention was firstly to ensure that it would be possible for schools in all parts of the state to achieve the required number of points within a reasonable budget, and secondly that a given number of points would represent approximately the same energy performance irrespective of the location of the school. (An analysis of the energy impacts of the Protocol is provided in section 4.1.)

   One committee member said that the only way to prove the applicability of the Protocol is to wait until it has been used in schools throughout the state, and then look for feedback from designers and districts.

   In addition, we wanted to find out whether a variation on the Washington Sustainable School Protocol could successfully be used in other Northwest states, but the feeling among the interviewees was that there would be insufficient incentive for schools to adopt it without a state-sponsored program or mandate. One interviewee noted that states without a state architect (such as Oregon) would have no administrative structure within which to assess compliance with a protocol.

2. *What factors might prevent the protocol from becoming widely used?*

   The greatest barrier to adoption of high performance new construction is the increased first cost of the building, which was mentioned by almost every interviewee. The overwhelming view was that it would be very difficult to increase the available per-square-foot funding for new construction, and that consequently the protocol will only become widely used if compliance does not increase first cost, or if incentives are available to cover the incremental cost.

   A number of interviewees stressed that the Protocol had specifically been designed to maximize its ease of use and widespread applicability. The committee had an explicit intention to keep the costs of compliance low, especially the cost of documentation. Several committee members mentioned that the Protocol contains a list of prescriptive measures as an alternative to performance-based compliance, because prescriptive measures do not require expensive energy modeling as proof of compliance.

   Two committee members believed that, to encourage compliance, the minimum requirements of the Protocol had been made quite lax. One interviewee said that the "low" energy requirement would allow the protocol to integrate well with the existing requirements of the Washington Office of the Superintendent of Public Instruction (OSPI), which also do not mandate a high level of energy performance. He believed that OSPI wants to avoid the impression that it is enforcing unfunded mandates.

   One committee member from the Washington Department of General Services said that the Committee wanted to avoid the impression that it was "making policy", since school districts are sensitive about this, and might oppose adoption of the Protocol on these grounds alone.

3. *Do you think that following the Protocol will actually save energy compared to the Washington State Energy Code or compared to typical schools new construction practice?*

   While the Protocol's performance-based requirement to exceed the Washington State Energy Code (WSEC) by 10%-50% suggests that the Protocol clearly represents an improvement over the Washington Code, few committee members believe the savings will actually be achieved in practice.

   Furthermore, most interviewees who expressed an opinion also believed that the Washington Code itself is fairly stringent, and that school buildings do not commonly exceed it by a wide margin.

   Most of the committee members we interviewed believed that the Protocol does not represent a significant savings over the Washington State Energy Code, but they differed about whether this was a shortcoming. Some believed that since the Washington Code is quite stringent no major energy improvements are required, and that the concentration of the Protocol should be on sustainability and quality issues. On the other hand, two committee members said that they were "disappointed" with the energy criteria (i.e. that the criteria are too lenient).

   One interviewee (not a committee member) believed that the Protocol was a "waste of time" because it did not advance the cause of energy efficiency. He said that the prescriptive measures are "vague" and don't necessarily represent an improvement over the Washington State Code. He said that low threshold performance-based compliance made compliance too easy, because performance based models can be "fudged" (or manipulated) within that degree of error.

   The only evidence currently available is from the final report of the five pilot project that was prepared for the Washington legislature. (Note that this report was not available at the time the original evaluation research was conducted.) The report shows possible energy savings of 25-30% in at least three of the schools but notes that this is based on theoretical studies (software modeling, calculations, etc.) rather than installed systems due to the very short time (two month) between when the projects were selected and the cut-off date for data collection[1]. It remains to be seen whether the systems as analyzed will be used in the constructed/remodeled buildings and what the actual energy savings will be.

4. *How important do you consider the Alliance's main concerns (mandatory 4 energy points, 3 optional points for not providing a/c) to be, within the protocol?*

[1] The report is currently available at http://www.obrienandco.com/. It is supposed to be permanently available at the Washington Office of Superintendent of Instruction website (http://www.k12.wa.us/SchFacilities/SustainableSchools.aspx) starting in late March 2005.

The Washington Sustainable Schools Committee includes many representatives whose primary concern is not energy but some other aspect of school performance, such as the learning environment, or wider aspects of sustainability. In this context, part of the Alliance's intention was to argue in favor of energy efficiency concerns within the committee. To investigate the process of developing the final protocol, we asked committee members whether the Alliance did an effective job of arguing for greater energy efficiency.

One interviewee said that the initial proposal before the Committee was that the minimum requirements of the Protocol should exceed the WSEC requirements by 10%, but that some Committee members representing school boards had opposed that, and so the minimum was set as being equal to Code. Another interviewee explained that a large part of the discussion dealt with the concern that if a minimum (requirement) of 10% beyond Washington code were set, then it could exclude a district from participating at all.

Subsequently, the Alliance put forward a proposal that would make it mandatory that four of the 38 required points should come from the energy section of the Protocol, which effectively reinstated the initially-proposed minimum. As the proposal was accepted, it suggests that Alliance staff, while not perhaps effective in promoting energy efficiency within the committee, were at least able to avoid losing ground.

The Alliance also put forward a proposal that there should be three points available for making 90% of classrooms naturally ventilated (i.e., free of air conditioning). This proposal was accepted into the Protocol, and almost all of the interviewees said that this was a realistic and effective way of reducing energy use, although it would only be possible in schools west of the Cascades.

One committee member said that Joel Loveland had spoken to the committee and had proposed that daylighting be a mandatory measure in the Protocol, but that this proposal was dropped because of the complexity of the climatic considerations and cost implications. Another interviewee explained that the discussion was focused on the confusion of how to determine a 2% daylight factor. Many of the committee members wanted patterns or prototype examples of good daylighting as opposed to a "daylight factor".

5. *Regarding the Alliance's work so far:*

    i. *Which aspects have been useful? Which have not been useful? Are there activities that the Alliance should not have undertaken?*

All of the interviewees who expressed a view said that they thought that the Alliance and its subcontractors did an excellent job of organizing the committee and maintaining momentum and focus. Several said that this was particularly impressive given the diverse viewpoints, the short timeframe and the outside commitments of the committee members.

One energy analyst said that, in general, the Alliance and the committee acted on the contractors' findings, and to that extent the Alliance's contractors were well used by the committee.

None of the committee members interviewed felt that any of the Alliance's work had not been useful or that the Alliance had undertaken any inappropriate work.

ii. How would things have been different without the Alliance's involvement?

One interviewee said that without the Alliance's involvement the pilot schools would probably have been based on LEED, which is not specific to schools. The same interviewee said that the schedule for the pilot projects dictated that the Protocol had to be finished during 2004 so it could be used in the design process for those schools, and that the momentum provided by the Alliance's funding allowed that deadline to be met.

Another interviewee pointed out that LEED criterion for energy credits is based upon improvements to a code baseline, exactly the same as the protocol's performance based approach. He went on to note that the package of prescriptive measures, however, is designed to be school-specific.

6. *What else could the Alliance have done to support Sustainable Schools in Washington?*

None of the interviewees thought that there was anything else specific that the Alliance should have done, or should now do to support sustainable schools in Washington. They believed that the process of developing the Protocol and encouraging sustainable schools should wait on the results of the pilot projects. One interviewee said that the Alliance should continue to "be out there, to be a voice" to convince school districts that sustainability is a mainstream concern and not a risky venture.

7. *What are the next steps for the Protocol? Is it a finished product, or is it a work in progress? Is there need for additional support and/or funding to move to the next steps?*

Almost all the committee members said that the five OSPI-funded pilot schools were the next step for the Protocol. The Protocol will be referenced for the appropriate design aspects of the new construction and modernization projects and for subsequent monitoring to determine whether the measures were successful.

One committee member from the Washington Department of General Services (DGS) said that the DGS intends to recognize the Protocol as being equivalent to LEED Silver, which will make Protocol-compliant buildings eligible for a variety of state incentive payments. He continued that the DGS will have a "media blitz" to promote the Protocol following the completion of the five pilot schools. He suggested that the Protocol could be integrated into OSPI's mandatory "D-form" process which Washington districts have to go through to obtain funding for new schools.

Several interviewees also believed that there is a strong possibility that more funding will be provided by the legislature for pilot projects, especially since 24 applications were received from 21 school districts for the five pilot projects already announced. One interviewee said that one member of the Washington state legislature is a “champion” for future pilot studies.

One committee member expressed frustration because he believed that the Alliance has “no marketing budget“ to promote the Protocol. He hoped that the Alliance would spread information about the Protocol through its website and its newsletter, or by speaking at conferences.

Several interviewees said that there are outstanding unresolved issues within the Protocol; these include:

- Whether the Protocol should continue to allow districts to “self-certify”, or whether this approach will be abused.
- Whether the Protocol should allow for enhanced levels of compliance similar to the “silver”, “gold” and “platinum” levels in LEED
- Whether the current compliance level of 38 points is sufficiently high. Several interviewees said that the pilot studies should provide evidence for this.

8. *Are you pleased with the outcome? Has it gone forward the way you thought/hoped it would?*

All of the committee members expressed satisfaction with the final draft of the Protocol, although for different reasons. The non-energy specialists were generally pleased with everything in the Protocol; however, the energy specialists felt that the energy criteria in the protocol are too lenient, although they were pleased with the other aspects of the protocol. All the committee members who expressed a view said that they were happy with the way the Protocol addresses classroom quality issues such as air quality and daylighting.

One committee member from a state agency said that he was pleased with the Protocol because it has higher criteria for daylighting than LEED and CHPS, and that this is appropriate for schools because of the improvements in student performance that have been linked to daylight.

Comparison with Washington State Department of Health Indoor Air Quality Program

To determine whether approaches similar to the Alliance’s had worked in another area related to schools, we contacted the program manager for the Washington State Department of Health (DoH) Indoor Air Quality (IAQ) program. The DoH has been effective in changing school construction practices using an interesting intervention model that encourages a sustained relationship with school districts.

They do not give incentives, but they work closely with educational organizations to educate school district staff about air quality. The DoH also works with Washington’s three main schools insurance providers (including Puget Sound

ESD and Canfield) to inform schools that they can reduce their insurance premiums by 2-3%. This is the equivalent of working with utilities to inform schools that their electricity and gas bills could decrease if they build an energy efficient school.

The program manager said that DoH has focused on building long-term relationships of trust with school districts and that the relationships have borne fruit because those districts have become “self-policing” and they frequently consider IAQ issues. The advantages of this long-term continuity include:

- If previous advice turned out to be beneficial to the district, they’re likely to be less skeptical about current advice
- IAQ is addressed at the earliest possible stage in the design process, allowing the architect to make IAQ measures integral to the design and therefore more likely to be retained through to construction.
- Familiarity with IAQ issues means that the district is an “informed client” likely to be effective in addressing any problems or conflicts that arise during the construction process.

The program manager said that the DoH has developed an IAQ best practices manual for both new and existing buildings that has become a de facto standard even though there is no law requiring IAQ measures in Washington. He also said that the DoH takes advantage of the EPA’s “Tools for Schools” program to provide design assistance and training to architects.

Questions Regarding the Alliance’s Work with the Nampa Schools Design Team

These questions were asked of all the interviewees who had been involved in the design of the Nampa schools, or who had been involved in subsequent “roundtable” meetings to convey the experiences of the Nampa design process.

1. *Who advised on the energy performance of the school?*

The designers and school district staff on the Nampa project said that they had received energy and design advice from BetterBricks advisor Kevin Van Den Wymelenberg, and indirectly from Ecotope, which had provided an energy analysis of several design options that were being considered for Nampa’s Willow Creek Elementary School. Apart from these sources, no other advice on energy performance was offered.

2. *Did this advice have any specific effect on the cost, energy performance or other aspects of the building?*

The architect of record for Willow Creek Elementary School told us that, as a result of design team meetings with a BetterBricks advisor, the following measures have been included in the design of the school:

- A rooftop heat recovery system[1].
- Increased perimeter wall length to maximize glazing area. Increased glazing and more detailed window design to exclude direct sunlight and to maximize the admission of diffuse light.
- North-south orientation of classrooms.
- Skylights in some classrooms[3] and the gymnasium
- Direct-indirect electric lighting in classrooms[3], with a lower lighting power density than would have been used with direct lighting.

He continued to say that, unfortunately, there was no money for photocontrols, even though photocontrols would allow the air conditioning system to be downsized, resulting in an equipment cost savings as well as a reduction in energy costs and maintenance costs.

The BetterBricks advisor told us that the bond only provided for $60 per square foot, and that in the year since that figure was decided upon the cost of building materials has increased to the point where it would cost $69 to build the most basic school. Consequently the district will be seeking an additional bond in the summer of 2005. The increasing costs may have caused the design team to leave out certain energy efficiency features they would otherwise have included.

Another reason for the partial implementation was that the contractor's estimated costs for the additional design measures were higher than the design team had expected. This may be because the contractor's unfamiliarity with the technologies led them to either overestimate the costs or to factor in a cost for learning on the job. Cost estimates were made both by the construction manager and by the contractor; neither of whom had received any assistance from the Alliance in preparing their cost estimates.

The BetterBricks advisor explained that the Ecotope report included cost estimates, prepared by a contractor. While BetterBricks offered pricing support, both before and after, the architect and his team rejected the measures as too expensive. The BetterBricks advisor was unable to convince the architect to work with him to refine the cost assumptions.

We learned that the initial contact between Kevin Van Den Wymelenberg and Nampa School District had been made by Sue Seifert at Idaho Energy Division, and that the Alliance schools team had only subsequently become involved. So the question arose: Would the outcome of the design process have been any different without the Alliance's involvement?

To answer this question we looked in detail at what else the Alliance had brought to the process. The most apparent contribution was Ecotope's energy analysis of alternative design options. This analysis was discussed in design team

[1] Follow-up information was provided by the BetterBricks advisor indicating that these measures were installed only in the Demonstration Classroom.

meetings and formed the basis for the design team's decision to choose the heat recovery option as offering the best payback. There is no way to know whether the team would have chosen a different option in the absence of this analysis. However, the interviewees agreed that the quantitative, objective nature of the analysis was helpful in increasing their understanding of the available options, and would provide a useful, solid basis for design improvements in subsequent projects where those measures could be included in the design from the beginning.

Two architects we interviewed said that their designs had been influenced by advice previously received from BetterBricks advisors. Both architects had taken model buildings to the Seattle Daylighting Lab to have their designs analyzed under the artificial sky, and said that their designs now included more glazing, clerestory windows, overhangs to exclude direct sunlight, and north-south orientation of the main wings of the building. One architect said that these changes were made to save energy, but that the visual quality of the interior was also a major factor. However, neither architect had carried out a quantitative analysis of energy savings. Instead, their design changes were based on what one architect described as "common sense".

In addition to the factual design advice, members of the design team felt that the process that the Alliance had facilitated (discussions about energy efficient design options) was in itself useful, and would lead to Nampa making better and more informed decisions about energy efficiency in the future. The construction manager for Nampa district said they were highly likely to adopt further energy efficiency measures in future projects, based on their experiences.

