energy design resources

design brief

PERFORMANCE-BASED COMPENSATION

Summary

Designing highly energy efficient buildings may require more time and money up front than designing structures that merely meet Title 24 energy requirements, but the resulting energy efficient structures generally cost much less over their lifetimes. Unfortunately, conventional fee structures paid to designers and contractors tend to provide economic incentives to minimize building costs, without regard for strategies that reduce lifetime operational and energy costs. This raises an interesting hypothesis: If fees were adjusted to reward design professionals for the amount an energy efficient facility would save the owners in the future—instead of the amount they spend today—the economic interests of the design team and the owner would be more closely aligned, and the result should be more efficient buildings.

Toward testing this concept, several buildings have been constructed with the intention to reward the design team if measured energy use after project completion falls below an agreed-upon target, and to penalize designers if it is above a certain threshold. Initial experiments demonstrate that all parties need to reach agreement as quickly as possible about two key issues: specifying performance thresholds and measuring the actual energy use of the finished building. Additionally, designers emphasize the importance of collaboration within the project team, the members of which should be united in their enthusiasm for achieving a high-quality product.

If fees were adjusted to reward design professionals for the amount an energy efficient facility would save the owners in the future—instead of the amount they spend today—the economic interests of the design team and the owner would be more closely aligned, and the result should be more efficient buildings.

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Introduction

In their search for techniques to improve the energy efficiency of buildings, several investigators have taken a look at the conventional design-and-construction process that's widely used throughout the construction industry. Although this process is the standard model that guides the interactions of developers, architects, contractors, and other industry stakeholders, interviews with these stakeholders provide strong evidence that dissatisfaction with the process is widespread (see sidebar).[1] The biggest objection of stakeholders seems to be that fierce competition and poor communication distract them from accomplishing their foremost goal: producing buildings that are attractive, comfortable, productive, and efficient.

Although there is no panacea for these institutional ailments, a number of design professionals are working on some promising

Stakeholders' Viewpoints on Conventional Commercial Building Projects

The following comments —as characterized by the Collaborative Process Institute—express some of the dissatisfaction of building stakeholders.[2]

Owners

"I feel like a referee between the designers and the builders."

"No one cares anymore about client service."

"No matter how hard we try, we always end up paying for something we don't need and needing something we didn't get."

Builders

"I'm often told to build details that make no sense, details I could improve upon if someone would just ask me."

"As for change orders, we have to try to get as much as we can on changes, since everything is bid out and if you don't play the change order game, someone else will and soon you'll be out of business."

Designers

"Owners don't realize what it takes to develop the level of service they want. Fees are not adequate to support the necessary effort."

"Contractors are no longer builders; they're claims specialists."

"I still love to design, but I'll tell you: this business is no longer about creativity; it's about protecting yourself from being sued."

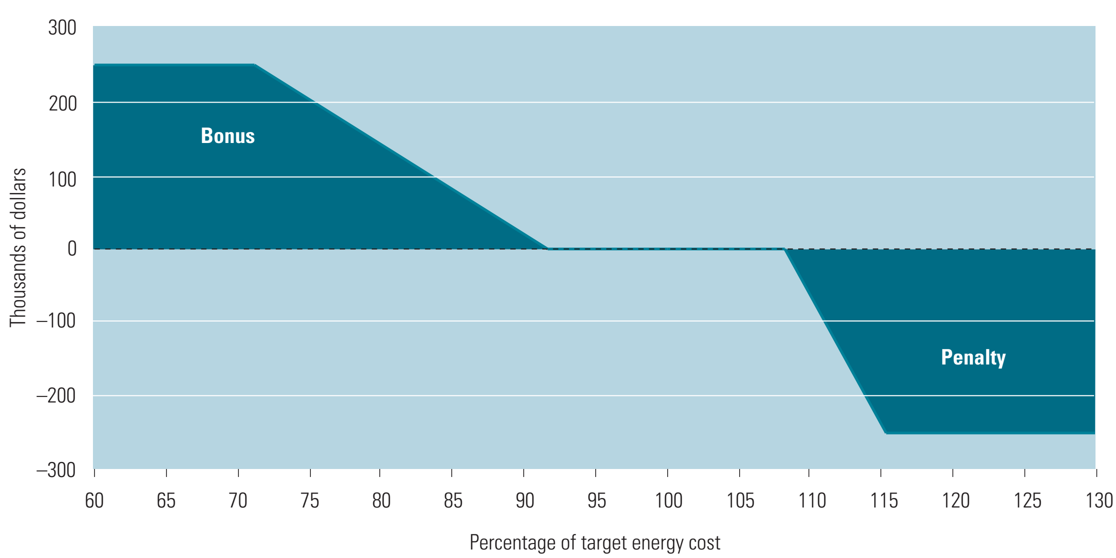
"The contractors weren't evil, but they didn't quite deliver."

