



Establishing Building-Level Energy Goals in Procurement Documents: Lessons Learned from Pilot Utility and Portfolio Projects

Preprint

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*Presented at the 2018 ACEEE Summer Study on Energy Efficiency in Buildings
Pacific Grove, California
August 12–17, 2018*

Suggested Citation

Torcellini, Paul A, Shanti D. Pless, and Ben Heymer. 2018. "Establishing Building-Level Energy Goals in Procurement Documents: Lessons Learned from Pilot Utility and Portfolio Projects: Preprint." Golden, CO: National Renewable Energy Laboratory. NREL/CP-5500-71699.
<https://www.nrel.gov/docs/fy18osti/71699.pdf>.

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Conference Paper
NREL/CP-5500-71699
September 2018

Contract No. DE-AC36-08GO28308

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This work was authored in part by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Building Technologies Office. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.

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ABSTRACT

Encouraging commercial building owners to set measurable energy goals before design begins can drive design and contractor teams to develop innovative energy efficiency solutions within conventional building budgets. A federal building owner piloted this technique and created a large-scale zero energy office building on a budget comparable to local market construction rates. The successes and lessons learned from this performance-based procurement project formed the basis of an expanded program using utilities as the outreach channel to replicate the approach. The utilities delivered incentive-based offerings to focus building owners on the whole building rather than on individual building components and systems. In addition, a ripple effect was evident, with individual building owners as well as owners of multiple-building portfolios adopting the techniques, sometimes with variations, but always maintaining the same core principles. The original performance-based procurement process and its successful implementation in a federal building project informed all these efforts. Those successes and lessons learned demonstrate that the approach can be adapted to utility programs with some variation and is a powerful tool for engaging building owners as they make critical design decisions that impact energy performance over the life of the building.

Background

Designing and delivering buildings is a complex process requiring many decisions involving aesthetics, function, energy performance, and budget. These building elements often have competing goals and each decision has cost implications (Leach, Pless, and Torcellini 2014). The ideal of aligning project goals to minimize cost and maximize value, especially energy efficiency, can be difficult to achieve. To encourage design and contractor teams to achieve high levels of energy efficiency within fixed budgets, the U.S. Department of Energy's (DOE's) National Renewable Energy Laboratory (NREL) pioneered the approach of setting goals and creating a procurement methodology to maximize the value achieved through the design and construction process. The process was based on best practices from the Design-Build Institute of America and other sources (DBIA 2014; Cheng 2015). The objective was to design, build, and operate a building that met a project's necessary programmatic functions and achieved a high level of energy efficiency within a typical budget that was set at the beginning of the project.

The first project to apply this strategy, the NREL Research Support Facility, used a design-build delivery method with performance-based goals as the driving criteria within a predetermined fixed price budget (Pless, Torcellini, and Shelton 2011; Pless et al. 2012; Scheib, Pless, and Torcellini 2014). The result was a Class A office building built with available funding that was delivered at less cost than the average of Class A buildings built at that time. Moreover, the building uses half the energy of a typical code-compliant building and continues to meet the performance goals developed for the request for proposals (RFP).

NREL's procurement methodology was based on these implementing techniques:

- A best value procurement approach that takes full advantage of the design and contracting team members' expertise
- A two-phase solicitation in which the pool of qualified candidates is narrowed to no more than three qualified teams
- Performance-based requirements—including substantiation criteria to measure success for each requirement—written into the RFP
- Interim interviews during the proposal competition to answer questions and provide clarification on the process and the owner's expectations
- Stipend payments to unsuccessful offerors.

NREL initiated a national search through a request for qualifications to identify design-build teams of contractors, subcontractors, and designers, and then narrowed the field to three teams. The final three teams competed to determine which could provide the most scope for the available budget.

An RFP communicated the requirements of the project to the three competing teams using performance-based criteria. These requirements were prioritized and categorized as follows:

- *Mission critical*—project elements that were required for the project to proceed. For example, the project came with a basic requirement of meeting minimum safety standards and meeting a minimum sustainability requirement imposed by the funding authorization.
- *Highly desirable*—project elements that the owner highly valued. These included absolute energy goals, occupancy guidelines, and building aesthetics. Each of these elements was “mission critical” from the owner's perspective, but if some of these elements could not be achieved because of limited budget, the project would still proceed.
- *If possible*—project elements considered “dreams.” If there was any way to incorporate these elements within the fixed project scope, the owner could consider it exceeding the original expectations of the project. This became the wish list for the project. The owner doubted that these elements would fit into the project scope based on the budget. Stretch energy goals fit into this category, including zero energy performance.