Design team members also felt that they had learned lessons about how to ensure that energy efficiency measures are adopted in the design, and are brought through to construction. Specifically, several interviewees mentioned the importance of involving the contractor and the construction manager (responsible for cost estimates) at the earliest possible stage.

3. *Can the school as designed act as a prototype for other schools in the district, or elsewhere in the state?*

The architect of record for the school said that yes, the features are likely to be used in future schools in the area and elsewhere in the state (all the architects we spoke to design schools throughout Idaho and, in one case, also in Montana). One architect said that "a completed school with these technologies is very persuasive" to other school districts. He mentioned especially the improved daylighting (including skylighting) and the indirect electric lighting of classrooms.

4. *Is it likely that the essential energy-saving features and lessons learned from the school will be retained in future projects, rather than being value-engineered out?*

The construction manager for Nampa School District said that the district and the school board are happy with the new design and with the energy saving features, so they hope to include them in future projects.

When asked if the district would consider building an even more energy efficient school, he said that they would be open to that, especially because two members of the board in Nampa are in favor of energy efficient and sustainable design in general. Now that the district has implemented changes in the prototype via the involvement of the BetterBricks advisors, they are likely to look favorably on future innovations. The success of these projects has opened the door to future progress.

Two architects specifically mentioned that schools are less vulnerable to value engineering than other commercial buildings. Because the budget for school projects is fixed, there are no benefits to coming in under budget.

5. *What is going to happen with future school projects?*

   The architect of record for the school said that, even though the same design features could be used in future school projects, next time around they will propose from the outset a complete package of energy efficiency measures that interact to minimize capital cost and operational cost. This approach is fundamentally different from the “add alternative” approach in which energy efficiency measures are added incrementally to a basic design. The intention behind this new approach is to make it uneconomic to remove any single element, because it would have a detrimental effect on the other elements in the design. However, he was worried that the capital cost of such a design might be too high to work within the bond amount, so he said that he would approach projects on a case-by-case basis.

6. *Regarding the Alliance’s work so far: Which aspects have been useful? Which have not been useful? Are there activities that the Alliance should not have undertaken?*

   All the members of the design team and client team that we spoke to said that the involvement of the BetterBricks advisor in the project had been very useful. One member of the design team had subsequently attended one of the roundtable meetings, and said that he thought it was a very useful forum for communicating positive experiences and advice from one district to others, and allowing decision-makers to talk to each other directly.

   The BetterBricks advisor to the design team said that Alliance staff had attended design team meetings and had fulfilled a useful role by “constantly reinforcing the big messages” such as the benefits of daylighting and other aspects of high performance schools.

   None of the interviewees felt that the Alliance had undertaken any inappropriate work.

Questions Regarding the Workshop and Roundtable Meetings in Idaho

1. *Were you satisfied with the outcome of the meeting(s) you attended?*

Almost all the interviewees were happy with the meetings as a whole, with around half of them commenting that they were particularly happy with the open dialogue that was established between people from different professions, with different priorities and different agendas. One engineer said that in the "breakout groups" that were set up to allow more detailed discussion of particular topics, all the participants agreed that the goals of high performance schools were both desirable and a practical possibility.

One architect interviewed was not satisfied with the meeting; he had a lot of experience designing schools with energy efficiency measures and complained that he had heard all the ideas before and that the presentations didn't give enough technical and quantitative information.

2. *Did you find it useful?*

Most of the interviewees said that more quantitative information could have been provided to demonstrate the effectiveness of energy saving measures. One engineer said that he wanted evidence of energy savings from electricity bills and wanted additional information from schools where energy efficiency measures had been successfully implemented.

Several interviewees said that although the meeting didn't provide quantitative information, they were satisfied that they had been given links to resources that would allow them to find the information they would need to make design decisions for future projects. One interviewee suggested that a follow-up memo summarizing the key resources described in the meeting would have been useful.

Only one of the interviewees (a mechanical engineer who seemed to be unfamiliar with energy efficiency measures) said that he had learned new technical information from the meeting. He mentioned orientation, light shelves and photosensors specifically.

Of the other interviewees, half said that the research results on daylight and test scores were new to them, while the other half said that they had learned nothing new.

3. *Have you / would you do anything different as a result of the meeting?*

Although none of the people interviewed had had a chance to implement high performance measures in schools since the meeting, two said specifically that they would actively look to promote daylighting and integrated design in their next school project.

None of the interviewees had contacted the Alliance or a BetterBricks advisor since the meeting, although half of them said that they would contact the Alliance if they had an opportunity to work on a project where energy efficiency measures could be implemented. One architect said that he would not contact the Alliance because he would expect the mechanical engineer to provide information on energy efficient systems.

4. *Would you want to attend another energy efficient school design roundtable or meeting?*

   Only one interviewee (the architect with experience of designing efficient schools) said that he would not be interested in attending another meeting, although he said that he would be interested in working with the BetterBricks advisors. All the other interviewees said that they would like to attend another meeting. One said that it would be useful to hear from other previous attendees about whether they had been able to implement high performance features. Another said that he would like to hear from school districts about their specific areas of concern, such as the potential for vandalism offered by increased areas of glazing, or the unfamiliarity of ground source heat pumps.

5. *Were any "next steps" decided upon at the meeting?*

   All the interviewees said that no specific next steps were discussed; one believed that the Alliance had lost momentum by not setting out next steps. One architect said that several attendees at the meeting had voiced the opinion that the Alliance should concentrate on persuading local people about the benefits of high performance, such as the health effects of fresh air and the improvement in test scores due to daylighting. Two interviewees said that there was a feeling of optimism at the end, particularly because one school district (the interviewee couldn't remember which one) had expressed a strong desire to incorporate high performance features into their next school.

   The summary of the High Performance Schools Workshop circulated to participants after the event identified increased contractor awareness of high performance school design as a priority, saying that "Building contractors should be asked to participate in future seminars to broaden communication and expectations among the owners, designer and trades." Despite this, only one contractor attended either of the two follow-up roundtables, and the participants we interviewed did not mention contractors as being an integral part of the outreach effort for high performance schools.

3.3 Summary of Markets and Market Actors

This section describes the new schools construction market in each state, including the size of the market, the process by which new schools are procured, and the market actors who are most influential and potentially most useful to the Alliance in promoting high performance schools.

Estimated Market Size by State

The estimates in Figure 5 are derived from the figures for statewide school enrollment published by state departments of education. For each state, we used a set of assumptions (detailed in Figure 5) to calculate how many square feet of new construction would be required annually to replace existing buildings, and to accommodate new students. The estimates in Figure 5 are slightly higher than the estimates developed in the Alliance Cost-Effectiveness (ACE) model of March 2003, which quoted 75 equivalent new schools (compared with 114 in this estimate) with a total of 6 million square feet of floor space (compared with 9.12 million in this estimate).

We could not obtain exhaustive information from any of the four states about the number of new school campuses that had been constructed; the states do not collect information in this form. Therefore we can't estimate how much of the 9.12 million square feet of floor space is expected to be new campuses, and how much is new buildings on existing campuses. However, during the interviews we conducted, one interviewee from the Oregon Department of Energy noted that most new construction in schools in Oregon consists of new (or replacement) buildings added to existing campuses, rather than the construction of whole new campuses. From our discussions with Department of Education staff in Idaho and Montana, this is certainly true in those states (no new campuses have been built in Montana for several years), though it may not be true in Washington where anecdotal evidence from bond records indicates that many entirely new schools have been built in recent years.

The Alliance's focus so far has been on high-growth districts that tend to have completely new campuses, as opposed to new buildings on existing campuses. New construction and major renovations on existing campuses may well be a much bigger market. This is clearly the case in Idaho. It should be noted that the pilot projects in Washington are a mix of new and existing schools.

	Washington	Oregon	Idaho	Montana
2003 K-12 enrollment	1,015,968	554,071	248,660	148,356
Number of students per school	459	449	449	175
(1) Estimated annual new floorspace to maintain existing enrollment	3.61 M sf	1.96 M sf	0.89 M sf	0.53 M sf
Average annual change over ten years[a]	+1.1%	+0.9%	+0.03%	-0.9%
(2) Estimated change in floorspace requirement due to changing number of students[b]	+1.59 M sf	+0.71 M sf	+0.11 M sf	-0.19 M sf
(3 = 2+1) Total estimated area of new school buildings per year	5.19 M sf	2.67 M sf	0.92 M sf	0.34 M sf
Equivalent number of new 80,000 sf schools[c]	65	33	12	4
a. Enrollment figures from state department of education websites. b. Assumes that each child requires 142 sf of floorspace (http://www.cefpi.org/issue2.html), and that school buildings are replaced once every 40 years. c. The 80,000 sf per school figure comes from the ACE model input assumptions.				

Figure 5 – Estimated floor area of new school building construction in each of the four Alliance states

School Funding Process by State

The market for new school construction differs in many respects between the four Alliance states; in Washington, direct public funding is available for new school construction; in Oregon some incentives exist for efficient new construction exist, whereas in Idaho and Montana no state or incentive money is available. Consequently the typical amount spent per square foot on new schools differs widely between the four states.

This section describes only the mandatory processes that school districts must go through to construct a new school; optional processes for additional funding (such as incentives) are described in Appendix E: Market Actors.

There are certain features common to the procurement processes in each of the four states:

- Bonds are issued by the school district to pay for new construction, and are repaid by local taxes over a period of years.
- Bonds are voted on by the local population after a period during which information about the proposed school is publicly available.
- The decision about how much money to raise from the bond is made by the district superintendent (an elected official) in conjunction with the district

board and other district staff including the business manager and operations manager.

- An architect is often (but not always) recruited early in the process to advise the board on the cost of the new school, and to provide a rendering of the proposed building to encourage the public to vote for the bond.
- Funding for the school's operational costs (including books and other educational goods) also has to cover the cost of maintaining the school buildings and paying the energy bills, so schools have a definite incentive to reduce the energy consumption of their buildings because this allows them to spend more money on educational goods.

The main differences between the states are summarized in Figure 6. In this section of the report, Idaho and Montana have been grouped together because their markets are very similar. The figures for the typical cost of new school construction in each state have varying degrees of accuracy, and should therefore only be taken as indicative, rather than accurate values. In the case of Washington the figure is exact, based on OSPI records, but in Oregon and Idaho/Montana the figures are based on verbal estimates given by interviewees and corroborated by others. Note also that these are the typical all-in costs for design and construction, and that the difference in cost likely reflects the differing extent to which state and utility funding is available to supplement bonds, i.e. it may not reflect an inherent difference in cost between states.

	Washington	Oregon	Idaho and Montana
Typical cost of new school	$152/sf[a]	$120/sf[b]	$75/sf[c]
Source of funding for new schools	50% state, 50% local, funds administered by OSPI This proportion varies according to the assessed value of school district property per student	100% local	100% local. In Idaho, the amount of a bond is limited by law to 5% of the assessed value of real estate in the district, minus the district's outstanding debt[e].
Applicable state energy code	WA non-res code, compliance is mandatory, targets are 8% higher than ASHRAE 90.1. WA code limits window area to 21% of wall area.	Oregon Structural Specialty Code, chapter 13. Compliance is mandatory.	ID: IECC 2000 MT: ASHRAE/IESNA 90.1-1989 through Dec. 8, 2004, then 2003 IECC.
State requirements for (new) school efficiency	Required to conduct an Energy Life Cycle Analysis (ELCA) test but design amendments not required. Test is run by WA DGA. OSPI reimburses up to $10k of costs incurred	None, no state money for new schools.	None, no state money for new schools
Number of bonds passed, 2003	55 (new school construction projects funded by OSPI)[g]	6[k] (12 votes failed)	ID: 2[i] MT: None in the past 2-3 years
Cost of electricity per kWh (including demand charges)*	$0.04-$0.07[a], $0.054[m]	$0.04-$0.05[h]	$0.03- 0.04[d,h], $0.046[m]
Cost of gas per therm	$0.65-$0.80[f], around $0.60 [m]	$0.80[l], $0.82[m]	around $0.49[m]

	Washington	Oregon	Idaho and Montana
Available incentives	Utilities: Seattle City Light Puget Power Tacoma Power, expected 2005 OSPI pilot program - $1.5M for five school projects during 2005	Business Energy Tax Credit (BETC), administered by Oregon Department of Energy. Building must be LEED certified, ODOE pays up to $50k toward the cost of certification. Energy Trust of Oregon new construction incentive program, schools can receive $80-100k	None from state agencies. Idaho Power is likely to begin a commercial incentive program during 2005.
% votes required for passage of a bond	60%, plus 40% turnout requirement (of those who voted in the last general election). State legislature may vote to change this to 50% in November.	50%	ID: 65%
* based on 616850 kWh/month, and 1300kW peak demand a. Communication with Peter Meyer, Tacoma Power b. Communication with Betty Merrill, Oregon Department of Energy c. Communication with Jim Coles, Design West architects and Jim Otradosky, CSHQA architects d. Communication with Sue Seifert, Idaho Energy Division e. Communication with Dr. Richard Bauscher, Middleton School Distict f. Puget Sound Energy, http://www.pse.com/account/rates/rates.html g. Communication wit Washington State Office of the Superintendent of Public Instruction (OSPI) h. Rate information from Idaho Power (http://www.idahopower.com/aboutus/regulatoryinfo/tariffs.asp) i. Communication with Idaho Department of Education, department of finance j. Communication with Anne Hooshagen, Oregon Department of Energy k. Oregon School Boards Association website: http://www.osba.org/hotopics/election/_results/index.asp l. Rate information from Cascade Natural Gas http://www.cngc.com/post/rates_tariffs/oregon/0104_Commercial_Rate.pdf m. Rate information from Avista Corp http://www.avistautilities.com/prices/rates/default.asp			

Figure 6 - Differences between the new schools markets in the four Alliance states

Washington

As shown in Figure 6, 55 bonds were passed in 2003 for the construction of new schools. In Washington, all new buildings must comply with the relevant portions of the Washington State Energy Code. Washington has the highest electricity prices of the four northwest states, and therefore Washington school districts have the greatest incentive to build efficient schools.

In Washington, state funding is provided for the building of new schools; this is the only one of the four northwest states in which state funding is available. On average, the state provides 50% of funding for new schools, although this varies according to the district. The 50% is not “matching funds”, it is calculated by OSPI according to taxable real estate value of the district such that wealthier districts receive less funding, and must raise bonds to cover the remaining cost of building the school. The provision of state funding may be one of the reasons that the average cost of new school construction in Washington (at $152/sf) is higher than in the other three states.

Funds for new school construction are released through the Office of the Superintendent of Public Instruction (OSPI), and are contingent upon the project meeting certain requirements such as conducting a comprehensive life-cycle cost study of energy efficiency measures. This set of requirements is known as the “D-form process”, and one of the people we interviewed at OSPI said that this could potentially be amended to include other requirements such as compliance with the Washington Sustainable Schools Protocol, or commissioning or long-term monitoring of the performance of the school.