alternatives. One approach is to create financial motivation by rewarding or penalizing architects and engineers for exceeding or failing to meet energy efficiency targets based on the measured performance of the final building (**Figure 1**).[3] A related approach is the collaborative partnership process, which utilizes specific tools and systems to build integrated teams and processes that result in accountability, trust, and financial success. This method may also incorporate financial signals, but it places a greater focus on the process of developing high-performance teams to pursue commonly determined goals.

The principal aim of the financial-incentives methodology is to maximize the likelihood that the resulting building will be as energy efficient as practical. Supporters of the collaborative design process assert that this model produces more successful buildings that are completed within costs and to owner specifications and result in less litigation, fewer change orders, and overall happier clients. In theory, the successful achievement of

Figure 1: Sample of a reward/penalty curve

The target baseline energy use for this example is represented by 100 percent on this graph, with a leeway of plus or minus 8 percent where no bonus or penalty comes into play. If building energy should prove to be less than 92 percent of the target amount, a bonus fee for the added savings will be paid on a graduated scale up to some maximum; in this case, $250,000. If, however, energy use exceeds 108 percent, penalty fees will be assessed at a rate three times as great as the bonus fee schedule; again, the limit for the penalty is capped at some upper limit, which in this example is $250,000.



Source: Eley Associates [3]

either efficiency or customer satisfaction—preferably both—will go a long way toward achieving all of these desirable goals.

As the following case studies show, building projects using well-coordinated teams of individuals—who have the proper motivation to produce effective buildings—entail numerous challenges. These include timing, communication, data management, and risk sharing. The results from early experimentation do not show that this approach is a cure-all for inefficient buildings and adversarial relations among designers, builders, subcontractors, and owners. However, these cases do provide some useful lessons and reason for optimism that there will be better solutions in the future.

The key to effective buildings lies in reforming the fee structure that determines what architects and engineers receive for their services.

Performance-Based Compensation

According to Amory Lovins, cofounder of the Rocky Mountain Institute, the key to effective buildings lies in reforming the fee structure that determines what architects and engineers receive for their services. There is plenty of room for restructuring, because "the present-valued energy cost of a typical modern office building is ten to a hundred times its total design fees."[4] When designers are compensated for the performance of the buildings they design, a fresh approach to the process frequently emerges.

The process for incorporating performance-based compensation into new building contracts includes the following steps:

- Establish a reliable energy model to determine the baseline- and target-energy specifications.
- Establish a penalty/reward structure based on the data from the energy model.
- Establish a measurement and verification (M&V) plan.
- Detail the penalty/reward structure and the M&V plan in the contract.

- Carry out the M&V and pay the reward or collect the penalty, depending on actual performance.

An early application of this method began in 1995 when the City of Oakland, California, awarded a competitively bid contract to a team to design two new administration buildings totaling 450,000 square feet (ft^2) of conditioned space. Prior to the selection of the team, Eley Associates—an energy consulting firm—had developed building energy targets using DOE-2. The contract specified a minimum level of energy performance, requiring the design-build team to compensate the city for added operating costs if those targets were not met.

Energy performance targets are determined by the owner and the design team and are specified in the contract.

The energy target accounted for weather, plug loads, hours of operation, occupancy, and other parameters, and it included a buffer of $20,000 within which there would be no incentive or penalty. The penalty was set at 15 times the amount that actual annual energy costs exceeded the target, while the reward would be five times the amount that annual costs fell below the target, and the reward or penalty would be capped at $250,000.[5]

The final version of the building simulation model set the electrical energy target at 4.5 million kilowatt-hours (kWh) per year and the gas energy target at 40,000 therms/year. This corresponds to a target energy cost of $458,300, or $1.02/ft^2. According to the project final report, the actual electric energy consumption is approximately 4.1 million kWh/year—about 9 percent lower than the target—while the gas consumption is about 74,000 therms/year, which is 85 percent greater than the target. The total energy cost is $441,340/year, which equals a respectable $0.98/ft^2. Thus, the building is performing somewhat better than expected, costing $16,960/year less than the target. Much of the savings resulted from energy efficient fans and their controls, and daylighting controls also seem to have contributed to above-target savings. The chiller equipment is efficient but appears to be oversized for the maximum load presented by the building. However, the savings are within the energy target deadband, so there will not be any bonus paid or penalty assessed.[6]