Each team was offered a financial incentive to participate in the competition and was evaluated based on its ability to meet each requirement, in prioritized order, for the available budget. This stipend partially covered the expense of creating a conceptual design to the point that teams could commit to the performance-based project elements. Note that the winning proposal did not receive a stipend; rather, the scope of the contract award included the conceptual design partially completed during the competition.

Each performance-based criterion was described using a set of metrics and a method for the contractor to substantiate that the criterion had been met at the time of building delivery. For example, absolute energy targets were specified and calculation methodologies were provided. Each project element or criterion had a similar outline. For energy, an energy use intensity (EUI) target of 25 kBtu/ft² annually (based on site energy) was in the “highly-desirable category” and 0 kBtu/ft² annually (or a zero energy building) was in the “if-possible” category. Again, NREL did not set out to create a zero energy building, because it was unclear whether zero energy was

achievable within the available budget. According to DOE, a zero energy (or net zero energy or zero net energy, which are different ways of saying the same thing) building is “an energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy (DOE 2015).” The language in the definition provides a sound foundation for a performance-based energy criterion.

The successful contractor was the one that met the most criteria in prioritized order. This became the basis of the contract. The contractor was instrumental in determining the scope of the project, and the contractor’s commitments were prescribed in its proposal. In this case, the contractor proposed meeting all the goals in all categories including the “if-possible” list, which included the zero energy goal. In the end, the contractor delivered the building early and within the original budget. The contractor also met the energy goals, which have been realized in actual measured performance for eight years.

A contract provides a minimum threshold for a work effort, so a voluntary incentive program was provided if the contractor exceeded expectations and went beyond the contract scope. This was another opportunity for the design-build team to demonstrate creativity and push the building’s performance beyond what was specified—the financial incentive encouraged creativity, and the result was that the team exceeded the expectations of the owner. This market-driven approach resulted in an integrated design process and a building that uses about half the energy of a similar building at no additional cost. The contractor was involved in developing the project scope—and was incentivized to exceed the scope—so it was motivated to continually optimize both cost and energy savings. The key to achieving zero energy is that the goal is measurable and clearly articulated in the RFP.

Accelerating Market Acceptance

Integrating performance-based procurement required NREL to make substantial changes to its project delivery mechanisms. Owners need motivation to change any established process—in this case, the motivation was frustration that energy efficiency was not integrated with architectural and programmatic decisions. The idea is that most decisions have an energy and environmental impact as well as a cost impact. If the contractor has a cost target and an energy target, then energy features will be integrated within the cost constraints. It is possible to hit energy targets without adding cost, and teams that master these skills will have a competitive advantage in the marketplace.

After the Research Support Facility project, the methodology was used on the NREL campus three additional times—for a cafe, a high-performance computing and laboratory complex, and a parking garage. Like the first project, these projects were delivered on time, within budget, and with no change orders. The measured energy performance matched the model predictions, and the process encouraged integrated design and technology innovation that resulted in creative solutions to design and construction problems. A critical aspect of the energy performance was that the simulation model had to represent the as-built condition of the completed building to substantiate that the energy goal had been met.

Developing the Accelerate Performance Program

Building on NREL’s experience, the effort was expanded to include pilot programs with select utilities and large portfolio owners. Called “Accelerate Performance,” this project is a DOE-funded joint venture between Seventhwave, the Institute for Sustainable Energy, NREL,

and partner utilities. The idea was to harness the energy savings potential of the commercial building sector by increasing owner demand for improved energy performance at a cost comparable to conventional construction (McMillen et al. 2015). Accelerate Performance eliminates key market barriers by balancing risk between owners and the contractors and design firms with the skills to create the most cost-effective solutions.

Accelerate Performance was implemented through utility efficiency programs. These programs offer financial incentives to utility customers that achieve prescribed levels of energy efficiency in commercial buildings. The programs often provide direct incentives to design teams to encourage energy efficiency, modeling expertise to support informed energy decisions, or a rebate for choosing more energy-efficient equipment. Today, for example, many utilities offer incentives to reduce the incremental costs of energy-efficient technologies or to pay for design assistance for modeling, design charrettes, and brainstorming sessions. The Database of State Incentives for Renewables & Efficiency[®] includes location-specific details about several commercial building energy efficiency utility programs (DSIRE n.d.).