The life-cycle cost studies are carried out by the design team and are submitted to the Washington Department of General Services, which is responsible for establishing which calculations are required. The DGS does not exhaustively check submissions, but assumes that they are made in good faith The DGS is also involved in revisions of the D-form process. Despite the fact that the life cycle cost test is “mandatory”, only around 80% of school districts now submit these studies for new schools. They are not required to amend their designs according to the results of the life cycle cost test. The cost of the study is refunded (up to $10,000) to the school district by OSPI.

Oregon

In Oregon, the funding for new school construction comes entirely from bonds financed by local taxes. Although the state does not directly fund the construction of new schools, the Oregon Department of Energy runs the Business Energy Tax Credit, through which incentive funding is available to schools (and other buildings) that meet the requirements of LEED Silver. This is intended to become a widespread source of additional funding for Oregon schools, but we were unable to find out what proportions of new schools currently qualify.

Schools in Oregon must meet the Oregon Structural Specialty Code, Chapter 13; this code (despite its name) contains requirements for energy efficiency. Under this code, school classrooms and offices must have occupancy sensors, and photocontrols are required if window area is >50% of wall area, or if the space has skylights. Interviewees believed that this code is significantly more stringent than ASHRAE 90.1. If more than $50,000 of work has been carried out, it is mandatory for public buildings in Oregon to be professionally commissioned.

In Oregon, several types of incentives for new school construction are available from the Energy Trust of Oregon, which administers a public benefit charge. The Energy Trust process is optional rather than mandatory.

Idaho and Montana

In Idaho and Montana, the state does not directly fund the construction of new schools, and no incentives are currently available from state agencies or utilities.

The average price per square foot for new schools in these states is very low, for a variety of reasons. Firstly, no state funding or incentive payments are available; secondly, the required majority to pass a bond is 65%, whereas in Washington and Oregon only 50% is required; thirdly, energy prices in Idaho and Montana are the lowest among the northwest states; fourthly, some of the people we interviewed said that conservative rural populations in these states usually vote against bonds because those bonds would have to be financed by additional taxes. Furthermore, in both states there is a law restricting the amount of money that can be obtained by a bond; in Idaho the amount is limited to 5% of the assessed value of real estate in the district, minus the schools district's outstanding debts. We were unable to determine the limit on bonds in Montana.

In Idaho, nonresidential new construction has to comply with the IECC 2000 Energy Code. In Montana nonresidential new construction has to comply with ASHRAE/IESNA 90.1 1989 through December 8, 2004. After that the 2003 IECC will go into effect. In both states, the fees available to architects are very low, which acts against innovation because any additional design work will not be paid for by the school district.

Because of the need for low cost construction, architects in Idaho tend to use a "template" school design, and adapt it only slightly to local and site conditions. Each architect has his or her own template which is adapted from one project to the next. Architects look for opportunities to evolve their template design incrementally by implementing individual energy efficiency measures such as heat recovery systems, increased daylighting, or indirect electric lighting, although in the vast majority of schools these measures are not yet used.

On the other hand, architects in Montana do not tend to use a template design, despite the increased design cost this incurs. This is partly because climatic differences in Montana are very extreme (hence, school designs from one area are unlikely to be appropriate in another), and partly because communities in Montana often demand that their schools are closely tailored to local needs and conditions, for instance that they integrate architecturally with the style of buildings in a particular town. Consequently, the additional aesthetic design work required to adapt to local styles, and to ensure the basic utility of the building in potentially harsh surroundings leaves almost no time for the architect to address energy efficiency concerns. One architect that we interviewed said that, given the extreme climates in Montana, significant energy saving opportunities are being missed. Ironically, the need to adapt a building to local conditions can often provide an excellent opportunity to address energy efficiency concerns, but it seems that in practice budget restrictions are too tight to allow this in Montana.

4. TECHNICAL REVIEW

In this section we present our technical review and assessment of two aspects of the Schools Target Market:

- Washington Sustainable Schools Protocol (WSSP)
- Alliance Cost Effectiveness (ACE) Model

4.1 Assessment of Washington Sustainable Schools Protocol

As part of our evaluation of the schools target market, we compared the prescriptive path measures of the Protocol to the Washington State Energy Code (WSEC) to assess whether it will result in energy savings in schools. In doing so, we recognize that energy savings was not the overall goal of the WSSP. The overall goal was to encourage and provide the tools necessary to build a "Sustainable School". However, energy savings iare an important element of sustainable schools and the area in which the Alliance has the most interest.

Our review, completed in the fall of 2004, looked only at the prescriptive path measures because the majority of interviewees we spoke with in the summer of 2004 suggested that the prescriptive path was more likely to be adopted by schools. Since the completion of our interviews, five schools participated in a pilot project and all of them used the performance approach. Then, in a meeting in February 2005 the WSSP development committee recommended dropping the prescriptive path. If the recommendation is accepted the following analysis may no longer be relevant to the Protocol.

The intent of the review was not to conduct an in-depth technical analysis, but rather to use our experience related to school design and energy codes to determine whether the requirements were reasonable, sufficiently clear and direct, and directly applicable to new school construction in Washington. Although we did not originally intend to perform any energy savings analysis, we were able to leverage other work we are currently conducting for the Alliance to estimate the energy savings using eQUEST to simulate a simplified classroom model.

The WSSP Advisory Group members we interviewed generally felt that the protocol was sufficiently detailed and stringent to save energy. While we agree in general with this assessment and believe that in most cases the Protocol will improve the energy efficiency of schools, there is a degree of elasticity that could allow a designer to produce a prescriptively Protocol-compliant building that would not actually save energy. The following review will illustrate and support this conclusion.

First we reviewed each of the Energy section requirements. Several of the prescriptive requirements are currently very vague. While they are good recommendations, and good issues to consider, implementation of these requirements does not specifically lead to energy savings. Examples of requirements that fit this category are described below.

Energy Efficiency Energy Credit 1: Superior Energy Performance

The Superior Energy Performance credit allots points for improving the energy efficiency of the proposed design. Four (4)to 12 points are available for reducing total energy use by 10% to 50%compared to the Non-Residential Energy Code baseline. Alternatively, the 4 points can be earned by incorporating 11 measures into the school design. The prescriptive measures, as reviewed below, are:

1. Bi-Level Controls
2. Automatic Lighting Reduction
3. Best Practices Mechanical System Design
4. Opaque Envelope Performance
5. Window Performance
6. Skylight Performance
7. Cool Roof
8. Mechanical Efficiency
9. Variable Air Volume
10. Lighting Power Density (LPD)
11. Daylight Responsive Controls

It is important to note that the measures for the Prescriptive Path must be used as the complete package and are intended to reduce building energy use by 10% beyond the NREC. This alternate path (Prescriptive) was provided so that schools that do not participate in the OSPI funding process which requires modeling, do not have to model each project if they choose not to do so. The results of the analysis conducted by NBI are shown in Appendix G.

We reviewed each of the prescriptive measures independently. For two performance measures, mechanical efficiency and LPD, we compared the Protocol requirements to the NREC requirements as shown in Figure 7. Based on a straight average, the measures are approximately 25% better than the base code requirements for Zone 1 (West) and approximately 20% better than code in Zone 2 (East). [0]

Bi-level Controls

The control device shall allow the occupant to reduce the connected lighting load in a reasonably uniform pattern by at least 50%.

According to a study on the effectiveness of bi-level lighting controls conducted by ADM Associates, for Southern California Edision[1], classroom lighting energy use is reduced by 8% due to manual use of bi-level controls by the occupants (primarily the teacher or another adult). Therefore, we believe that requiring bi-level controls, while not locking in energy savings, does provide an opportunity for energy savings.

Automatic Lighting Reduction

The automatic control device shall shut off lighting or reduce lighting for interior rooms.

Energy savings from lighting controls are highly dependent on the usage patterns of the controlled space. These usage patterns appear to be correlated to some extent to the space type. Several studies conducted by various entities over the last 10 years have reported a range of savings estimates. A high efficiency lighting study conducted by the Lighting Research Center (LRC)[2] concluded that the average energy savings in classrooms is approximately 30%. The 1993 Advanced Building Guidelines[3] estimate 35%-45% savings, but don't provide any basis for those claims. The 2001 California Title 24 energy standards allow a 10% LPD increase credit in all spaces greater than 250 sf for the installation of occupancy sensors. According to the 2002 California Building Efficiency Assessment Study[4], occupancy sensors resulted in approximately 3% of the lighting energy savings. This last study is based on on-site data collection and monitoring of schools with occupancy sensors installed as part of the *Savings By Design* new construction program. The relatively low savings from occupancy sensors could be a result of relatively low installed LPDs, and therefore may not be directly applicable to Washington schools.

For classrooms, which are occupied full time during much of the day, the control devices will not result in energy savings throughout the day, but may result in substantial savings after school hours if there is not some other type of lights-off sweep, either automatic or manual.

Additionally, if bi-level controls are installed, as described previously, then the automatic control devices will not save as much energy as estimated based on maximum lighting levels.

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1 Lighting Controls Effectiveness Assessment, Final Report on Bi-Level Lighting Study, by ADM Associates, Inc., for Southern California Edison, May 2002.

2 Reducing Barriers to Use of High Efficiency Lighting Systems, by Lighting Research Center, Rensselaer Polytechnic Institute, for US DOE, January 22, 2003

3 Advanced Building Guidelines: 1993, by Eley Associates, for EPRI, California Energy Commission, US DOE.

4 2002 Building Effectiveness Assessment Study, An Evaluation of the Savings By Design Program, by RLW Analytics, Inc., for Southern California Edison, July 2004.

Best Practices Mechanical Design

Employ best practices design techniques to improve system performance and meet ASHRAE Standard 55.

This requirement identifies specific actions required by the design engineer to ensure proper sizing. Energy savings are achievable through good mechanical design and system installation; however the requirements are guidelines that don't necessarily guarantee that the HVAC system will save energy (compared to the absence of the requirements).

Similar requirements have been implemented in other regions based on the ASHRAE Standard 90.1 mandatory provision to provide load calculations. While conducting load calculations and sizing equipment to meet those loads is generally a good idea, there have been concerns from practitioners that the requirement results in increased time and paperwork, without producing increased energy savings. The intent of this requirement is to prevent equipment oversizing. However, as identified by one practitioner:

> *Oversizing of equipment is not always an energy penalty. Oversized cooling towers, pipe and ducts actually reduce energy use. With application of variable speed drives oversizing of chillers, fans and pumps is generally a negligible effect.*[1]

We are not advocating oversizing of equipment nor are we suggesting that proper sizing of packaged units is not appropriate. Indeed, built-up equipment as cited above does not typically apply to schools in Washington. However, we do want to caution against blanket requirements that may not be appropriate for all applications. Right-sizing strategies and staging of packaged units can save energy.

Opaque Envelope Performance

The opaque envelope measures are compared to the Washington State Energy Code (WSEC) in Figure 7. Based on a straight average, the opaque envelope measures are approximately 30% better than the base code requirements for Zone 1 (West) and approximately 20% better than code in Zone 2 (East).

[1] Taylor Engineering letter to the California Energy Commission, November 1, 2001.

School Component		WA Zone 1 (West - Tacoma)			WA Zone 2 (East - Spokane)		
		WSEC	WSSP	% Improvement	WSEC	WSSP	% Improvement
Wall	U-factor	0.14	0.06	57%	0.11	0.06	45%
Roof	U-factor	0.036	0.034	6%	0.031	0.034	-10%
Roof	Absorptivity	0.66	0.45	32%	0.66	0.45	32%
Glass	U-factor	0.60	0.35	42%	0.6	0.35	42%
Glass	SHGC	0.65	0.40	38%	0.6	0.40	33%
Skylight	U-factor	1.27	0.45	65%	1.27	0.45	65%
Skylight	SHGC	0.62	0.40	35%	0.62	0.40	35%
Lighting Power Density (LPD) by Space	Whole Building	1.50	1.2	20%	1.50	1.2	20%
	Classroom	1.35	1.2	11%	1.35	1.2	11%
	Library	1.50	1.3	13%	1.50	1.3	13%
	Office	1.20	1.1	8%	1.20	1.1	8%
	Auditorium	1.00	0.7	30%	1.00	0.7	30%
HVAC System Eff. (for Classrooms)	A/C EER	9.4	10.0	6%	9.4	10.0	6%
	Furnace Efficiency (%)	80%	80%	0%	80%	80%	0%

Figure 7 - WSSP Prescriptive Performance Requirements

Window Performance

Each vertical fenestration system must meet the U-Factor and SHGC.

The window requirements are compared to the Washington State Energy Code (WSEC) requirements in Figure 7. Based on a straight average, the window requirements are approximately 40% better than the base requirements for both Zone 1 (West) and Zone 2 (East).

Skylight Performance

Each horizontal fenestration system must meet the U-Factor and SHGC.

The skylight requirements are compared to the Washington State Energy Code (WSEC) requirements in Figure 7. Based on a straight average, the skylight requirements are approximately 50% better than the base requirements for Zone 1 (West) and Zone 2 (East).

Cool Roof

On low-slop roofs (2:12 or less) install an ENERGY STAR® labeled Cool Roof for a minimum of 75% of the roof surface or an ecoroof for a minimum of 50% of the roof surface.

Cool roofs provide energy savings by reducing the heat gain through the roof and therefore will save cooling energy. For this reason, a Cool Roof is intended for the east zone according to the Protocol authors. Ecoroofs are more appropriate for the west zone.

The 2005 California Title-24 standards require cool roofs on low-slope roofs of nonresidential buildings. The energy savings related to this requirement were estimated by PG&E, both by climate zone (CZ) and in aggregate, and reported in the Codes and Standards Enhancement (CASE) report.[1] According to the CASE report, “Prior research has indicated that savings are greatest for buildings located in climates with long cooling seasons and short heating seasons”. These are obviously not the conditions in Washington, especially west of the Cascades. California Climate Zone 1 (CZ1 - Eureka) represents the California north coast, which is more representative of the Washington coast . The CASE report indicates that the “definite” life cycle costs (LCC) were found in climate zones 2-16 and “likely” LCC savings were found in CZ1. The CZ1 results for a “Title 24 prototypical building” with R-19 roof insulation, along with the minimum, maximum and average results for all 16 climate zones are presented in Figure 8. The energy savings are per 1,000 sf of air conditioned roof area units. As shown in the table, CZ1 savings represent the minimum savings in the state.

	kWh	**therms**	**Source MBTU**
CZ 1	117	-8.8	0.33
Minimum	117	-10.7	0.33
Maximum	438	-1.8	4.30
Average	316	-5.0	2.73

Figure 8 - Cool Roof Annual Energy Savings (per 1,000 sf of air conditioned roof area) for California Climate Zone 1 (Eureka, CA)

Radiant barriers reduce heat loss and heat gain through the roof, therefore save energy in both the cooling and heating season. Ecoroofs can provide the same savings potential, especially in the heating season, since traditional schedule schools are not operating in the cooling season. We have not thoroughly studied the overall thermal benefits of ecoroofs, so we cannot assess whether they are more effective than radiant barriers.

Mechanical Efficiency

The mechanical efficiency requirements are compared to the Washington State Energy Code (WSEC) requirements in Figure 7. The air conditioner EER requirement is 6% better than the code requirement, for both zones. Furnace efficiency is equivalent to the code requirement.