Scott Wentworth, energy engineer for the City of Oakland and a former design-build engineer, describes the essence of the process: "Our principal aim was to use incentives to establish responsibility by linking project objectives with the building's performance."[7] Wentworth's vision included detailed data acquisition and analysis for measuring the building's performance over time and assessing the subsequent penalty or fee.

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City of Oakland
Municipal Buildings Division

Brian Hill, project manager for Hensel Phelps Construction Co., claims that the project plan was nice in theory, but it was so complex that the people working on the project didn't understand it well enough to implement it as fully as desirable. For example, the electrician made decisions about what to meter without having a clear view of what was needed. As a result, there was a delay in installing the data acquisition system, and it was a challenge to find the precise circuits to measure in order to validate all appropriate parameters.

Another aspect of the Oakland project that proved difficult was building commissioning, which was complicated by the fact that an industrial hygienist required the owners to operate the building for some time with 100 percent outside air, instead of recirculating about 80 percent of space-conditioned air (which is how the building is operated under normal circumstances). This reduced the heating, ventilation, and air conditioning (HVAC) system efficiency and skewed the monitoring data.[8] It also complicated the M&V process.

From Wentworth's point of view, incorporating financial motivation into the contract had a positive impact on the building process by promoting shared responsibility and encouraging contractors to meet the specifications through a more innovative approach, such as installing variable-speed pumps on the chilled water system and perimeter daylighting controls. But it was apparent that despite the reward/penalty agreement, contractors were still averse to taking risks. For instance, the chillers that were installed may have been larger than necessary and therefore not optimal for energy efficiency, despite the recommendations flowing from engineering models for smaller units. By installing a larger chiller, the contractor avoids the risk of the user complaining about inadequate cooling on the hottest days of the summer, but the owner also inherits higher energy bills throughout the cooling season. Figuring out who should take which risks and when remains a quandary that cannot be solved by financial motivation alone.

Wentworth believes that risk barriers are better approached through improved communication and collaboration. In order to create an environment in which participants feel safe to accept risk, designers need to educate owners about how much risk they are taking by designing for optimum efficiency—such as smaller chillers—and owners need to be willing to live by their decisions, which may include adding chiller capacity later if occupancy patterns change. Part of this can be accomplished by more explicit contracts, but it is more important to take time up front to establish effective collaboration among the designers, contractors, and owner.

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In the end, Hill and others seem pleased to have completed a notable, energy efficient building that has won both a Design-Build Excellence award and a Gold Nugget award (see **Figure 2,** next page).[9] Additionally, both Hensel Phelps and the City of Oakland qualified for financial incentives from the Pacific Gas and Electric Company (PG&E) to offset the increased cost of the energy efficiency features.

Collaborative Theory

The Collaborative Process (TCP) expands on the process side of the reward/penalty model by focusing on cooperation and understanding among the players. TCP was developed by the Collaborative Process Institute (CPI), a voluntary organization

Figure 2: The Oakland Administration Building

The new construction and historic preservation portions of the Oakland Administration Building total 540,000 ft^2, which includes 37,000 ft^2 of retail space and a 90,000-ft^2 parking garage.

Source: Scott Wentworth, City of Oakland [9]

made up of architects, designers, contractors, builders, and owners to provide an alternative to traditional building design and construction processes that pit the different parties against one another.[10] Although the collaborative process is not focused on the energy efficiency aspect of new buildings, it offers some insight into overcoming common barriers—such as inadequate communication and cooperation among stakeholders—that hamper good building design and construction.

As Jack Damonte, a San Francisco architect and secretary for CPI explains, "If we're not drawing defensively, then everyone ought to benefit. The insurance rates ought to be lower, the cost to the owner should be lower, and the quality should be higher."[11] A key aspect of the process is making sure that the building owner is included in design team discussions from the beginning. This helps ensure that everyone is working toward the same goal.