The Accelerate Performance pilot program asked utilities to shift the financial incentives to a process-based model. Incentives would be awarded to building owners if they included performance-based goals in their RFPs and contracts with design and construction teams. DOE funds were used to pilot these utility efforts and to provide programmatic and technical support to encourage utilities and interested commercial customers to make this shift.

DOE initiated the Accelerate Performance program through a competitive solicitation and the proposal from the Seventhwave, the Institute for Sustainable Energy, and NREL team was selected. Serving as implementers, the team chose utilities that expressed interest in the new initiative and were well-known to team members. Each utility provided a letter of intent to participate in the program and agreed to the DOE-required cost share.

The implementers developed performance-based procurement training and materials for utility personnel, who identified appropriate building projects in their service territories. Then the implementers helped the owners of those buildings create measurable goals and methods to substantiate those goals. For example, the implementers provided RFP templates with some limited customization so that owners could adapt the template to their needs. They also helped owners create evaluation criteria to choose the best-qualified team to deliver the building.

Although DOE funded the pilot efforts, the goal was to create self-sustaining utility-based programs. In addition, there was an expectation that the programs would save additional energy compared to existing programs—the goal was an average of 50% energy savings relative to current new construction norms, compared with the more typical 30% modeled savings for most new construction programs.

Utility program managers are interested in motivational tools that achieve higher levels of energy efficiency using less programmatic funding. More stringent energy codes, as well as the increasing complexity of building systems, threaten to reduce energy saved per utility dollar invested, a common metric for utility energy efficiency program effectiveness. Utilities offer energy efficiency programs as a service to customers, but most are structured around engagement with design professionals and struggle to engage directly with building owners in early project planning stages. The idea behind Accelerate Performance is to engage owners from the beginning of the process and to include owners' procurement processes in utility incentive offerings.

Accelerate Performance also addresses limitations in utility incentive programs. For example, in many new construction projects, utility incentives are paid at the end of the

construction process based on computer models of the building's projected energy use. This approach assumes the models are accurate and does not have the advantage of measuring and verifying actual energy use during operation. Another model is pay-for-performance, in which the relationship between the owner and the utility extends another 12 to 18 months and incentives are paid based on measured energy use.

Performance-based procurement streamlines this process, because when an absolute energy target is included as a criterion early in the design process, the contractual responsibility for meeting that target falls to the contractor, the designer, or the construction manager, depending on the project delivery mechanism (McMillen et al. 2016). If the building falls short during the measurement and verification (M&V) process, the building is not performing, and a warranty claim is used to correct any problems.

The implementers selected utilities in two states to be the initial Accelerate Performance partners.

Connecticut. The State of Connecticut has a robust commercial and industrial incentive program administered through the two investor-owned utilities in the state using ratepayer funds. Accelerated Performance concepts were approved by the Connecticut Clean Energy Board as part of its commercial and industrial offerings and this allowed the use of existing incentives of \$3/ft² to be applied to a performance-based process. The Board oversees the efficiency programs and sets the policy direction for efficiency activities in the state.

The objective is to achieve a 50% level of savings compared with current norms for new construction and major retrofits. The utilities prepared promotional materials and trained personnel to provide initial direction for the program. The Institute for Sustainable Energy at Eastern Connecticut State University and NREL provided local support for the effort in Connecticut. Several building portfolio owners as well as other individual building owners have signed up. In addition, state-owned buildings and schools were identified as possible early implementation projects. As a variant, a design-build contractor is using the techniques to communicate the value of this process to owners and has achieved high levels of energy performance.

Illinois. Commonwealth Edison (ComEd) adopted Accelerate Performance as a permanent track within its new construction energy efficiency program. In addition to the usual new construction technical support, which includes modeling and design review, this track features owner-focused outreach by the utility and its program implementers. It also includes early project planning technical assistance to set targets, develop a draft M&V plan, draft an RFP, and assist owners with the interview process for designers and contractors, among other things.