[1] PG&E, *Inclusion of Cool Roofs in Nonresidential Title 24 Prescriptive Requirements,* Revised Report, August 2002.

Variable Speed Control

Variable speed pumps and fans shall have controls that will result in motor demand of no more than 30% of design wattage at 50% of design flow.

This is a good design option that will result in energy savings for variable flow pumping systems and variable air volume HVAC systems. According to the New Buildings Institute, the committee determined that this is currently not standard design; therefore we expect that this requirement will result in savings compared to standard practice.

Lighting Power Density (LPD)

The LPD requirements as compared to the Washington State Energy Code (WSEC) are shown in Figure 7. The school whole building lighting power density is 20% better (1.5 to 1.2 Watts/sf) than the base code requirement. The whole LPD was directly from the Advanced Buildings Benchmark and accepted by the committee as the value used. However, this may be over-estimated, when compared to space specific requirements. Classrooms make up a majority of the school floor space, save approximately half that much (11%). The other primary area categories also have lower reductions: library 13% and office 8%. The greatest reduction is for auditorium at 30%. There was not enough information provided to determine whether the overall school wide 20% reduction is achievable based on these space allotments.[0]

Daylighting Responsive Lighting Control

In daylit areas, automatic daylight responsive lighting controls shall be installed to automatically reduce electric lighting power in response to available daylight.

Energy savings from automatic daylighting controls are highly dependent on the specific application and sky conditions. The overall energy savings from daylighting, from both windows and skylights in our simplified model was approximately 30% of the classroom lighting energy.

In summary, our measure by measure review suggests that the Protocol requirements are sound and reasonable energy efficiency options. The building envelope component requirements are clearly better than code. However, building envelope improvements do not typically have a large impact on the overall energy use and savings of commercial buildings.

Additionally, there are several measures: bi-level controls, automatic lighting reduction, Best Practices mechanical system design, cool roof, variable air volume and daylight responsive controls, which may not save as much energy as anticipated by the protocol. In order to better assess the achievable energy savings we performed an energy analysis on a prototype multi-classroom model, as describe in the following section.

Energy Analysis

In addition to the measure-by-measure review, we used an existing model of a typical classroom wing in Seattle and performed parametric analyses to estimate whether the compilation of the prescriptive requirements results in energy savings. While we realize that this is just one preliminary approach to determining savings, it provides a good, if simplified, basis for an assessment of the overall impact of these requirements.

We estimated energy savings by running simulations of a sample building, first with components that comply with the Washington State Energy Code (WSEC) then with the prescriptive measures from the protocol. The results are presented in Figure 9. A description of the sample school is provided in Appendix F. While it is not an exhaustive analysis, it does provide for a quick check of the applicability of the code. It should be noted, that the results of our analysis are relatively close to the total energy savings calculated by the NBI analysis (provided in Appendix G).

We modeled two base case projects: one with and one without skylights, in three cities (Seattle, Tacoma, Spokane) for a total of six base case runs. We then looked at the high performance requirements for those six base case models according to the Zone 1 and Zone 2 WSSP requirements. We analyzed Seattle separately from Tacoma since the City of Seattle has an upgraded, more stringent energy code, than the WSEC.

As shown in Figure 9, there is very little electric savings in Seattle, although there is a small percentage of gas savings. This result is to be expected, since the WSSP requirements are very similar to the Seattle code. There is a small amount of savings in Seattle, due to a higher efficiency HVAC unit. However, there are no lighting energy savings, since the LPD requirements are the same as code.

The results, as shown in Figure 9, show that overall the non-skylit high performance classrooms in Tacoma and Spokane saved 25% total building electric energy, and the skylit classrooms saved 35% total electric energy. There are cooling and fan energy savings in Tacoma and Spokane; however most of the energy savings comes from lighting. (The high performance classroom was modeled with 1.2 W/sf, compared to the base case of 1.5 W/sf.) Based on this difference in LPD, we are seeing approximately30% lighting energy savings. The non-skylit classroom also includes daylighting controls for sidelighting. For this case, the energy savings for the skylit classrooms are even greater, at over 50%, due to the fact that the high performance skylit classroom includes daylighting controls for the toplighting. There are negative therm savings for both the skylit and non-skylit model in both locations.

From these results, we conclude that the estimated energy savings are achievable in the all areas of the state, except Seattle, which already has an energy code that is as stringent as the WSSP.

Conditions		ELECTRICITY (kWh)						NATURAL GAS (therms)		
City	Skylights - Y/N	LIGHTS	MISC EQUIP	SPACE COOLING	PUMPS & AUX	VENT FANS	**TOTAL**	SPACE HEATING	D.H.W.	**TOTAL**
Seattle	w/ skylts	0.0%	0.0%	6.6%	0.0%	1.4%	**0.6%**	5.0%	0.0%	**4.3%**
	no skylts	0.0%	0.0%	3.2%	0.0%	2.2%	**0.4%**	6.1%	0.0%	**0.0%**
Tacoma	w/ skylts	51.0%	0.0%	45.6%	0.0%	29.3%	**35.1%**	-4.2%	0.0%	**-3.5%**
	no skylts	32.7%	0.0%	38.8%	0.0%	27.4%	**25.1%**	-1.6%	0.0%	**-1.3%**
Spokane	w/ skylts	55.5%	0.0%	37.4%	0.0%	26.1%	**35.5%**	-5.3%	0.0%	**-4.7%**
	no skylts	34.6%	0.0%	35.1%	0.0%	24.3%	**25.3%**	-2.8%	0.0%	**-2.4%**

Figure 9 - WSSP Prescriptive Performance Energy Savings Results

Energy Efficiency Energy Credit 2: HVAC and Operable Windows

Install controls/devices or HVAC systems that are responsive to operable windows or doors when opened.

This energy credit “recommends” that each classroom have an operable window, but requires that in order to get the credit the windows must be properly controlled with HVAC responsive controls. The requirement will most likely result in energy savings, particularly in coastal areas. However, it is neither easy nor inexpensive to have sensors for each operable window (similar to burglar alarm sensors), so we do not expect this credit to be used often.

Alternative Energy Sources

Energy Credit 3: Renewable Energy and Distributed Generation

Use on-site renewable energy and distributed generation for a portion of a school’s energy use.

Up to 4 points can be obtained by supplying 10% of the buildings load through alternative energy sources. This is a good option to include in the protocol. We expect that this will be used by schools and design teams that were already considering alternative energy sources, but will not drive the decision, nor be widely used.

Commissioning and Training

The purpose of the commissioning and training requirement as stated in the protocol is to: *verify that fundamental building elements and systems are designed, installed and operated as intended by the construction documents*.

Within this section there are prerequisites and energy points available that outline the procedure for a successful commissioning process. The requirements for the Commissioning process are straight forward and easy to follow. However, the requirements, while describing the process, do not lock-in or guarantee energy savings.

Energy Credit 4: Commissioning

Interest in commissioning of building HVAC and control systems has been increasing. Effective building commissioning, for both new construction and retro-commissioning, is an effective means for ensuring equipment effectiveness and resulting energy efficiency. There are many case studies, several presented on the BetterBricks web site, reporting on effective commissioning. Savings estimates range from 10%-35% energy savings from commissioning.

Credit 4.1 requires that the design team develops a joint statement of project goals and principles. While it is a good first step in the overall commissioning process, taken by itself it seems to be a meaningless “point”. While we don’t expect that any district that voluntarily complies with the Protocol will be “gaming” the system, it is possible that if a project needs one more point to qualify, the design team could simply sign a joint statement, without having given the commissioning process the serious thought that it requires. In other words this requirement could be seen as a give away.

Credit 4.2 requires that a commissioning agent is hired, and provides specific guidelines on what the commissioning agent needs to do to complete the commissioning process. Credit 4.2 requires much more thought and commitment to commissioning, and should be worth more points than Credit 4.1.

Energy Credit 5: Energy Management Systems

Install an energy management system (EMS) to monitor the energy use of the lighting, equipment, HVAC, hot water systems and miscellaneous equipment

As per the Energy Design Resources (EDR) website (www.energydesignresources.com), “On average, energy management systems save about 10 percent of overall annual building energy consumption.” However, as stated in the Protocol, new schools typically install energy management systems. Since EMS installations are fairly standard, particularly in large schools this requirement may be a giveaway.

The protocol goes on to say “EMS systems can potentially save significant energy, but only if the staff understands how to operate it.” This supports our concern that while EMS can save energy, the fact that they are installed does not guarantee energy savings. Only one part of the “Operator Interface” design requirements addresses the action which actually saves energy, which is “diagnosing building problems”. Monitoring and reporting building energy consumption will not in and of itself save energy. However, it is an important first step to Acceptance Testing and should be included in the finished product. Energy savings is accomplished only when the building operator identifies a problem (through monitoring and trending) and then is able to act on a diagnosis of the problem. There is nothing in the Protocol to ensure that this happens.

It also seems that the previous requirements/options for automatic lighting control devices, daylighting controls and HVAC and operable windows allows for double counting of some of the actual achieved energy savings.

Conclusion

From our review of each of the prescriptive requirements, we conclude that each measure can result in energy savings, based on the assumptions of the requirements. However, we cannot say with certainty that the energy savings will be realized, on a statewide basis if schools opt for the prescriptive path. In general, while most of these requirements are beneficial to promoting energy efficiency and providing building designers, owners and occupants with the ability to design and operate a building more efficiently, the prescriptive requirements are not necessarily stringent enough to lock in energy savings. We acknowledge that this is really all any program, including legally mandated code, can accomplish, however, based on interviewee comments we received we feel compelled to acknowledge this opinion. Our assessment is influenced in part by the responses we received from the committee members when they were asked whether they thought that following the Protocols would actually save energy. As stated previously, in Section 3.2, few committee members believe that savings will actually be achieved in practice. We also agree with one interviewee who described some of the prescriptive measures as “vague.” Clearly, some of the requirements, such as envelope requirements, are straightforward in terms of energy savings. Others, such as the commissioning requirements, are less clear. We also acknowledge that the Protocol is based on sound examples such as the CHPS Criteria.

We therefore conclude that energy savings could be achieved through implementation of all of these prescriptive measures/requirements but they are not guaranteed. Our analysis shows that energy consumption for a school following the Protocol’s prescriptive path could range from equal to the existing Washington State Energy Code (i.e. no savings) to 20% less than a building built to code.

4.2 Assessment of Alliance Cost Effectiveness (ACE) Model

We conducted an initial review of the key assumptions for the schools Alliance Cost Effectiveness (ACE) model. Following is a list of the inputs and assumptions that are likely to have the largest impact on the cost effectiveness analysis.

Target Market Size

ACE model assumptions

- In 2003, 6 million square feet of new schools were built or renovated.
- Growth in annual construction volume is 1.9% per year for new and about 1% per year for major renovation.
- The eligible market in 2010 will be 7.3 million square feet.

The resulting cumulative effect is that by 2010 there will be approximately 100 new schools impacted by the program.

Analysis

In Section 3.3 we provide an estimate of school construction in the four-state area over ten years, based on state department of education websites. As shown in Figure 5 on page 33, we estimated 114 new schools, for a total of 9.12 million square feet. Our estimate is approximately 25% higher than the 7.3 million square feet used in the ACE model.

Recommendation

While the square footage estimates we provided in Section 3.3 are from department of education websites, and therefore we believe are reliable, we recommend that the Alliance should use the 7.3 million sf currently used in the ACE model as a conservative estimate.

Savings

Savings are estimated for all-electric schools and fossil fuel schools.

ACE model assumptions

- From the Baylon Baseline study about 74% of new PNW buildings use fossil fuel.
- Savings are transferred from three old Alliance projects (Commercial Windows, BOC, and Public Building Commissioning) as well as adding one new lighting measure.
- All schools are assumed to accept all four measures and all-electric schools save 3.73 kWh/sf-year and fossil fuel schools save 2.95 kWh/sf-year plus 0.038 therms/sf-year of gas savings

Analysis

The documentation references a "Baylon Baseline" study, stating that about 74% of new Northwest buildings use fossil fuel. A full citation is not provided, so we are unable to determine whether the 74% is specifically applicable to schools. Based on this assumption, the model estimates that all-electric schools save 3.73 kWh/sf-year and fossil fuel schools save 2.95 kWh/sf-year, and 0.038 therms/sf-year of gas savings.

Savings are assumed based on a transfer from three "old" Alliance projects, including the Commercial Windows Initiative (CWI), Building Operator Certification (BOC), and Public Building Commissioning. While the BOC project is completed, it is unclear why CWI and Public Building Commissioning are considered old. For the BOC project it is unclear what savings are being claimed, and whether associated costs from the initial project are being included.

In addition, one new lighting measure is added. The lighting measure is not described in the model, but 40% of the savings of the all-electric school and 50% of the electric savings from the fossil fuel school are estimated to come from the lighting measure. Additional lighting savings are claimed for the BOC and Commissioning measures. Lighting savings overall represents 60% and 78% of the total estimated savings for the all-electric and fossil fuel schools, respectively.

Recommendation

More information is needed in order for us to assess the reasonableness and accuracy of the savings estimates. It appears that the program savings are based on “borrowing” measures and savings from other programs. For all projects it is important to verify that the same savings are not being used in the ACE models for each of the projects in determining cost effectiveness. The program savings should be associated with the specific activity related to the new schools target market.

Measure Life

ACE model assumptions

There are two entries for measure life in the ACE “Input Assumptions” tab:

- Life (years) - Assumes shortest life ECM: 17.2 yrs
- Wtd. Life per unit (years): 17.2 yrs
- Window life is 45 years but the other ECMs are 15 years.

Analysis

The weighted or shortest measure life of 17.2 years seems fairly high. The window measure life also seems high. A realistic assumption for window life is 15 to 30 years. The other measures are assumed to have measure lives of 15 years. For the lighting “measure” this is a reasonable value assuming that the actual measures are light fixtures and not controls, or tuning. Given that the other measures are based on building performance commissioning and trained building operators, the 15 year life may be overestimated. Specifically, we question whether the effects of commissioning last 15 years, and what percentage of trained building operators will remain at their current location over a 15 year period.

Recommendation

The source of the measure life estimates need to be provided in order for us to assess their reasonableness. Additionally, the specific measures need to be identified so that appropriate measure life values can be assigned to them.

Without that information we recommend at a minimum that the Alliance reference the CALMAC 2000 M&E Protocols[1] *Effective Measure Life* values.

Cost

<u>*ACE model assumptions*</u>

- Costs are also transferred from the existing Alliance projects as well as adding $0.50/SF for the lighting measure for a total cost of $0.89/SF.
- Alliance funding is $250,000 for contract, $35,000 evaluation, and $60,000 for three years of administration at 0.2 FTE.
- Local utility administration is $345,000 over eight years.

<u>*Analysis*</u>

The cost information is very general, making it difficult to assess the validity of the estimates without a better understanding of the actual measures. The funding information is confusing. The Alliance provides funding (i.e., venture funding) for 2003 and 2004. However, in tab *CE Summary-Units*, a forecast of venture units through 2010 is provided. Perhaps this means that the effort in 2003 and 2004 will have an impact through 2010. This assumption may be overly optimistic.