The cornerstone of TCP is the high-performance team built to encourage collaborative processes, accountability, trust, and financial alignment of business practices to ensure success for each team member. Some of the key tenets of TCP are:

- Build teams thoughtfully and systematically.
- Act on the premise that teams make better choices than individuals.
- Form contracts that support collaboration and high-performance team concepts.
- Articulate common purposes by forming specific goals, and use them to foster momentum and commitment.
- Maximize the likelihood of good design by developing a wide range of solutions to problems. (Bad design is not the result of selecting the wrong item from a list of possible solutions but from starting with too short a list.)
- Evaluate the team's success at achieving project goals by gathering feedback and monitoring building performance.[12]

Members of the CPI have applied the collaborative process model in various situations, with varying degrees of success. A $25 million project—the Mechanical Engineering Laboratory Building currently in construction at Stanford University—is the result of such a process (**Figure 3,** next page).[13] The success of this project is not measured in building energy savings. Rather, it is evaluated on the degree to which all stakeholders can agree upon the project's goals and complete the building to each person's functional, aesthetic, and financial satisfaction.

Beginning with the selection of the architect (Damonte), the Stanford team expanded by selecting the other players one by one, including the contractor, the mechanical/electrical design consultant, the critical subcontractors, and others important to the design process. During the project's commencement, work

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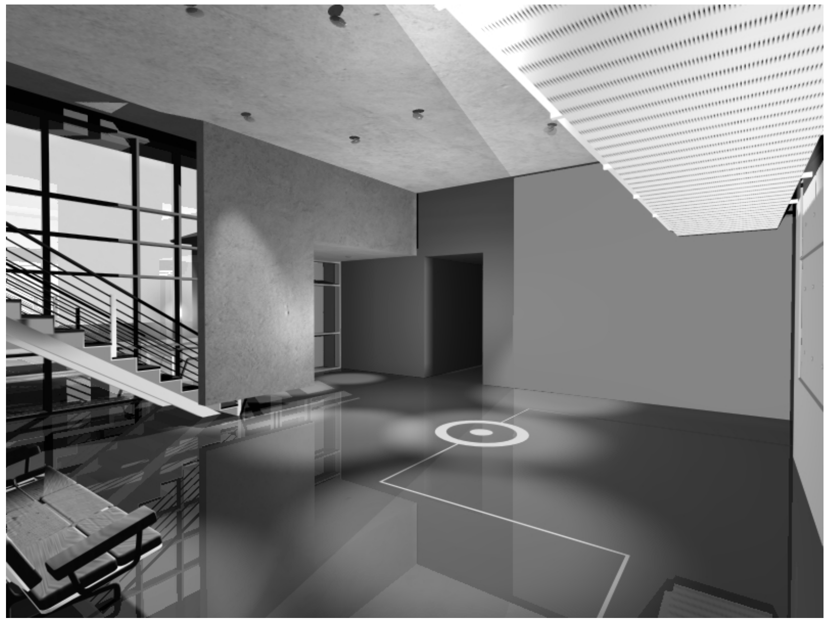
Figure 3: Stanford Mechanical Engineering Laboratory Building

This rendering shows the interior lobby of the Stanford University Mechanical Engineering Laboratory Building, which is now under construction. The floor finish includes a block-out depression for a plaque to memorialize the thrust of science as it currently exists for this department.



Source: MBT Architecture [13]

consisted solely of meetings where the team defined the goal and mission of the project without getting bogged down in schedules or budgets. "We were pretty hard on ourselves," reports Damonte. "It's critical to create that time and protect it so that everyone's on the same page and you don't end up repeating past problems."[14]

Cooperating with faculty, the team came up with innovative designs for accommodating a variety of laboratories and testing facilities within one building. One task in particular—designing an engine testing lab below a biomechanical engineering lab-presented a technically unique challenge for the team. The collaborative approach to the project enhanced the ability of the team to solve this difficult problem.

When the team lost a member several months into the design process, the group was shaken and set back by others' attempts to change plans midstream. Another challenge arose when the mechanical designer and mechanical contractor were unable to cooperate effectively and resorted to "defensive drawings" (which occur when parties compete against each other in the design process for the cheapest plan). Although having such critical entities work together should, in theory, save time and money, this type of collaboration is difficult to achieve in practice.

Construction will be complete early in 2001, and Damonte is convinced that the final product will be a good design. The process may not have gone exactly according to plan, but Damonte is clearly proud of the fact that this project was successful by virtue of having a strong, talented, and committed team. Furthermore, the project is on time and on budget—a rarity in the history of building projects for the university.