Energy targets and M&V plans are prerequisites for participation. Currently, the program offers and pays incentives in the usual way—per kWh and therm saved based on energy models. The incentive rates are set at 140% of the standard new construction incentive rates. The utility doesn't enforce the energy target, because it pays the incentive based on modeled rather than measured energy savings, but it provides a framework for building owners to adopt and enforce agreements related to energy performance. The Illinois program has worked well, at least in part because the implementer for the utility was one of the Accelerate Performance pilot program implementers.

Lessons Learned

Modifying long-standing design and construction practices can be challenging. Many owners are unfamiliar and uncomfortable with setting project goals and need help during the process. They lack the confidence to implement these goals and need strategies and tools to help them identify goals and choose design teams that can help them meet the goals.

It is difficult for utilities to engage owners early in the building procurement process. This may be a result of the current structure of most incentive programs, which fund additional analysis during the design process or incentivize hardware to help reduce the cost of energy-efficient equipment. To be most successful, however, utilities must help owners establish energy goals and select design teams and contractors that can meet the owners' (and the utilities') energy goals.

Financial incentives alone are far too small to influence an owner's process, so a more robust education and outreach effort is often required. Utilities are well-positioned and have the staff to work with building owners through design teams, but performance-based procurement requires building owners to set energy targets before they hire a design team. Utilities are typically not aware of or involved in projects this early in the process and reaching potential customers before they start the design or procurement process has emerged as a key challenge to adopting this approach. Overcoming this challenge requires utilities to become trusted advisors to building owners—a new role for many of them, but one they are equipped to play.

Many building owners and developers are not well-versed in energy efficiency terminology; they are often unfamiliar with EUI metrics and may not have information about the performance of past projects. For performance-based procurement to succeed, the benefits of the approach need to be reframed in terms of financial performance and the benefits of increased owner engagement at the beginning of the project—reduced operations and maintenance requirements and stable, predictable energy costs over the life of the building, for example.

Project cancellations and delays are also common, and future programs should have stricter eligibility requirements for screening applicants. This early involvement requirement is a risk for the program, because it requires effort and engagement with no guarantee that the project will move forward, even if the owner agrees that goal setting and performance-based procurement is the solution.

The owner needs to create goals that ensure a successful transition from construction to operation. Although the building might be designed to be very efficient, it needs to be operated properly to continue to meet its zero energy target. Some of that responsibility can be shifted to the design team by including language in the RFP stipulating that the building be easy to operate and its energy use be easy to measure. This approach does not, however, provide mechanisms for measuring, verifying, and evaluating the data to ensure that—after it is completed and occupied—the building meets all the goals established before the project began.

Buildings with inflexible non-energy-related design criteria (retail, industrial, restaurants, and hotel chains, among others) are not good pilot candidates for performance-based procurement because the opportunities for innovation are limited. For many large organizations, branding is tied to the look and feel of their buildings, making it difficult and risky to alter existing designs. Performance-based standards allow design variations to achieve energy efficiency at little or no cost. Limiting design changes to the envelope, however, also limits these opportunities. Energy efficiency improvements in these buildings are often limited to energy-efficient heating, ventilating, and air-conditioning equipment. Owners of large portfolios of

similar buildings may also be prone to institutional inertia; for example, they can be resistant to changes in long-established design, construction, and maintenance processes.

In addition, although the approach can work for any building, success is more likely in large projects with the financial and human resource expertise to execute all the steps. Dedicated in-house staff willing to learn about performance-based procurement during the process of selecting and managing the design team can help ensure the success of the project. For smaller owners, it can seem like a monumental task to establish absolute energy goals, research and select an appropriate design and construction team, and take on other project leadership roles. It is much less intimidating to purchase architectural services from a firm that will develop the design and make most of the decisions. This strategy rarely leads to the most innovative or cost-effective solutions to design and building challenges, however.

Incorporating Accelerate Performance principles into master planning documents is a way to ensure that performance-based procurement strategies are integrated into the overall goals of large portfolio, campus, and district building projects. This approach offers utilities the opportunity to influence projects very early in the design process and establish and maintain mutually beneficial relationships with large portfolio owners. Energy performance-based procurement, combined with a design-build process, is a best practice that utilities can use to help their large portfolio customers set EUI goals and hire design and construction teams to meet those goals. Utilities understand that this process incentivizes integrated design, district energy systems, and other approaches that wouldn't be considered in a typical energy design assistance program. The result is happy customers who are saving energy and money.