It is also unclear which organizations are contributing to each effort, how much they are contributing, and over what period of time. For example, the assumptions on the *CE Summary-Units* tab state that the Alliance funding is $260,000. However, it is our understanding that this money has been used for other efforts such as development of the Washington Sustainable Schools Protocol (WSSP) and assistance on an Idaho school prototype [2], and not on the projects specified in the ACE model. The assumptions also state that local utility administration is $335,000 over eight years. Without additional information we are unclear what this means.

<u>*Recommendation*</u>

The costs used in the model need to match the measures that are being used to estimated energy savings. It appears that there is a disconnect between energy savings and measure and program costs. At a minimum, we recommend that the Alliance aligns the two sets of assumptions. Additionally, the Alliance should provide, in the ACE model spreadsheet, more detail on the cost assumptions.

[1] *Procedures for the Verification of Costs, Benefits, and Shareholder Earnings from Demand Side Management (DSM) Programs (MA&E Protocols*), California Demand-Side Management Measurement Advisory Committee (CALMAC). See also p. 17-18 of the California Public Utilities Commission (CPUC) Energy Efficiency Policy Manual Version 2, Aug. 2003.

[2] We are still waiting for detailed budget information on the Schools Target Market effort to get a clear understanding of how the funds have been spent.

Detailed Inputs

It is difficult to assess the importance of the key inputs and assumptions without understanding how the ACE model uses the inputs. In order to provide a better assessment of the tool we would need sources for the following assumptions, as well as additional information as listed below.

There is no source information for the following assumptions listed on the *CE Summary-Units* tab.

- *In 2003, 6 million SF/year of new schools will be built or renovated.*
- *Growth is 1.9% per year for new and about 1% per year for major renovation.*
- *All-electric schools save 3.73 kWh/SF-year and fossil fuel schools save 2.95 kWh/SF-year plus 0.038 therms/SF-year of gas savings*.

Additional information and descriptions needed for the assumptions listed on the *CE Summary-Units* tab.

- *Eligible market in 2010 is 7.3 million SF of which 2 million (27%) is converted (5% baseline and 22% project).*

  How is the percent converted estimated?
- *From the Baylon Baseline study, about 74% of new PNW buildings use fossil fuel.*

A full reference is needed.

There is no source information for the assumptions listed on the *Input Assumptions* tab of the spreadsheet.

- *Sources for following assumptions:*
  - *Average school size (sf)*
  - *Number of new schools & SF/year in region*
  - *Area of new schools in the region*
  - *Market Growth (New plus major renovation)*
- *Source for Percent of New Schools EUI below Existing EUI.*
- Sources for kWh savings per sqft?
  - *Heating*
  - *Cooling*
  - *Ventilation*
  - *Auxiliary*
  - *Mix*
  - *Interior lights*
  - *Refrigeration*
  - *Water heating*
  - *Plug load & other*
- How was maximum achievable potential of 14.7 percent market share determined?

5. CONCLUSIONS AND RECOMMENDATIONS

In this section, conclusions and recommendations are described together (rather than in separate lists) to make it clear how the recommendations emerge logically from the conclusions and from other corroborating information. At the end of each subsection a brief summary of the recommendations is given.

A large part of the 2003-2004 effort by the Alliance staff was spent getting to know the schools market in two of the four states, and establishing working relationships with potential allies. The Alliance staff started to build credibility with the WSSP group and the Nampa schools design team, upon which future efforts can be based. A wider understanding of other potential allies in the school construction market could allow this effort to be strengthened and deepened.

The stated mission of the Commercial Sector Initiative is to motivate building owners to incorporate energy efficiency measures into their buildings. Clearly with schools, the superintendents and school boards are the key players, and so the Alliance staff should make every effort to interface with these groups, by presenting them with credible information and identifying a few champions who will speak up to their peers, advocating energy efficiency measures.

The school construction market tends to be very conservative, resource constrained and slow to change. It is highly regulated, and faces many forces that work against greater energy efficiency. Perhaps the greatest force is the traditional interpretation of fiscal responsibility to the funding public, which dictates that lower first costs will be favored over lower operating costs. Incremental changes over time are more likely than revolutionary new approaches.

While there are many other players who are also advocates for energy efficiency in schools, the existing schools infrastructure provides a useful network that may also strengthen other Alliance programs. The Alliance seems to be able to provide a central focus and serve a “convener” function that accelerates the work of others.

The energy savings potential of the schools new construction market may be small due to the relatively low energy use of schools. However, the schools new construction market is probably the most public forum in which Alliance members can engage. Regardless of energy savings, participating in this market is likely to generate good will, useful contacts and precedents for intervention in other new construction markets.

Thus, it would seem to be a wise investment to continue to build on the learning experiences of 2003-2004 and follow through with the initiatives begun in that period. The Alliance staff might best re-focus their efforts on increasing outreach to superintendents and school district administrators, and creating credible materials that document the “evidence” of the energy, cost and occupant benefits of energy efficiency measures in K-12 schools.

5.1 Washington

The Alliance staff identified an immediate opportunity to participate in the creation of the Washington Sustainable Schools Protocol; the chain of events that led to the convening of the Protocol Committee is described earlier in this report. The Alliance provided important financial support for this process, and as a result is credited with being the entity that kept the process on schedule. Now that the Protocol is complete, Washington will be able to proceed with its plan to building five demonstration schools.

The Protocol process gave the Alliance staff the opportunity to interact with other school market actors and have a forum as a visible advocate for energy efficiency. It should be borne in mind that energy efficiency was not the primary goal for most of the participants in the Committee, although it was something that most of them had in common as a secondary goal. It is unclear, however, if the Alliance staff actually succeeded in achieving the goal of a more aggressively energy efficient standard than would have occurred without their participation. There were clearly forces pushing in both directions. The consensus of the group is that the Protocol is a modest first step that needs to be widely adopted and shown successful before more aggressive energy measures can be incorporated.

It is often the case in the development of new protocols that cost-benefit modeling is not conducted for each measure; this is in part because the interactions between measures in real building designs are highly complex, and in part because in a good design the whole is greater than the sum of the parts. Nevertheless, potential adopters of the protocol might be more firmly persuaded of its merits if the cost effectiveness of each measure (or of particular groups of measures) could be convincingly evaluated. Furthermore, if the WSSP is to be adopted by utilities as a basis for providing incentives for new construction, cost-benefit analyses will be an essential step in justifying the Protocol's effectiveness.

The Alliance now has the opportunity to continue to support development of the five demonstration schools by encouraging the successful adoption of more aggressive energy efficiency measures, and then, importantly, to document the design process, lessons learned, and outcomes. All of this should provide more of the 'credible evidence' much desired by members of the school construction community.

There are other program activities and market actors that can be pursued in Washington. Because Washington has a centralized funding source and state oversight on school construction, participation with other state agencies involved in schools should be very promising. The Department of Health, in particular, seems to have a successful model for influencing school construction.

RECOMMENDATIONS

We recommend that the Alliance continue to support the WSSP, and look for opportunities to integrate with other programs, such as the DoH best practices guide. We assume that the Alliance will also document the impact of design assistance for the five pilot WSSP projects, and report on actual energy savings and costs of improved design. Similarly, the Alliance should also monitor the performance of the five pilot projects once constructed and help OSPI in writing up case studies. The Alliance and its contractors should continue to push for more stringent energy efficiency measures in any revised WSSP.

5.2 Oregon

The Alliance staff put very little effort in interfacing with Oregon schools, deferring to existing efforts already in process, primarily led by the Oregon Department of Energy. There seemed to be some tension between the two groups that prevented collaboration. More recently, the Oregon based BetterBricks Advisors and Portland Daylighting Lab staff has participated in developing a very low energy school prototype suitable for the climate of the Willamette Valley. Since this is still in process, it is unclear how influential it will prove to be.

A number of interviewees in Oregon expressed appreciation for Alliance services and supporting materials. It would seem that there are opportunities to continue to support existing Oregon efforts in those areas.

RECOMMENDATIONS

We recommend that the Alliance collaborate with the Oregon Department of Energy (ODOE) to create Oregon specific school designs. Staff at ODOE believes that their LEED-based program for new construction is effective, although we did not attempt to verify this since ODOE's programs are outside the scope of this evaluation.

5.3 Idaho and Montana

The Alliance staff determined that given the limited amount of new school construction in Idaho and Montana, and the lack of state agency participation in that process, that the best opportunity for intervention was direct participation in a relatively high profile design process. After a few attempts, the Alliance staff secured the interest of the Nampa School District in pursuing energy efficiency alternatives and provided additional support to that process. The BetterBricks advisors would have participated in this process anyway. However, the Alliance staff was able to add additional resources to the process, both making more rigorous, via the analysis preformed by Ecotope, and more high profile, by convening additional meetings and roundtables.

Participating in these meetings gave the Alliance additional credibility and visibility on the issue of energy efficient schools, and seemed to introduce new concepts to a number of members of the school construction market that had not previously heard of them. Perhaps, most importantly, participating in these meetings is likely to have set the ground work for continued relationships with other local advocates of high performance schools.

The re-design of the Nampa school was only partially successful in incorporating new energy efficiency features, but seems to have whetted an appetite for more in the future. Those we spoke with familiar with the process believe that school design innovation is an incremental process that needs sustained effort over time to achieve results.

RECOMMENDATIONS

We recommend that the Alliance continue to interface with the Nampa school district and their design teams and publicize efforts to introduce more energy efficiency measures into school design. The Alliance should also continue to collaborate with any other agencies active in school construction and energy efficiency.

5.4 Outreach

The initial logic model and program plan for High Performance Schools both stressed peer-to-peer dissemination of knowledge and advocacy of high performance schools. This approach was confirmed by the baseline study done by Research Into Action. However, very little of the Alliance effort in 2003-2004 was put into supporting development of such a peer-to-peer network.

The first steps could be interpreted to have been taken with participation in the WSSP and the Nampa school project. However, these efforts will only bear fruit with continued participation, in order to build sustained relationships with those players.

Other opportunities exist to promote a peer-to-peer outreach effort. Attending meetings and conferences of school superintendents and school administrators was the most common suggestion of those we interviewed. Interviewees strongly believed that the Alliance representatives would have credibility at these meetings and could provide a useful role in advocating for greater energy efficiency and providing “evidence” of its benefits. The Oregon Department of Energy gave examples of long term pay-offs that had resulted from their earlier participation in such events.

The Alliance is generally respected for the quality of its materials and technical advisors, and there were many suggestions that additional technical support would be welcomed, especially in Oregon and Idaho. Of the efforts of 2003-2004, only the Ecotope report on the Idaho prototype remains as a reference-able document. Other analysis that was reportedly done specifically for the WSSP process could not be obtained by this report team. It seems doubtful that any such analysis was formalized beyond verbal presentations. Thus, we would recommend that an increased level of effort be put into finalizing information and making it useful to others outside of the immediate process.

The Research Into Action baseline study and our interviews both supported the need for “evidence” that energy efficiency in schools is cost effective and has additional benefits. The studies on daylighting and student performance were often cited as the most compelling reason to implement high performance measures. Over and over again we heard requests that more “proof” be provided, especially regarding the cost effectiveness of measures. The Alliance is an appropriate vehicle to collect, produce and disseminate this “proof” that is most likely to motivate a change in the school construction market.

RECOMMENDATIONS

The Alliance should provide compelling literature and presentation material that argues the case for energy efficiency in schools. It would be beneficial for the Alliance to identify the key conferences and events that should be targeted per year, and get speakers lined up to present at these events. Whenever possible, the Alliance should support the creation and publishing of back up materials that provide the “evidence” requested by architects and superintendents, such as the Ecotope analysis of the Idaho school prototype. Other examples might include:

- cost estimates on high performance schools measures and design strategies
- case histories of design processes that resulted in energy efficiency measures
- testimonials from school boards, superintendents, or construction managers
- monitored energy performance on high performance schools, and comparison to plausible base case

Creating these materials from the WWSP pilot projects may be a good first step to get a success story. The Alliance can then aggressively market the success of the pilot projects.

We also recommend that the Alliance support direct outreach to school superintendents. The Alliance could attend the local, state and regional school board and superintendent conferences and speak directly to them about energy efficiency and “high performance” or “sustainable” schools.

APPENDIX A: TIMELINE OF EVENTS AND ALLIANCE ACTIVITIES IN SCHOOLS TARGET MARKET

Year	Program Activities, Commercial Sector Initiative (New Schools)	Activities by others relevant to CSI (New Schools)
2000		March, Washington Office of Superintendent of Public Instruction, *School Facilities Manual*. http://www.k12.wa.us/SchFacilities/pubdocs/SFMANUAL/intro.pdf
2002		September, Executive Order 02-03: *Sustainable Practices by State Agencies*. Directs state agencies to establish objectives and plans that consider sustainable practices including facility construction, operation and maintenance. http://www.governor.wa.gov/eo/eo_02-03.htm
2003	January, NEEA Staff Recommendation Memo: CBI Target Markets: New Schools. Established size of market, initial list of barriers and opportunities, initial strategy, progress indicators and implementation timeline.	January, Washington State Legislature hears first reading of bill 1171: *Establishing Green Building Programs*. This bill would require that all state facilities over 50,000 sf go through the LEED certification process. http://www.leg.wa.gov/wsladm/billinfo1/dspBillSummary.cfm?billnumber=1171
	June, NEEA in partnership with CEFPI convened a committee made up of architects, engineers, school facility planner, utility representatives and state education officials. This committee would work to understand and define the market barriers to the adoption of high performance schools in Washington.	
2004	March 9th, *Idaho High Performance Schools Workshop* held at Idaho Power facility in downtown Boise. Approx 20 architects, 20 engineers, + some school district representatives discuss high performance school standards (CHPS and LEED) and strategies for improving school construction in Idaho.	
	May 14tth, *Daylight and Heat Recovery Ventilation* report written by Ecotope Inc. analyzes the relative energy savings and capital cost increases that accrue from four different variations on a basic school design. May 26th, follow-up round table held in Boise,	

Year	Program Activities, Commercial Sector Initiative (New Schools)	Activities by others relevant to CSI (New Schools)
	further to March 9th workshop May 27th, *Commercial Sector Initiative Baseline Study: Schools*, submitted by Research Into Action. Surveyed attitudes of decision makers who were closely involved in the design process	
		June 28, Washington Office of the Superintendent of Public Instruction (OSPI) issues bulletin No. 041-04 *Washington Sustainable Schools Program*, requesting districts to submit projects for average $250,000 funding to test the WSSP in five pilot projects.