MBT Architecture completed a $30 million laboratory, for which the documented change-order rate at the end of the project was one-half of one percent.

Prior to the Stanford project, Damonte's firm had worked on a building for the biotech company ALZA Corp. in Mountain View, California, using a model similar to the collaborative process. The group completed a $30 million laboratory, for which the documented change-order rate at the end of the project was one-half of one percent. To put this into perspective, Damonte compares this rate to university projects in which a 5 percent change-order rate usually gets an A grade from the owner. As the change-order rate approaches 10 percent, the design team is at risk of a lawsuit by the owner. "Half a percent is unheard of," says Damonte. Besides, he adds that the building design was "a remarkable, fun experience."

Although there aren't a hundred examples of TCP in practice, a handful of such projects are under way. One of the founders of CPI, Stuart Eckblad, is implementing many of the collaborative ideas at Kaiser Permanente in California where he now works. Another board member, Jeff Gee, who belongs to the facilities group at University of California–Berkeley, is trying to change the paradigm there from a pure low-bid approach to a negotiated approach. Damonte will be providing professional guidance to UC-Berkeley graduate students in for-credit research projects using the Stanford building project as a case study.

The reduction in the number of change orders results in tangible savings for building owners. Additionally, CPI has drawn interest from larger groups such as the Design-Build Institute of America (DBIA), which approached CPI about becoming a subcommittee, and the Design Professional Insurance Corp. (DPIC), which has expressed an interest in the organization because it recognizes the collaborative process as a way to reduce excess costs down the road.

TCP depends on goodwill and good management, and the lack of either can undermine the process.

On the downside, because—like all design projects—TCP depends on goodwill and good management, the lack of either can undermine the process. Those who are managed need to feel that they are working together in a collegial fashion for the common end of producing an excellent building. If this fails, the process can deteriorate, as was the case with the Stanford project when the team lost a critical member and contractors were not centered on the same goals for a while.

It is estimated that the Clackamas High School building will use 44 percent less energy than a building built to meet Oregon's stringent energy code.

Upside Rewards with Collaboration

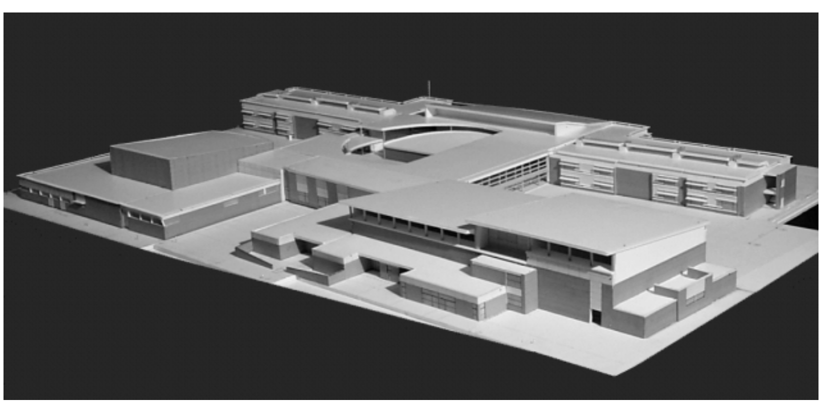
A new 275,000-ft^2 high school slated to serve 1,800 students in North Clackamas near Portland, Oregon, will be completed in summer 2001. It combines a collaborative approach with "upside" performance bonuses, which means that the design team will be rewarded for exceeding the target but not penalized for failing to meet it. The design team is united in its enthusiasm for producing a very energy efficient structure that is educational in several senses of the term. With help from Eley Associates and the Rocky Mountain Institute to establish and analyze the performance of potential energy efficiency measures, it is estimated that the building will use 44 percent less energy than a building built to meet Oregon's stringent energy code. While the structure is still under construction, Eley has made DOE-2 runs showing that the annual energy use of a building built to code would average $109,300, whereas the building as designed should have an annual energy bill of about \$70,000, which is less than 40 cents per ft^2 (see **Figure 4**).[15]

"We feel that this is a conservative number and we can do even better,"[16] claims Boora Architects' Heinz Rudolf, leader of the design team. If they do, the performance clauses in the contract with the local school district will kick in. These call for the savings achieved over this target for the first two years of the building's operation to be shared 50/50 by the design team and the school district. The three main players involved in the project—Boora, the engineering firm, and the owner—will share the performance bonus. Although the bonus is not likely to amount to more than about \$20,000, the team has already been paid \$100,000 to compensate them for special design work to achieve the 44 percent savings over baseline.