Based on the success of the Research Support Facility and other NREL projects that used performance-based procurement, the NREL team developed an idealistic and somewhat doctrinaire view of what performance-based procurement was and what it could accomplish; some building owners, however, found that off-putting. Many owners have long-standing procurement methods and delivery mechanisms in place and find the prospect of change uncomfortable. It takes a very savvy and motivated owner to adopt a new process. A way to increase acceptance is to support owners to take small steps—a sort of performance-based procurement “lite.” The process was reduced to a set of core elements that accomplishes most of the benefits of performance-based procurement and demonstrates the benefits of the process. Additional energy and cost savings can be achieved as owners gain experience and become more comfortable with the concept.

Core Elements

Performance-based procurement updates delivery practices so that innovative approaches to improved building energy efficiency are easier and more cost-effective to implement. Based on NREL's and Accelerate Performance's experiences to date, some core elements are critical to successful performance-based procurement:

- Strong leadership from building owners throughout the process
- Absolute energy targets (as well as other project goals) set early—before design begins—and strictly enforced
- Contractual mechanisms and incentives to ensure compliance with owners' requirements
- A motivated and committed design and construction team capable of providing energy modeling and post-occupancy services

- A robust M&V plan along with other post-occupancy resources to ensure that the building performs as designed.

Market Impacts and Successes

In addition to providing a path for optimizing building energy efficiency, a performance-based procurement strategy builds basic energy literacy among building owners. There is no need to outsource energy goal-setting to the architect, who may have little incentive to build sustainably or preserve the budget for mechanical, electrical, and plumbing design; commissioning; and post-occupancy expenses.

The process of prioritizing goals from the start puts the design process on the right track. Although owners typically understand the opportunities of sustainable design, they need a risk management strategy to control costs and capture real benefits, and performance-based procurement can be that strategy. Many owners struggle to navigate the requirements of codes, green certifications, and local requirements. The performance-based procurement process helps owners navigate this complex sustainability landscape; owners set the high-level goals early and use design and construction professionals to achieve the goals for a reasonable price.

Design teams also can benefit from their involvement in projects that use performance-based procurement. They often appreciate the added discipline and constraints imposed by building owners, and many have found that they can leverage the experience as a market differentiator. In addition, performance-based procurement provides a mechanism for protecting budgets for envelope improvements and mechanical, electrical, and plumbing systems in the face of pressure from architects and interior designers to value engineer these systems.

Anecdotally, projects that use performance-based procurement undergo fewer design changes. Even projects that adopt a “lite” approach see significant benefits from a more focused design process. Encouraging owners to include performance goals in procurement documents for design teams and contractors or encouraging designers and contractors to include performance goals when they sell the project to owners can serve as first steps toward full adoption of performance-based procurement. Finally, performance-based procurement is compatible with construction industry trends such as Lean Construction, zero energy, Passive House, Architecture 2030, LEED (Leadership in Energy and Environmental Design) (Turner and Frankel 2008), and others.

Based on the utility pilots and the initial NREL pilots, several states and organizations have made progress adopting procurement-based performance, often as a path to zero energy buildings and districts. In addition to the states listed below, other states and their utilities are considering adopting the program and discussions are ongoing.

California

The State of California has mandated that all new commercial construction will be zero energy by 2030. As a result, this large portfolio owner has piloted methods to achieve zero energy without substantially increasing construction costs. Most of California’s larger projects use a design-build delivery mechanism, and the California Department of General Services (DGS) has used a form of performance-based procurement (best value approach) on several projects over the past twenty years. Recent projects, however, are tightening the standards by, for example, establishing absolute energy goals. Based on the results of these pilots, the program will be expanded.

Although California uses a policy approach (Burgoyne 2017) through its zero energy requirements rather than working through utilities, it incorporates performance-based principles as the means to get to zero energy. For example, it provides guidance on the energy targets required to get a building to zero energy ready so that the policy mandate is satisfied. These targets are included in design-build contracts, which results in a competitive process that can reduce costs and still meet the energy goals.

Specifically, the new California Air Resources Board headquarters building project in Riverside, California (CARB 2017), used performance-based goals together with a design-build construction contract and is contractually on track to be a zero energy building. In addition, the new DGS office building under development in Sacramento, California (DGS 2017), includes performance criteria together with a design-build delivery mechanism, and is also expected to be a zero energy building.