APPENDIX B: RESEARCH INTO ACTION'S PROPOSED PROGRESS INDICATORS

Indicator	Baseline Measurement	Comment
Heard Any Information on How Design of Schools Can Improve Academic Performance	80% heard some information	Expect to see an increasing percentage
Perception of School-Design's Impact on Student Attendance	35% say big effect ("4" or "5")	Expect to see an increasing percentage
Perception of School-Design's Impact on Teacher Turnover	35% say big effect ("4" or "5")	Expect to see an increasing percentage

Figure 10 - Progress Indicators: Impact of Building Design

Indicator	Baseline Measurement	Comment
Awareness of natural ventilation	56%	Expect to see an increasing percentage
Awareness of Light Shelves	41%	Expect to see an increasing percentage
Plans to Consider Using Skylights	69%	Expect to see an increasing percentage
Plans to Consider Using Auto-Dimming Lights	40%	Expect to see an increasing percentage
Plans to Consider Using Low-E Windows	57%	Expect to see an increasing percentage
Plans to Consider Using Life-Cycle Costing	59%	Expect to see an increasing percentage
Plans to Consider Using Commissioning	60%	Expect to see an increasing percentage
Plans to Consider Using Natural Ventilation	23%	Expect to see an increasing percentage
Plans to Consider Using Light Shelves	25%	Expect to see an increasing percentage

Figure 11 - Progress Indicators: Awareness, Use of Efficiency Measures

Indicator	Baseline Measurement	Comment
Perception that Highly Energy-Efficient Schools Are More Expensive to Build Than Conventional Schools	71% say highly energy-efficient schools cost more to build	Expect to see a decreasing percentage

Figure 12 - Progress Indicators: Design/Construction Costs

Indicator	Baseline Measurement	Comment
Need for Proof Of Savings Associated With Energy-Efficient Schools	48% say proof of savings needed	Expect to see a decreasing percentage

Figure 13 - Progress Indicators: Awareness of Energy Savings

Indicator	Baseline Measurement	Comment
Perception of Likelihood Districts Will Adopt Energy-Efficient Building Policy	59% say “likely” or “very likely”	Expect to see an increasing percentage
Perception of Likelihood Districts Will Adopt Policy If Supporting Materials Are Available	72% say “likely” or “very likely”	Expect to see an increasing percentage
Districts Officially Adopted Energy-Efficient Building Policy	0%	Expect to see an increasing percentage

Figure 14 - Progress Indicators: Willingness to Adopt An Energy-Efficient Building Policy

APPENDIX C: IDAHO HIGH PERFORMANCE SCHOOLS MEETING REPORTS

These reports were written by Ken Baker, who organized each of the meetings. Reports are available for three meetings:

- March 2004 Idaho High Performance Schools Workshop, Boise
- May 2004 Follow-up Roundtable, Boise.
- July 2004 Follow-up Roundtable, Pocatello.

March 9th Workshop Report

Background

High performance schools are facilities that improve the learning environment while saving energy, resources and money. High performance designs can have a positive effect on health and comfort, and strategies such as daylighting have been shown to enhance student learning. Good indoor air quality is essential for teacher and student health. Good design also produces more comfortable environments with proper lighting, air temperature, humidity and noise levels. This reduces distractions and creates environments where students and teachers can see clearly, hear accurately and not feel too warm or too cold. Over the past five years several Idaho K-12 school districts have shown increasing interest in gaining an understanding of the benefits of high performance schools. In particular, Nampa, Meridian, Boise, Idaho Falls, Jerome, Pocatello, Emmett and Council school districts have made good efforts to save energy in existing buildings. New buildings, however, offer a challenge. Districts build new schools in the elementary and secondary sectors based on template designs that are used again and again. Though use of this repetitive model can reduce design and construction fees, saving first cost dollars, current templates may not reflect the best in energy efficiency and day lighting practices. As a result the total cost of building ownership (including energy, water, equipment maintenance and replacement) can be significant. These lifetime costs create a growing financial burden on the district and divert funds that could be invested directly into new textbooks or teacher salaries. A collaborative effort has been established to assist all Idaho K-12 districts as they attempt to design and construct high performance schools in Idaho. The kick off for this new partnership happened on March 9, 2004 in a meeting of Idaho School Stakeholders.

Stakeholder Summit

On March 9th, 2004, Rebuild Idaho hosted a one-day K-12 school seminar at the Idaho Power facilities in downtown Boise. Invitations were sent out to six targeted K-12 districts (Nampa, Meridian, Boise, Jerome, Pocatello, and Coeur d’ Alene) and the A&E firms that they frequently work with in new school design. There were over 65 attendees, approximately 20 architects and 20 engineers, along with school district representatives.

The purpose of the meeting was to:

- Develop a group understanding of the benefits of high performance schools
- Explore various strategies for defining high performance schools
- Review current school construction in Idaho
- Identify resources available to assist in the construction of high performance schools
- Identify next steps for high performance schools in Idaho

The first two hours featured presentations on high performance schools. The goal was to give attendees a background on some of the work already performed in Idaho and the Northwest region. The remainder of the day was devoted to interactive group work. The attendees broke into small groups of architects, engineers and school districts. Outcomes of the group work included documented responses to questions such as: What defines a high performance school in Idaho?, and What barriers prevent high performance strategies from being incorporated in new school construction. Each small group reported to the full audience of attendees.

Results

As a result of the small group breakouts, the attendees engaged in a lively discussion. Interestingly, several central or overlapping themes emerged and are important to consider.

- What is high performance in Idaho?
- Of particular interest is that the biggest barrier to high performing schools in Idaho was not dollars (although it did come in second). We need better-communicated goals and policies for our schools - a high performance commitment from policy makers, school boards and administrators – and direction and discretion for the facility managers. One of our goals should be to educate these policy makers so that can provide support and guidance to the high performance process.
- Adequate funding is a barrier. A goal should be established to look into high performance features that have the highest return on investment. There will need to be an education effort built on this directed toward policy makers. One-page case studies were specifically cited as one needed educational tool.
- Architects and engineers – The design team needs an opportunity to communicate early in the design process. Engineers, in particular, expressed an interest in being involved earlier in the design process so

that systems are well integrated and perform for optimum comfort and efficiency.

- If the A& Es are going to spend more time in design, fees should reflect the extra workload. Also, the low-bid process for design team selection doesn't work well and needs to be changed to reflect more of a qualification approach. This would require legislative work.
- The schools group focused on a buildings and system performance. Key to this group was lower maintenance and operations costs, and assistance in putting together a further set of high performance criteria. Operations staff should be considered a stakeholder in the design process. Training for staff, students, teachers and parents would be beneficial.
- Consumer education was also a recurring theme. The community at large should be more aware of the potential benefits of high performing schools and potential long-term impacts on student learning and financial savings. • Building contractors should be asked to participate in future seminars to broaden communication and expectations among the owners, designer and trades.
- Value engineering belongs in the design process previous to the bid process. Careful consideration in the value engineering process should be placed on ensuring lifetime costs are addressed instead of simply cutting first costs. This cut of first costs may threaten the long-term investment in high performance.
- And finally, as a last word the attendees were very supportive of the seminar and stressed how important it would be to follow up with other sessions. We should move to a more hands-on approach working one-on-one with design teams during the design process and continue to bring larger groups together to discuss and develop an Idaho approach to high performance schools. It was also noted that the term high performance might not work for Idaho.

Available Resources

Since 1998 Rebuild Idaho, a program of the Idaho Energy Division, has been assisting K- 12 school districts in planning for energy efficiency in their buildings, old and new. The Rebuild program offers Partnerships planning and limited technical assistance, training and access to energy efficiency processes and resources.

BetterBricks is a non-profit initiative of the Northwest Energy Efficiency Alliance. Their no-cost service connect building professionals with the information, tools, education and design assistance needed to design and construct buildings that are better for people and the environment. Situated within the Alliance's Better Bricks program, staff from the Lighting Design Lab in Seattle has been offering lighting and daylighting training to the Idaho design community for over 5 years. Additionally, BetterBricks Advisors have already been working with some school districts by sponsoring charrettes, or design reviews of prototype school plans for high growth districts in Idaho.

In February 2004 , BetterBricks partnered with the University of Idaho to establish an Idaho Integrated Design Lab. This lab will be a resource for the Idaho design community and building owners.

Idaho Power Company and Avista Utilities, long-time supporters of efficiency programs, have recently begun development of their new energy efficient commercial building program.

Architects and Engineers in Idaho have begun to embrace aspects of integrated design and green building. For example, many architectural and engineering firms now have LEED accredited staff, and integrated design and efficiency workshops offered over the past year were well attended. Firms and individuals seem ready to take on high performance building design responsibilities and are perhaps only waiting for the correct signals from the emerging market.

May 26th 2004 Round Table Report

Location: Boise Idaho

Attendees: 23

Facilitator: Sherry McKibben

Summary

The round table was designed as a follow up to a March 9, 2004 meeting of Idaho A&Es and K-12 schools personnel. The purpose of the 1.5-hour session was to explore and discuss high performance design and process decisions made by the Nampa School District and the process they engaged with their design professionals as they looked to make changes to the current template for elementary and middle schools and developed the design of the new school. The new University of Idaho Integrated Design Lab utilized resources of the BetterBricks advisor program and together they played an integral part of the process, providing high performance design and equipment recommendations to the design team.

The session was formatted to provide an open dialogue on the design team communication process and issues encountered in the effort to explore the viability and cost efficiency of high performance features. Panelists included Design West architect Jim Cole, Jim Otradosky of CSHQA, Steve Bastian of Elkhorn Engineering, electrical engineer Amy Dockter of CSHQA, Gerry Lachcik, Director of Facilities for Nampa School District, and Kevin Van Den Wymelenberg with the U of I Integrated Design Lab.

The audience consisted of a few members of the local architectural and engineer community, Idaho Power Company staff, Idaho Energy Division representatives, and various program representatives of the Northwest Energy Efficiency Alliance. A representative of the Oregon Office of Energy also attended.

Highlights from the Discussion

The integrated design process is valid and valuable! This was probably the most meaningful message that collectively emerged from the panel. The team communication process employed by the district in the design of three schools provided a novel and effective communication base for the design team that resulted in a real effort at assessment and several design enhancements. For example; 1) daylighting enhancements will be made to the design of elementary schools; and, 2) a direct digital control system will be added to the project buildings as a result of this process.

As a follow up to the Energy Efficiency Measures developed by the Integrated Design Lab and BetterBricks advisors, Jim Cole with Design West presented a two-page cost sheet on daylighting and lighting enhancements that were assessed for inclusion into the elementary school design. Jim listed a cost per classroom for many upgrade features such as additional glazing for daylighting, lighting controls, and lighting fixture type.

Jim Otradosky, CSHQA, noted that current design practice for schools is rapidly changing to include more high performance features such as daylighting and new lighting technologies. CSHQA employs a team approach that brings electrical and mechanical engineers into the design process.

Steve Bastian, Elkhorn Engineering, relayed that his company implemented an extensive interview process with control companies in a search for the best value system for Nampa elementary schools. He felt it was a very effective method for communicating and meeting the client’s needs and expressed that it was a valuable process in which to participate.

Other issues that surfaced include:

- School districts need to ask for additional bonding dollars up front. Pre bonding costs need to be determined, an indication that the integrated design process needs to begin earlier in the design process. An estimated $5 per square foot will buy a lot of energy efficiency and high performance features. This is especially true with the elementary schools where the price per square foot has been engineered down over the years of prototype modification.
- The design process becomes frustrating to A&E’s when they look into technologies that cannot be afforded. The process of getting to higher performing schools is definitely a learning experience.
- There is a need to change the attitudes of sub-contractors to get them more involved from a solution perspective. Getting contractors, construction managers and subs involved in the integrated design process would be helpful.

- School superintendents need to be educated/involved in order for the high performance process to move forward. The effort requires a superintendent champion that is willing to discuss HP benefits with peers.

Moving Forward

As always, the larger question is action steps need to be implemented in order to most effectively move this process forward. Three key strategies seem to emerge: 1. Educate the decision makers such as district superintendents and school boards of the complete cost/benefit picture so that there is support for adequate budgets to make high performance schools achievable. 2. Continue to provide technical assistance to districts to assist them in the implementation of the integrated design process, bringing together the full design team including A&Es, contractors, subs and other key stakeholders. 3. Market both potential and documented success and benefits of high performance schools to the community. Create a support base for bonds, etc.

Closing

The round table certainly reflected that this was a good process for the school district and their design team. Appreciation was expressed to Sue Seifert and the Rebuild Idaho team for providing a base for this process and to Better Bricks for their continued technical assistance. Unfortunately, most of the local design community representatives did not attend this session, possibly because of a perception this was a Nampa School District program. Several participants at the March 9th meeting indicated they could not attend because it was too far to travel to Boise for a 1.5-hour session. It has been suggested that we provide a similar format for discussion in eastern and northern Idaho.

July 28th 2004 Round Table Report

Location:	Pocatello Idaho
Attendees:	29
Facilitator:	Ken Baker, Better Bricks
Speakers:	Sue Seifert, Idaho Energy Division
	Kevin Van Den Wymelenberg, Integrated Design Lab
	Rich Bauscher, Middleton Idaho Superintendent
	Eric Strauber, Lighting Design Lab

Summary

There were 29 total attendees - 23 locals - at this first Eastern Idaho high performance schools round table. This session was coordinated and implemented after local architects asked that we bring the HP school discussion to Eastern Idaho. The session was planned and developed by Sue Seifert, Kevin Van Den Wymelenberg and Ken Baker. Of key issue during the March and May Boise HP school sessions was engaging superintendents in the discussions. Sue Seifert and Ken Baker worked with Jeffrey Cole to contract with Middleton Superintendent Rich Bauscher and begin utilizing his expertise in school bonding. Darrell Buffaloe, facilities manager for Idaho State University provided significant support through provision of a campus facility and made personal contact with many of the school district administrators and university department heads. Pete Anderson, Principal with Myers-Anderson assisted by contacting local architects.

Highlights from the Discussion

This was a good forum and discussion venue for this group. Many were not familiar with the concept of HP buildings and the session format allowed for a good broad educational process as well as dialogue with participants. None of the A&Es were LEED accredited, in large contrast to the Boise area where green design is beginning to emerge as the next wave of design.

Participants were interested in continuing a discussion of HP schools. Of the 5 school districts represented, most were in the process of running bonds for new buildings. The message that green buildings may be more bondable was certainly heard by this group and several districts asked about follow-up activities. The local design community believes this area is too conservative to take high performance seriously. We relayed that conservatism can form a basis for selling high performance.

Moving Forward

I suggest we consider more BB activities be brought into the local design community to further influence thinking and to provide education on available assistance. Better Bricks staff could also provide more educational opportunities and forums for bringing the architects and their clients together. We are also working to get session attendees to the November 4, & 5 Idaho Energy Conference where 3 BB sessions are being planned along with a tour of a local school.

APPENDIX D: INTERVIEW GUIDES

All interviews included a primary list of questions covering the interviewee's name, employer, job title, relationship with the Alliance, and their views of the Alliance's work in the new schools market.

Those interviewees who had been a member of the Washington Sustainable Schools Protocol Advisory Committee were asked one set of additional questions, and those who had worked on the Nampa project were asked another set of additional questions.

Primary Questions

About the interviewee

1. Who do you work for?
2. What's your job title?
3. What is your relationship with The Alliance?
4. When did your relationship with The Alliance begin and end?

About the Alliance's high performance schools logic model

5. Do you think that The Alliance's peer-to-peer model for disseminating information about high performance schools will work effectively?
6. What further work should be done by The Alliance to support high performance schools?
7. Do any other opportunities exist, for instance to leverage other local or regional programs?
8. Are there any barriers that act against high performance schools?