And what happens if for some reason the 44 percent savings goal is not met? "Our reputation will suffer," says Rudolf, who is clearly intent on averting this possibility on behalf of his design firm and all of the other members of the project team. "All of

Figure 4: Rendering of the northwest elevation of Clackamas High School building

The Clackamas High School is designed as an energy-efficient "green" building with natural ventilation and daylighting, and many recycled materials are being used in its construction. It is located on a 42-acre plot, preserving wetlands and native plants. Thus it will serve as a full-scale teaching aid that illustrates sustainable architecture in many practical details.



Source: Boora Architects Inc. [15]

our consultants are optimistic, committed to the process, and interested in the research aspects of the project."[17]

Natural lighting and natural ventilation are key elements of the building design. The building layout includes several courtyards, which both enhance natural ventilation performance and allow most rooms to have natural light. All classrooms have large glazing surfaces, typically 7 ft high by 18 ft long. Lower glazing elements have specularly selective glazing to limit glare and give good thermal performance; upper glazing surfaces are virtually clear to allow plenty of natural light to be bounced off interior light shelves onto white ceiling tiles. Backup lighting from a pair of high-output T-5 fixtures also bathes the ceiling, so both natural and electric lighting result in glare-free, indirect illumination. Louvers below the glazing surfaces may be operated manually from inside each room to control the flow of ventilation air without risking the entry of either rain or intruders (see **Figure 5**).[18]

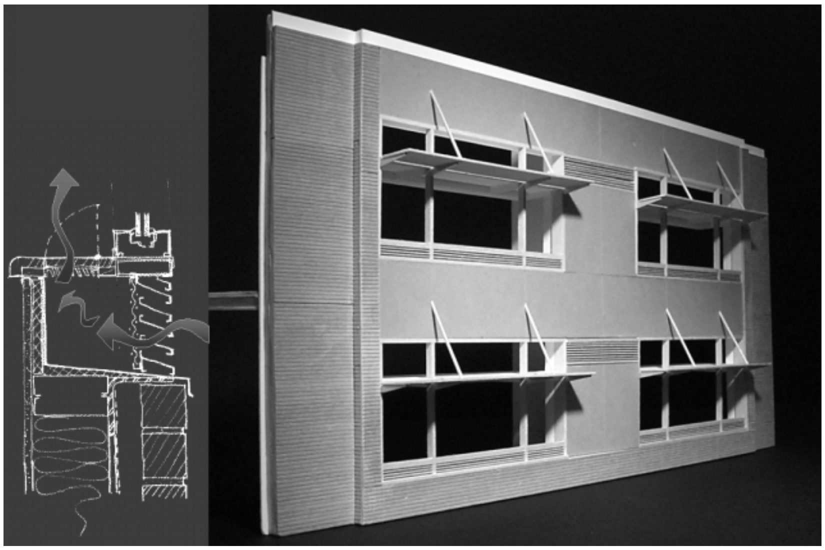
The design team was encouraged by the fee structure and attitude of the school district to explore innovative, practical, energy efficient design features.

There are several novel aspects to this evolving project that herald a good product. First, the design team was encouraged by the fee structure and attitude of the school district to explore innovative, practical, energy efficient design features. In addition, Portland General Electric Co. (PGE), the local power company, underwrote experimentation at the daylighting lab in Seattle and on the building site itself to ensure that the lighting and ventilation systems would perform well. "We built a 1,000-ft^2, full-scale mockup of a classroom, orienting it on site exactly as it would be in the completed building," Rudolf explains. In controlled experiments, the room experienced 1,000 cubic feet per minute of natural ventilation with an indoor-outdoor temperature difference of only 20° Fahrenheit. The daylighting system also worked well, and the pair of high-output T-5 fixtures produced nighttime illumination levels at desktops of 50 foot-candles.

These innovations, coupled with good insulation and air-sealing details, led to the downsizing of both boilers and chillers. The

Figure 5: Natural ventilation and daylighting detail for Clackamas High School

Supply air for the natural ventilation system comes from below the windows through a set of louvers. A mechanical damper above the inside grill controls flow. The light shelves that extend to the inside serve to both distribute light across the white interior ceiling, which diffuses it to the desktops below, and guard against glare from direct sunlight.