Colorado

Colorado's largest utility, Xcel Energy, has a robust new construction program that provides incentives and design assistance by underwriting the cost of energy modeling and integrated design. As part of the effort, NREL and Xcel are engaging with developers of "districts" or parcels of land that will be built out into a collection of multiuse buildings. The strategy is to work with the developer to create master planning documents that include energy performance-based criteria. Expanding from traditional energy metrics, such as EUIs, the plan also considers synergies between buildings (which may have different owners) to maximize the energy efficiency of the entire district. These projects can include strategies such as community solar, thermal and electrical storage, and centralized ground source heat pumps.

The utility benefits by minimizing the amount of utility infrastructure required in the build-out of the district. The performance goals provide a basis for designing each building to ensure that it is a "good neighbor" within the district. The incentive program provides design assistance to help meet the objectives as well as payouts to building owners that meet the goals. In this approach, the standards can be rigid because meeting individual performance targets is essential to the overall success of the project.

For example, the Denver Water Board Master Plan included Accelerate Performance concepts in its master plan and identified absolute energy targets (EUIs) as a step toward its objective of developing a zero energy campus. Construction on the campus is currently under way. In another example, the National Western Center Master Plan identified creating a zero energy district as one of its goals (Denver 2015). The site is the home of the annual National Western Stock Show. Construction is expected to begin in 2018.

Minnesota

In Minnesota, Accelerate Performance served six pilot projects through the Conservation Applied Research and Development (CARD) program. These projects intersected with different utility programs, including Xcel Energy's Business New Construction program and the Center for Energy and Environment's Minnesota Sustainable Building 2030 program. The pilots included owner-focused outreach and early project planning technical assistance to set energy targets, draft M&V plans, draft RFPs, and interview design and contractor teams, in addition to the usual new construction technical support. No additional financial incentives were offered.

Mayo Clinic’s Generose expansion project in Rochester, Minnesota, used the performance-based-procurement approach to reduce both energy use and capital cost. This is the first example of absolute energy targets being used in the healthcare sector, and Seventhwave supported the project through Accelerate Performance.

Conclusions

As the market acceptance of zero energy buildings grows, the paths to zero are becoming more refined and better understood. Although building owners and design and construction professionals often resist changing practices and approaches that have “worked” for years, performance-based procurement offers advantages for all involved that can reduce risks and resistance. Building owners can reduce uncertainties related to project cost overruns, maintenance costs, and volatile future energy prices by including absolute energy targets and other performance goals in RFPs; designers and builders can use their creativity and expertise to build beautiful buildings that save owners money and are easy on the environment; and utilities can help their customers save money through reduced energy use.

Through the pilot program implementation, the Accelerate Performance implementers identified elements critical to successful performance-based procurement, including:

- Strong leadership from building owners throughout the process
- Absolute energy targets (as well as other project goals) set early—before design begins—and strictly enforced
- Contractual mechanisms and incentives to ensure compliance with owners’ requirements
- A motivated and committed design and construction team capable of providing energy modeling and post-occupancy services
- A robust M&V plan along with other post-occupancy resources to ensure that the building performs as designed.

They also identified common challenges that can slow the adoption of performance-based procurement:

- Many building owners resist modifying long-standing design and construction practices
- Utilities rarely engage owners early enough in the building procurement process to ensure the time and engagement to plan and execute the necessary steps; reaching potential customers before they start the design or procurement process has emerged as a key challenge to adopting this approach
- Financial incentives alone are far too small to influence an owner’s process, so utilities must assume new roles as trusted advisors to owners, in addition to robust education and outreach efforts
- Portfolio owners often have inflexible non-energy-related design criteria (retail, industrial, restaurants, and hotel chains, among others) and are not good candidates for performance-based procurement
- College campuses, state agencies, and similar organizations have the staff to set goals and execute the process very effectively, but often struggle to change existing processes.

Getting to zero energy is a paradigm shift for many building owners and design and construction professionals. To increase acceptance of performance-based procurement—a proven path to zero energy—utilities and their program implementers can support owners to take small steps in a sort of performance-based procurement “lite.” As more zero energy projects are completed and owners gain experience and familiarity with the process and concepts, the benefits of a full-fledged performance-based procurement strategy will become apparent.

Acknowledgment

This work was authored in part by Alliance for Sustainable Energy, LLC, the manager and operator of the National Renewable Energy Laboratory for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by U.S. Department of Energy Office of Energy Efficiency and Building Technology Office. The views expressed in this paper do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.

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