Further questions for Washington Sustainable Schools Advisory Committee

1. How applicable is the protocol as a state-wide design tool?
2. What factors might prevent the protocol from becoming widely used?
3. Do you think that following the protocol will actually save energy compared to the Washington State Energy Code, or compared to typical schools new construction practice?
4. How important do you consider the Alliance's main concerns (mandatory 4 energy points, 3 optional points for not providing a/c) to be, within the protocol?
5. Regarding The Alliance's work so far:
    i. Which aspects have been useful?

ii. Which haven't?

iii. Are there activities that you feel The Alliance should not have undertaken?

iv. How would things have been different without The Alliance's involvement?

6. What else could The Alliance have done to support Sustainable Schools in Washington?
7. What are the next steps for the protocol? Is it a finished product, or is it a work in progress? Is there need for additional support and/or funding to move to the next steps?
8. Are you pleased with the outcome? Has it gone forward the way you thought/hoped it would?
9. Who else should I talk to?

Further questions for people involved with Nampa schools

1. Who advised on the energy performance of the school?
2. Did this advice have any specific effect on the cost, energy performance or other aspects of the building?
3. Can the school as designed act as a prototype for other schools in the district, or elsewhere in the state?
4. Is it likely that the essential energy-saving features and lessons learned from the school will be retained in future projects, rather than being value-engineered out?
5. What is going to happen next with the Prototype?
6. Regarding The Alliance's work so far:

i. Which aspects have been useful?

ii. *Are there activities that you feel The Alliance should not have undertaken?*

APPENDIX E: MARKET ACTORS

This section provides descriptions of other agencies, individuals, companies or organizations that are active in promoting high performance schools, and could be useful partners for the Alliance. This is not an exhaustive list of market actors; only those we believe to be useful in the context of new school construction are listed. Actors are listed by geographical area, as follows:

- Regional and National Market Actors
- Washington Market Actors
- Oregon Market Actors
- Idaho Market Actors
- Montana Market Actors

Websites for various organizations are provided at the end of this section.

Regional and National Market Actors

Regional and national organizations are, in general, not as useful to the Alliance as state organizations, but there are a few resources provided by national organizations that may be useful.

The US Environmental Protection Agency is active in promoting energy efficiency in all types of buildings, and has an active program to promote "**Energy Star Schools**" by giving recognition to those schools that meet EPA's own criteria for efficiency (these criteria are not based on LEED or ASHRAE or any other national standard). However, the Energy Star Schools program is very different from the Alliance's efforts in new school construction, because EPA only becomes involved after a school is finished, rather than becoming involved during the design phase. The EPA does, however, have an active program of seminars targeted at school designers and district staff, which the Alliance may be able to leverage.

The website of the US Environmental Protection Agency's Energy Star program contains a piece of software called "Target Finder" that can be used by school boards to estimate whether their energy bills are significantly higher than average. This software could be used by the Alliance to give school business managers and operations managers indicative figures for how much money they could save by implementing energy efficiency measures in a new school.

Target Finder is based on a sensitivity analysis of the CBECS database that quantifies the effect of several variables on energy efficiency, to determine the range of energy bills for buildings of a particular type and size. The software estimates a percentile score for the user's building, i.e. if the building is on the 15^{th} percentile, 85 percent of buildings have higher energy bills. This information could be used by school districts as a ball park number to judge whether existing buildings should be replaced with new, more efficient ones. The EPA offers monthly briefings on how to use the Target Finder software.

The **US Green Building Council** has not yet published a version of its LEED standard specifically for schools, but LEED-CI (for commercial and industrial new construction) is considered appropriate as a benchmark for schools by the Oregon Department of Energy, and has been used by them as the target for new schools construction. The USGBC is beginning development of a version of LEED specific to schools. At the time of writing no public draft was available, and the USGBC members we interviewed did not know whether the USGBC is intending to work together with the teams that developed the Collaborative for High Performance Schools (CHPS) and the Washington Sustainable Schools Protocols. One interviewee believed that Washington protocol would be a useful pilot exercise but would eventually be absorbed by the LEED standard.

Rebuild America runs the **Energy Smart Schools** program, which operates through state branches, (Rebuild Idaho, etc). Energy Smart Schools provides assistance to school districts on a project-by-project basis for both new construction and remodels. The assistance typically takes one of two forms; either a partnership between the district and commercial companies that are “partners” of the Energy Smart Schools program (such as equipment manufacturers and engineers), or direct assistance to the district in the form of, for instance, energy analyses. Energy Smart Schools has been involved with a handful of projects in the northwest, and publicizes those projects on its website and in targeted marketing. The Energy Smart Schools network of commercial partners might be a useful resource to the Alliance in any future project-by-project work.

The **Council for Educational Facility Planners International** (CEFPI) is a national organization whose “sole mission is improving the places where children learn”. The Alliance has already worked closely with CEFPI in setting up the committee for the Washington Sustainable Schools program. CEFPI members are school district staff actively involved in planning, designing, building, equipping and maintaining schools and colleges, and they constitute the core audience for the Alliance’s message on high performance schools. CEFPI provides a peer-reviewed professional accreditation (“Recognized Educational Facility Planner” – REFP) that requires members to attend continuing professional development seminars. CEFPI organizes frequent professional events, maintains local chapters, circulates a bi-annual newsletter and monthly e-news, and recognizes outstanding achievement among its members with a variety of awards.

CEFPI has established the “Paragon Schoolhouse Project” which identifies schools in need of renovation, and then works with professional “partners” (architects, contractors, manufacturers) to create a “high performance, healthy, sustainable school”. The Paragon Schoolhouse Project has completed a successful pilot project in Pennsylvania.

The **American Institute of Architects** is a highly active professional organization that requires its members to attend continuing education classes (classes must be accredited by the AIA), and organizes monthly professional seminars and social gatherings in each local section. There are a total of fifteen local sections in the northwest (six in Washington, four in Oregon, four in Idaho, one in Montana). By developing a presentation accredited for AIA continuing education seminars, the Alliance could reach a very large audience of architects .

The **American Association of School Administrators** (AASA) is a professional organization that provides information, support, training and accreditation to school administrators throughout the country. They have a program of seminars for their members, and have a website that provides useful information to school operations managers about issues such as indoor air quality, mold and nutrition, but there is only one document on the site that mentions energy use, and there is no information about daylighting. The AASA website and its training programs could be adapted to integrate with the Alliance's guidance on high performance schools, to provide a unified message to AASA members.

The **National School Boards Association** (NSBA) fulfils a similar role, but appears to provide more in-depth information about construction issues than AASA; for instance, NSBA's a website provides guidance on architectural issues for school district staff and school board members in a section called "Learning by Design". This includes qualitative guidance on energy efficiency and the quality of the learning environment, and a framework "curriculum-based specification" to apply to the design and construction of new buildings. It contains several case studies and links to primary research papers on student performance. These resources would provide useful common ground for the design team and the school district at the outset of the procurement process, and could be leveraged by the Alliance.

Both these educational organizations have chapters within each state, as well as a national organization.

School Board Consultants

School board consultants offer their services to school districts that are seeking to pass bonds. The role of the consultant is to maximize the chance of the bond being passed by working with the school district, the design team and the local community to address the issues that concern each party. We spoke to one architectural firm that offers this service, and to one school superintendent who used to work as a consultant. We do not know how many similar consultants are working in the northwest states.

The superintendent has been approached by the Idaho Energy Division to work with them to advocate energy efficiency to school districts early in the procurement process, and he has expressed interest in working with the Alliance and others to develop resources that could be used by school districts to persuade school boards and their local community of the desirability of high performance schools.

Washington

As described in Section 0, the **Washington Department of General Services** (DGS) reviews the life-cycle cost submittals that school districts are required to make as part of OSPI's "D-form" funding process. The DGS is very conversant with the process as a whole, and DGS staff know which are the best points at which to intervene, and what the critical decision points are. DGS would be an excellent source of advice for Washington school districts that were looking to integrate the Sustainable Schools Protocol into their applications for OSPI funds. DGS would also be the obvious partner for the Alliance if the Alliance were looking to amend or add to OSPI's processes. One representative from DGS was on the advisory board for the Washington Sustainable Schools Protocol, so is already familiar with the Alliances' goals.

Washington State utilities provide several types of incentives and assistance to school design teams: **Tacoma Power** provides free design advice and DOE2 modeling, and plans to begin a non-residential new building incentive program in 2005, although the budget has not yet been approved. Incentives are expected to be linked to the building's hours of operation, so the amount of money available for schools would not be as high as for offices. Tacoma Power claims to maintain close relationships with school districts in Tacoma, and to know about new construction projects at the earliest stages. There seems to be potential for the new Tacoma Power incentive program to be integrated with the Alliance's goals in promoting high performance schools.

Seattle City Light already offers incentives for the installation of energy efficient equipment in new non-residential buildings, and for the development of a commissioning plan (though not for the actual commissioning costs). Seattle City Light also provides incentives for design teams to employ independent energy efficiency consultants; their efforts are primarily focused on encouraging design teams to adopt the LEED criteria ($15,000 incentive for LEED accreditation, plus an extra $5,000 if a silver rating is achieved). It may be possible for Seattle City Light to support the Washington Sustainable Schools Protocol in addition to LEED for new construction in schools.

There are several statewide associations for school professionals in Washington; these associations appear to be very active, and may be very useful to the Alliance in conveying the benefits of high performance schools to decision-makers. These associations all hold annual conferences, regional workshops and professional development meetings, and publish newsletters. These organizations are listed at the end of this section.

The **Oregon Department of Energy** (ODOE) runs a number of programs to encourage energy efficiency in schools. Firstly, ODOE has a team of energy advisors who work with school districts and who (by ODOE's admission) are not as specialized as the BetterBricks advisors. ODOE frequently requests the help of BetterBricks advisors in specific new school projects. Secondly, ODOE provides seminars for school designers and school district staff (at the annual conferences of the professional organizations listed below); these seminars could utilize the existing Alliance high performance schools presentation materials. Thirdly, ODOE runs a database of information about the energy consumption of existing schools under the “SB1149” program that could help the Alliance to estimate the magnitude of energy savings from specific energy efficiency measures, and perhaps to break this information down by climate zone, urban/rural location, school grade level, school size, etc.

The background to the SB1149 database is as follows: In 2002 the Oregon Legislature passed Senate Bill 1149 (“SB1149”) which introduced competition into Oregon's retail electricity market. The bill provides that Portland General Electric and PacifiCorp must collect a public-purpose charge from consumers equal to 3 percent of their total revenues. Ten percent of these public purpose funds must go towards energy efficiency efforts in the public schools within their service areas. The Oregon Department of Energy administers the school public purpose funds. The funds are only available for retrofit measures in existing schools, not for new school construction.

Under SB1149, every school in Oregon (except for those built within the previous three years) is subject to an annual audit of energy use density (kWh/sf), and this figure is used to determine whether the school is eligible for SB1149 funding. The energy use information is maintained in a statewide database. The SB1149 database was established in 2002 and now includes around 50% of schools in Oregon. Since the database contains “before” and “after” data on the energy consumption of schools that have undergone retrofit measures, this data could potentially be used to estimate the impact of energy efficient technologies and designs, to provide quantitative support for the measures in the Washington Sustainable Schools Protocol and the Alliance’s wider efforts to encourage high performance schools.

Additionally, the Oregon Department of Energy runs the following two incentive programs that can provide funding for new schools:

- The Energy Loan Program provides low-interest, fixed-rate loans for projects that promote energy conservation and renewable energy resource development. School districts receive special rates. The loans can be for almost any purpose, including new construction, and can also be used to finance energy evaluations of schools.
- The Business Energy Tax Credit Program allows public entities, including schools, to benefit even though they do not have an Oregon tax liability. A school applies for the tax credit, but includes an Oregon business or individual with tax liability in the process. The school can then pass-through the tax credit to the business or individual for a lump-sum payment equal to the net present value of the tax credit (currently set at 27 percent for projects with eligible costs over $20,000). Schools must recruit their own pass-through partners.

Rebuild Oregon is run by the Oregon Department of Energy. Since the Oregon DOE has dedicated programs for both new school construction and school remodeling, the Rebuild Oregon program concentrates on other building types, and may not be a useful resource for the Alliance.

Another major player is the **Energy Trust of Oregon** (ETO), which is responsible for administering the bulk of the money collected by the SB1149 tax. ETO has an energy efficiency program for new buildings, offering $0.10/kWh and $0.80/therm. To determine the level of incentive payments, the installed equipment is compared to standard equipment using modeling software. There is an incentive cap of $200,000 for new schools.

There are several professional organizations within Oregon, with whom the Oregon Department of Energy has previously collaborated to give seminars to educational professionals. ODOE staff reported that these seminars were very successful in stimulating interest in energy efficiency among school districts, albeit with a time lag of several years in some cases. Web addresses for these organizations are listed in Appendix E.

Idaho

The Idaho Energy Division runs the **Rebuild Idaho** program, which is active in promoting high performance schools throughout the state; Rebuild Idaho was responsible for bringing the Nampa High School project to the attention of the Alliance.

Rebuild Idaho has no budget to provide incentive payments, but works to encourage energy efficiency in two ways; firstly by arranging “roundtables” (these are separate from the roundtables organized by the Alliance) and other events intended to bring together designers, owners and energy specialists to find ways to incorporate energy efficiency into their specification and construction processes; and secondly by advising local designers and owners about energy efficiency information provided by the Rebuild America program (both online and in person), and about other locally available resources such as the Idaho Integrated Design Lab.

Rebuild America (of which Rebuild Idaho is a part) maintains a network of product manufacturers to provide presentations on energy efficiency to local architects and others; these presentations are to some degree product specific, but are a free and informative resource.

Rebuild Idaho also gives its own presentations (using resources developed by the Alliance) and works closely with the Idaho Power Company. Rebuild Idaho is already a useful resource to many Alliance programs; continued collaboration will provide further leverage to promote high performance schools.

The **Idaho Power Company** is the largest utility within the state, and is likely to establish an incentive program for nonresidential new construction within the next few months. There is currently no other nonresidential new construction incentive program in Idaho. The details of the program are not yet decided upon, but our interviews with staff at Idaho Power lead us to believe that it is likely to include new school construction.

The **Idaho Department of Education** is highly active in providing professional development courses for school district staff. It hosts an annual statewide conference for district superintendents, along with two other annual superintendents' meetings that are well attended. Speakers are invited to the two annual meetings but not to the August conference. Superintendents also attend regional meetings four to five times per year, in addition to the statewide meetings.

The **Idaho School Boards Association** is active in providing professional development courses for its members; it holds an annual conference and twice-monthly tele-training sessions, as well as a downloadable policy manual for members.

Web addresses for these organizations are shown in Web Site Listings.

Montana

The **Montana Department of Environmental Quality** (DEQ) administers the US Department of Energy State Energy Program in the state of Montana, and is responsible for providing incentives for energy efficient buildings. The DEQ's programs include only retrofit measures in existing buildings, rather than new construction. The DEQ provides 50% matching funding for "Preliminary Building Analyses" that help building owners to evaluate whether retrofit measures will be cost-effective. The DEQ interacts with the Alliance in the area of retrofit measures.