Source: Boora Architects Inc. [18]

resulting savings in initial cost partially defrayed the cost of more efficient windows and the daylighting scheme. A simple two-pipe fan coil unit is installed in ducts above the ceilings of classrooms and other spaces. This is used to supply heat in the winter, but because classrooms and the gymnasium are normally not cooled at all, the chiller is sized to serve only offices, the auditorium, and a media center. However, if the gym needs cooling for a special event or second-floor classrooms need cooling, this can be accomplished via the same two-pipe system, trading off some cooling from common spaces.

A detailed building commissioning process will take place as the Clackamas High School nears completion. Building commissioning for new schools is not the routine in Oregon, but special support from the Oregon Department of Energy and the local utility will make a thorough commissioning possible. In addition to ascertaining that all systems are functional and light-

Several aspects of the Clackamas High School project increase the likelihood of a building that meets everyone's expectations: a dedicated design team, good collaboration and common goals with the owner, rigorous modeling for optimal efficiency, detailed contract language, and financial motivation.

ing controls are calibrated, the building commissioning engineering firm will verify the performance of the energy management system (EMS), which will play the dual role of controlling systems and measuring energy use. To determine the degree to which energy performance targets are met or exceeded, outdoor lighting, plug loads in offices and the kitchen, and kitchen and shower hot-water use are excluded, since these depend on occupancy patterns that are quite variable and impossible to predict years in advance. These and other ground rules are clearly spelled out in detailed contractual documents, which should simplify electrical work and expedite quantifying energy performance (see sidebar). All parties involved in the project seem united in sharing the goal of achieving a building that will serve students comfortably for many years and will have low energy costs.

In summary, the Clackamas High School project is another example of an experiment-in-progress using performance-based compensation. Although no performance figures are available yet, several aspects of the project increase the likelihood of a building that meets everyone's expectations: a dedicated design team, good collaboration and common goals with the owner, rigorous modeling for optimal efficiency, detailed contract language, and financial motivation.

Lessons and Recommendations

Although the theory of incorporating collaborative teams and performance-based compensation into the building process is not new, the techniques are still being tested and refined on real-life projects. The conclusion for now is that successful projects depend on a number of critical factors. These include the following:

Timing. Timing is crucial to developing collaboration and arranging for a reward/penalty payment process. "There is a narrow band of opportunity before contracts with the design team are finalized to perform an energy model and establish the

The Performance Contract Between North Clackamas School District No. 12 and Boora

The Performance Contract supplements the traditional professional services agreement between the owner and the architectural/engineering (A/E) firm. The prologue to the Performance Contract stresses the commitment of the School District to "architectural lighting, HVAC, and energy management systems that operate efficiently, provide a high quality of occupant comfort, and are easily maintained and serviced."[19] Key features follow:

- *Compensation and target*—The owner agrees to compensate the A/E firm an additional $104,575 for the services needed to achieve the target level of performance. In the event that the building fails to meet the target level of performance, the owner and the A/E firm agree to work together to ensure that the building meets the desired performance.
- *Shared savings*—If the building exceeds the target of 44 percent, the owner agrees to split the added savings equally with the A/E team for a period of two years.
- *Modifications*—In the event that the building design is modified in a way that adversely affects expected energy performance, the owner and the A/E firm agree to renegotiate the target level of performance.
- *Performance*—The base and target levels of performance will be adjusted for factors that are not under the control of the A/E firm. These include computers; office, lab, and classroom equipment; weather; schedules of operation; hot water use; utility rates; and special uses.
- *Commissioning*—The purpose of commissioning is to ensure that systems are operating according to their design intent and that they are providing proper indoor air quality, comfort, and energy efficiency. The commissioning process will result in a properly functioning facility, properly trained operation staff, and documentation that describes system design intent and commissioning procedures.

performance targets for the job," explains Charles Eley of Eley Associates. "But these are necessary elements that have to be part of the contract."[20] Some potentially exciting projects, like Four Times Square in New York and a college campus in Florida, have fallen through as performance-incentive jobs because agreements couldn't be reached during the formative stages of the process.