Despite the absence of new construction incentive programs, the DEQ could be a useful contact for the Alliance in the context of new schools because the DEQ regularly presents to school administrators at their annual statewide conference, and therefore has an existing channel of communication to school district staff.

In Montana, regulated utilities are required to collect "USB" system benefits charges from their customers to fund programs; these include the **Northwestern Energy** and **Montana-Dakota Utilities**. Only one of the Montana utilities, Northwestern Energy, runs a new construction incentive program; Northwestern's program is open to new schools, and incentives are based on the estimated avoided cost of electricity and supply. Northwestern Energy markets its program through its website and through its electricity bills (it could send out targeted marketing to schools), so the Alliance could leverage these marketing channels.

The **Montana School Boards Association** provides professional development courses for its members; it holds an annual statewide conference, a spring workshop and regional workshops.

Web addresses for these organizations are shown in Web Site Listings.

Web Site Listings

National Organizations

US EPA Energy Star Target Finder software:
http://www.energystar.gov/index.cfm?c=target_finder.bus_target_finder

Energy Smart Schools (Rebuild America)

www.energysmartschools.gov

American Institute of Architects

www.aia.org

American Association of School Administrators:

http://www.aasa.org/

National School Boards Association:

www.nsba.org

National School Boards Journal's section on "Learning By Design":

www.asbj.com/lbd/

Washington Organizations

Washington Association of School Business Officials

http://www.wasbo.org/

Washington Association of Maintenance and Operations Administrators

http://www.wamoa.org/

Washington Association of School Administrators (state branch of AASA)

http://www.wasa-oly.org/

Washington State School Directors' Association

http://www.wssda.org.

Oregon Organizations

Oregon School Boards Association (state branch of NSBA).

http://www.osba.org/

Confederation of Oregon School Administrators

http://www.cosa.k12.or.us/

Oregon Association of School Business Officials

http://www.oasbo.com/

Oregon Schools Facility Managers Association http://www.osfma.org

Idaho and Montana Organizations

Idaho School Boards Association (State branch of NSBA).

http://www.idsba.org/.

Montana School Boards Association (State branch of the NSBA).

http://www.mtsba.org/

Montana Department of Environmental Quality

http://www.deq.state.mt.us/energy/

APPENDIX F: CLASSROOM MODEL DESCRIPTION

A section of a school building with two classrooms and a central double loaded corridor was modeled. The classrooms have dimensions 30' by 30' and the corridor has a width of 12'. Floor to roof height is 13' with a ceiling at 10'. The classroom walls facing to the sides are considered as adiabatic (the classrooms have other classrooms with similar temperatures on either side). Both skylit and non-skylit classrooms were modeled. In the skylit model, four skylights are spaced 15' o.c., and 7'6" from the perimeter walls. The reference point is positioned in the center of the classroom at 2'6" from the ground and equidistant from the skylights.

A normal classroom construction that meets the Washington State Nonresidential Energy Code in each Climate Zone1[1] was modeled. Wall construction has a U-factor of 0.084. Roof construction has a U-factor of 0.036, with acoustic tile ceiling finish on the interior, and a built up roof finish on the exterior, with a 0.6 absorptivity. The classrooms have a 25% window to wall area ratio (three - 5' by 5' tall windows), with code compliant windows having a U-factor of 0.55 and a SHCG of 0.40. The classrooms have a carpeted 6-in. concrete slab with R-10 perimeter insulation.

Assuming an occupancy of 30 sf/person, the classroom has 30 people, 1.2 W/sf lighting load, and 0.6 W/sf plug load. Lighting setpoint will be back calculated using SkyCalc. The schedule considered will be a normal school schedule from SkyCalc. The cooling equipment will be 9.7 SEER[2] (EER=9.4 or EIR=0.3629).

[1] Seattle Energy Code Chapter 13: Building Envelope, TABLE 13-1 Building Envelope Requirements for Climate Zone 1. (Reference: http://www.ci.seattle.wa.us/dclu/energy/nonres/CHAP13.htm#T131)

[2] Seattle Energy Code Chapter 14 (Ref: http://www.ci.seattle.wa.us/dclu/energy/nonres/Tables14.htm)

APPENDIX G: NBI'S WSSP ENERGY PERFORMANCE ANALYSIS

		Tacoma (Seattle)		
		ASHRAE_ECO	WA_ECO	ABG_ECO
Electric (kBTU/sqft/yr)	Total	22.98	21.01	17.72
	Area Lighting	12.79	10.85	8.21
	Plug Loads	4.42	4.42	4.42
	Heating	0.00	0.00	0.00
	Cooling	0.87	0.84	0.65
	Pumps	0.03	0.03	0.03
	Fans	4.88	4.87	4.41
	DHW	0.00	0.00	0.00
Gas (KBTU/sqft/yr)	Total	29.79	32.68	32.24
	Area Lighting	0.00	0.00	0.00
	Plug Loads	0.00	0.00	0.00
	Heating	23.33	26.22	25.78
	Cooling	0.00	0.00	0.00
	Pumps	0.00	0.00	0.00
	Fans	0.00	0.00	0.00
	DHW	6.46	6.46	6.46

		Spokane		
		ASHRAE_ECO	WA_ECO	ABG_ECO
Electric (kBTU/sqft/yr)	Total	24.41	22.40	19.00
	Area Lighting	12.79	10.85	8.21
	Plug Loads	4.42	4.42	4.42
	Heating	0.00	0.00	0.00
	Cooling	1.41	1.43	1.11
	Pumps	0.03	0.03	0.03
	Fans	5.76	5.67	5.22
	DHW	0.00	0.00	0.00
Gas (KBTU/sqft/yr)	Total	42.26	44.15	44.57
	Area Lighting	0.00	0.00	0.00
	Plug Loads	0.00	0.00	0.00
	Heating	35.61	37.50	37.92
	Cooling	0.00	0.00	0.00
	Pumps	0.00	0.00	0.00
	Fans	0.00	0.00	0.00
	DHW	6.65	6.65	6.65

		Tacoma (Seattle)		
		ASHRAE	WASEC	ABG
Electric (Percent Diff.)	Total	**0.0%**	**8.6%**	**22.9%**
	Area Lighting	0.0%	15.2%	35.8%
	Plug Loads	0.0%	0.0%	0.0%
	Heating	0.0%	0.0%	0.0%
	Cooling	0.0%	3.3%	25.5%
	Pumps	0.0%	0.0%	0.0%
	Fans	0.0%	0.1%	9.7%
	DHW	0.0%	0.0%	0.0%
Gas (Percent Diff.)	Total	**0.0%**	**-9.7%**	**-8.2%**
	Area Lighting	0.0%	0.0%	0.0%
	Plug Loads	0.0%	0.0%	0.0%
	Heating	0.0%	-12.4%	-10.5%
	Cooling	0.0%	0.0%	0.0%
	Pumps	0.0%	0.0%	0.0%
	Fans	0.0%	0.0%	0.0%
	DHW	0.0%	0.0%	0.0%

		Spokane		
		ASHRAE	WASEC	ABG
Electric (Percent Diff.)	Total	**0.0%**	**8.2%**	**22.2%**
	Area Lighting	0.0%	15.2%	35.8%
	Plug Loads	0.0%	0.0%	0.0%
	Heating	0.0%	0.0%	0.0%
	Cooling	0.0%	-1.6%	21.3%
	Pumps	0.0%	0.0%	0.0%
	Fans	0.0%	1.5%	9.3%
	DHW	0.0%	0.0%	0.0%
Gas (Percent Diff.)	Total	**0.0%**	**-4.5%**	**-5.5%**
	Area Lighting	0.0%	0.0%	0.0%
	Plug Loads	0.0%	0.0%	0.0%
	Heating	0.0%	-5.3%	-6.5%
	Cooling	0.0%	0.0%	0.0%
	Pumps	0.0%	0.0%	0.0%
	Fans	0.0%	0.0%	0.0%
	DHW	0.0%	0.0%	0.0%

APPENDIX H: THEORY AND LOGIC MODEL

This section presents two versions of the schools logic model.

Figure 15 shows the Alliance's "Schools Modified Logic Model", provided in the Request for Proposals for this evaluation. The activities undertaken by the Alliance are shown in non-italics, and evaluation activities are shown in italics.

Figure 16 is our proposed modification to the existing logic model. In this model, a link is created between each strategy and the tools and materials required to achieve it. It splits each strategy into two stages (more stages can be added as each task develops), and gives progress indicators for each.

Our recommended strategies are based on two primary roles of the Alliance schools activity:

- Provide technical and didactic resources to aid school decision-makers in increasing support for high performance schools and the WSS Protocol among their peers.
- Co-ordinate the work of BetterBricks advisors, to provide integrated design services in support of high performance schools on a case-by-case basis.

A. Tool and Materials Development	B. Strategies	C. Near-Term, Discrete Success Indicators (6-12 months)	D. MT Indicators (One year or more)	E. Overall MT Goals in 2010
A1. Establish a rating system in Washington that defines high performance schools with a strong energy efficiency component. *(Document efficiency level; should it be used for other states?)* A2. Develop model implementation "guidelines", including multiple classroom prototypes in various construction cost categories, that provide practical explanations of how to achieve HP goals. *(Document status and development issues)* A3. Develop integrated training curriculum, to promote awareness of HP schools, rating systems and implementation guidelines. *(Document status and development issues)* A4. Develop marketing collateral material including two to three strong case studies. *(Document status, development issues)*	B1. Outreach with Alliance staff and contractors. B2. Marketing and Communication. B3. Training. B4. Technical Assistance.	C1. In WA, high-growth districts and/or OSPI use the rating system and implement it in 5 schools: 2 in 2004 (160,000sf); 3 in 2005 (240,000sf) *(See C2 for evaluation.)* C2. Provide design and other assistance for the construction of HP schools in 1-3 high growth districts in both WA and ID. *(Document assistance provided to each project and changes resulting from our support. (Should be available in BB project database.)In ID, document process/interaction with Meridian and Nampa school districts and use of integrated design process.)* C3. Integrated training curriculum is implemented by BB contractors. *(Document activities plus trainer and participant satisfaction)* C4. Rating system with strong	D1. Attitudes and practices of the key people at the state and district level, including superintendents and capital project staff, are changed to be more knowledgeable about and aware of items covered in the baseline survey – daylighting, natural ventilation, financial impacts, lighting controls, rating systems, etc. *(Repeat baseline survey.)* D2. Rating system with strong energy efficiency components, high-performance schools policy, and the business case for school districts is developed for OR. *(Document status, development issues and relationship to WA and ID standards)* D3. High performance schools policy exists in MT. *(Document status, content, compare to other state standards)* D4. After D2 is accomplished, rating systems are used in high-growth school districts in OR and MT. D5. In WA, OSPI and high-	E1. 22% of new school sf is HPS (over a baseline of 5% in that year). (Verify) E2. 5.2M cumulative sf (over baseline) will be HPS. (Verify) E3. High growth school districts in all states have adopted rating systems with stringent energy components and construct HP schools as standard practice. *(Verify)*

A. Tool and Materials Development	B. Strategies	C. Near-Term, Discrete Success Indicators (6-12 months)	D. MT Indicators (One year or more)	E. Overall MT Goals in 2010
A5. Identify school districts and design teams to pursue. *(Review list from baseline survey plus whoever else has come to attention, e.g. Meridian)*		energy efficiency component and the business case for school districts is developed for ID. *(Document status, efficiency levels, development issues and relationship to WA standard)* C5. Model implementation guidelines are used by design teams. *(Assess use by and usefulness to target audiences.)*	growth districts adopt the rating system as official policy. *(Determine that constructed schools meet requirements of the adopted policy and verify energy savings.)* D6. Provide design and other assistance for the construction of HP schools in 1-3 high-growth districts in both OR and MT. *(Document assistance provided to each project and changes resulting from our support. Should be available in BB project database.)*	

Figure 15 - Modified Schools Logic Model

Strategy	Stage	Tools and Materials Development	Progress Indicators	Timeframe
A: Peer-to-peer diffusion of information about the benefits of high performance schools	A1: Cultivate a group of superintendents in Washington, Oregon, Idaho and Montana who are supportive of high performance schools	Audit / commission existing buildings and present results to superintendents and operations managers in situ. Also case studies, cost studies, classroom prototypes, Alliance staff to speak at conferences	Recruit 10 superintendents who actively promote the idea to their peers	(6-18 months)
	A2: Use this group of superintendents to convince their peers of the value of high performance schools	As per stage 1 but refined from experience and feedback. Superintendents speak at state and regional meetings	Superintendents are invited to speak at 1-2 meetings per year each.	(18-36 months)
B. Washington Sustainable Schools Protocol	B1: Establish a rating system in Washington that defines high performance schools with a strong energy efficiency component.	Draft of Washington Sustainable Schools Protocol. B2. Provide design and other assistance for five pilot schools B3. Case studies of five WA pilot schools	B2. Protocol refined as a result of design team experiences and monitored energy performance of pilot schools	(6-18 months)
	B3: Integrate WSSP into OSPI's process for providing new school construction funding, such that new schools must be constructed according to the protocol to receive state funds or incentives.	?	success	(18-36 months)

Strategy	Stage	Tools and Materials Development	Progress Indicators	Timeframe
	Collaborate with WA DGS on marketing the results of the five pilot school projects to Washington school districts	TBD in conjunction with DGS	TBD in conjunction with DGS	(6-18 months)
	B4: Review applicability of WSSP to ID, OR and MT. Adapt if necessary, or develop new protocol.	Case studies	Draft of ID, OR and/or MT HP schools protocol	(18-36 months)
C. Encourage architects that specialize in schools to schedule a training session with a BetterBricks advisor, to cover technical issues surrounding high performance	C1. Contact school architects throughout the Northwest to schedule BetterBricks training,	BetterBricks advisors, case studies as per 1 and 2	20 new architecture firms specializing in schools receive training from a BBA	(6-18 months)
	C2. Contact school architects throughout the Northwest to schedule BetterBricks training,	BetterBricks advisors, case studies as per 1 and 2	20 new architecture firms specializing in schools receive training from a BBA	(18-36 months)
D. Continue to provide project-specific design assistance to design teams, as per the Nampa project	D1: In co-ordination with other agencies, identify new school design projects in OR, ID and MT early in their development, and assign a BBA to the design team to provide assistance. BBA should discuss proposed measures with contractor as early as possible.	BetterBricks Advisors, case studies and cost studies as per 1	10 new school projects receive input from a BetterBricks advisor.	(6-18 months)
	D2: As per stage 1	As per stage 1	As per stage 1	(18-36 months)

Strategy	Stage	Tools and Materials Development	Progress Indicators	Timeframe
E. Provide resources to contractors, to allow them to price and install high performance measures successfully	E1. Provide training through existing professional development courses run by contractors' organizations.	Contractor-specific training. Example pricing of high performance measures Include contractors in design team meetings in strategy D	TBD in conjunction with contractors' professional organizations	(6-18 months)

Figure 16 - Proposed Program Logic Model