Building effective teams. This is key to most design jobs and is at the heart of TCP. Damonte observes that "effective teams are built out of individuals suited for a particular job; it doesn't work to simply select members of a preformed group of subcontractors."[21] Effective teams share responsibility and risk for all stages of the project, from conception to commissioning and rewards or penalties. One way to ensure a good team is to make ener-

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—Scott Wentworth
City of Oakland Municipal
Buildings Division

gy efficiency aspects 3 to 5 percent of the scoring criteria for proposals. Wentworth maintains that “traditionally, energy efficiency and sustainable design have no weight in project scoring criteria, and if it’s not a scoring criterion, it won’t show up on their radar screen.”[22] If energy efficiency becomes a scoring criterion, it can also be used as an indicator of how bidders can handle other cutting-edge issues with which they may or may not be familiar.

Clarity of mission. Partisans of both the financial-motivation approach and the collaborative team approach emphasize the need for the team to take the time to explore ideas and make sure everyone is fully informed and supportive of the project goals and program. In the case of the financial-motivation approach, this includes (1) understanding the technical details needed for control and monitoring functions and (2) agreeing on the methods used for defining the energy target and verifying how closely the final project reaches it.

Clarity of contract. For reward/penalty agreements, the contract must articulate “the deal” in useful detail, specifying when and how much cash flows as a function of energy performance. Those with experience in performance-based compensation convey the impression that the key to effective contracts is to define a base case in order to establish a way of accurately and equitably deciding on rewards and penalties. In the case of the collaborative process, the contract must focus on fiscal responsibility. “One of the reasons it’s hard to sell the idea of collaboration,” Damonte says, “is that many owners think you’re putting the fox in charge of the chicken coop.”[23] Through a reasonable system of checks and balances and creative solutions, the collaborative team should be able to provide quality buildings that are within budget, and it should avoid having to defend cost overruns.

Many projects that were based on collaboration and performance-based fees at their commencement have failed due to timing, disagreement on the validity of the modeling, and the difficulty in measuring building performance. Integrating value-based compensation into the mix is a complex task that is fundamental to the redesigning of the building process. But performance-based fees as such are a species of a larger genus—the effective tone, spirit, cooperation, communication, and teamwork that collectively constitute The Collaborative Process. Failure may result if collaboration is not a main characteristic of the design process. However, if a genuine team can be formed and is able to work in a spirit of cooperation, there is a high degree of likelihood that a good, energy efficient building will be produced that is satisfying to all parties.

Notes

1 According to the Collaborative Process Institute.

2 Collaborative Process Institute, from www.cpinst.org (downloaded August 8, 2000).

3 Eley Associates, 142 Minna Street, San Francisco, CA 94105, tel 415-957-1977, fax 415-957-1381, e-mail info@eley.com.

4 Amory Lovins, "Energy Efficient Buildings: Institutional Barriers and Opportunities," E SOURCE *Strategic Issues Paper SIP II* (December 1992), p. 37.

5 Ann Peterson and Charles Eley, "New Building Performance Contracting: Lessons Learned and New Ideas," *Proceedings American Council for an Energy Efficient Economy (ACEEE) Summer Study on Energy Efficient Buildings (1996).*

6 Eric Kolderup, personal communication (August 8, 2000), Eley Associates [3], e-mail kolderup@eley.com; Eley Associates, *Final Report: Oakland Administration Building Energy Performance Contract* (December 22, 2000) [3].

7 Scott Wentworth, personal communication (October 11, 2000), Engineer, City of Oakland, Municipal Buildings Division, 7101 Edgewater Drive, Building 2, Oakland, CA 94621-3001, tel 510-615-5421, swentworth@oakland-net.com.

8 Jeff Ross Stein, Aditi Raychoudhury, and Charles Eley, "The Jury is (Halfway) In: New Building Performance Contracting Results." *Proceedings ACEEE Summer Study on Energy Efficient Buildings* (2000).

9 Scott Wentworth [7].

10 Collaborative Process Institute, "Collaboration in the Building Process, White Paper," (November 6, 1997), from www.cpinst.org/white.html (downloaded August 8, 2000).

11 Jack Damonte, personal communication (October 13, 2000), Principal and Senior Architect, MBT Architecture, and Secretary, CPI, tel 415-896-0800, e-mail damonte@mbtarch.com.

12 Collaborative Process Institute [10].

13 MBT Architecture, 185 Berry Street, Suite 5700, San Francisco, CA 94107, tel 715-896-0800, web www.mbtarch.com.

14 Jack Damonte [11].

15 Boora Architects Inc., 720 S.W. Washington Street, Suite 800, Portland, OR 95205.

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