

## **Verified! How Performance-Based Procurement Can Boost New Construction Program Savings and Empower Building Owners**

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### **ABSTRACT**

Most utility new construction programs depend on modeled projections and deemed savings based on individual technologies. The industry has established ways to evaluate these programs based on the promise – not the actual performance – of these buildings post-occupancy. Deeper savings from a more integrated design with continuous performance monitoring are left on the table, locking out the higher performance for the lifetime of the building.

This paper will demonstrate how performance-based procurement can empower utility incentive offerings to drive deep energy savings and reduce administrative costs. The key is to incentivize a change in the building owner's procurement process and reward actual building energy performance rather than incentivizing specific measures. The paper looks at strategies to transition new construction programs from technology-based verification to actual measurement of performance outcomes. Accelerate Performance, a U.S. Department of Energy (DOE) funded initiative, changes the building procurement approach, which spurs innovation and motivates the design and contracting industry to achieve deep energy savings in new construction—in the case of DOE's National Renewable Energy Laboratory Research Support Facility (NREL) in Golden, CO, 50% without increasing initial costs. Utility programs in three states, Illinois, Minnesota, and Connecticut, are actively piloting the approach with leading-edge owners. The paper will share savings results and lessons learned from the three different utility pilot programs. The paper provides practical guidance for utility program managers about how to apply the Accelerate Performance approach to supplement their current new construction program offerings.

### **Introduction**

Utility energy efficiency program administrators are on the hunt for deeper, persistent and sustainable savings and some are using their new construction programs to serve as test beds to experiment with performance based approaches which could bring deeper savings and provide a higher level of service to their customers. Building owners are investing in energy efficient technology as they build new buildings and owners fully expect their new buildings to operate efficiently after construction. However, some owners are discovering building energy use is higher than expected once their buildings begin operating.

Owners and utilities want some of the same outcomes: 1. Energy savings should meet or exceed predictions made during the building design phase; 2. Energy savings should persist and be sustained as the building is operated over time. Accelerate Performance empowers owners to set performance targets, transforms building owners' procurement processes to ensure real efficiency is gained for the owner's budget, and aligns utility offerings with the new procurement

process. At the end of the process, the owner receives a building that works, the utility claims deeper savings and those savings persist as the building moves into operations. The following sections examine Accelerate Performance pilot implementation progress from the participating utilities' perspectives, highlights two owner case studies and discusses recent lessons learned.

## **Performance Based Procurement and New Construction Energy Efficiency Programs**

Energy efficiency program administrators are charged with offering a portfolio of incentives and services to their entire customer base and must include a variety of energy efficient technologies, systems and buildings. Utilities are interested in promoting efficient new construction because program administrators want to acquire savings with long persistence and want to exploit all opportunities for savings.

As energy codes and equipment standards advance, energy savings from new construction incentive programs are eroding. Program administrators are under increasing pressure to meet savings goals by uncovering new sources of energy savings and by adjusting existing program strategies to achieve deeper savings. New construction energy efficiency programs leave savings on the table for a variety of reasons, like not fully claiming savings from interactive effects. The U.S. Environmental Protection Agency (EPA) defines interactive effects as increases or decreases in the use of electricity that occur outside of the end uses targeted by a specific energy efficient measure, project or program (EPA 2015). For example, if a new construction program offers prescriptive incentives for discrete measures, such as lighting and air conditioning, the program may not capture savings from a project's reduced air conditioning load when an owner chooses an energy efficient lighting system. In addition, projects may come into the program after crucial decisions impacting future energy use have already been made. These traditional approaches to new construction energy efficiency programs miss engaging with owners and design teams during the most influential stages of planning, design and operation.

Accelerate Performance is a U.S. Department of Energy (DOE)-funded initiative that promotes performance based procurement in the commercial new construction market. It provides a path for utility program administrators to obtain deeper, persistent savings by engaging with owners before they select their design team. Using the Accelerate Performance process, building owners prioritize project goals, specify an energy use requirement and select the design and contractor teams based on their ability to meet the project goals, including energy performance. The owner also requires the design and contracting team to predict, measure and verify energy performance as part of the contract. Figure 1 below compares current practice to the performance based procurement practice and includes a brief description of owner activities from Planning through Operations.

The yellow line represents typical building owner activities when planning and building a new facility. Building owner activity increases during the request for proposal (RFP) stage, continues to increase in schematic design (SD) and design development (DD) and starts to decrease as construction documents (CD) are finalized and the project moves into construction and then levels off as the building moves into the operation phase. The blue line follows the performance-based acquisition (or procurement) process. For performance-based procurement, the owner expends greater effort early in the project planning phase, setting a project cost and energy budget, prioritizing and documenting goals for the building, which includes an energy performance target.

From the owner perspective, crucial steps in the process include setting project goals and an energy performance target, inserting those goals into owner request for proposals (RFP) and contract language and selecting the design and construction team based on their ability to meet those goals and targets within the owner’s stated budget. From the utility new construction incentive program perspective, incentives are typically based on estimated savings from an energy model and are paid at the end of construction. For our pilot partner utilities, crucial next steps include exploring how new construction incentives could align with the Accelerate Performance process.

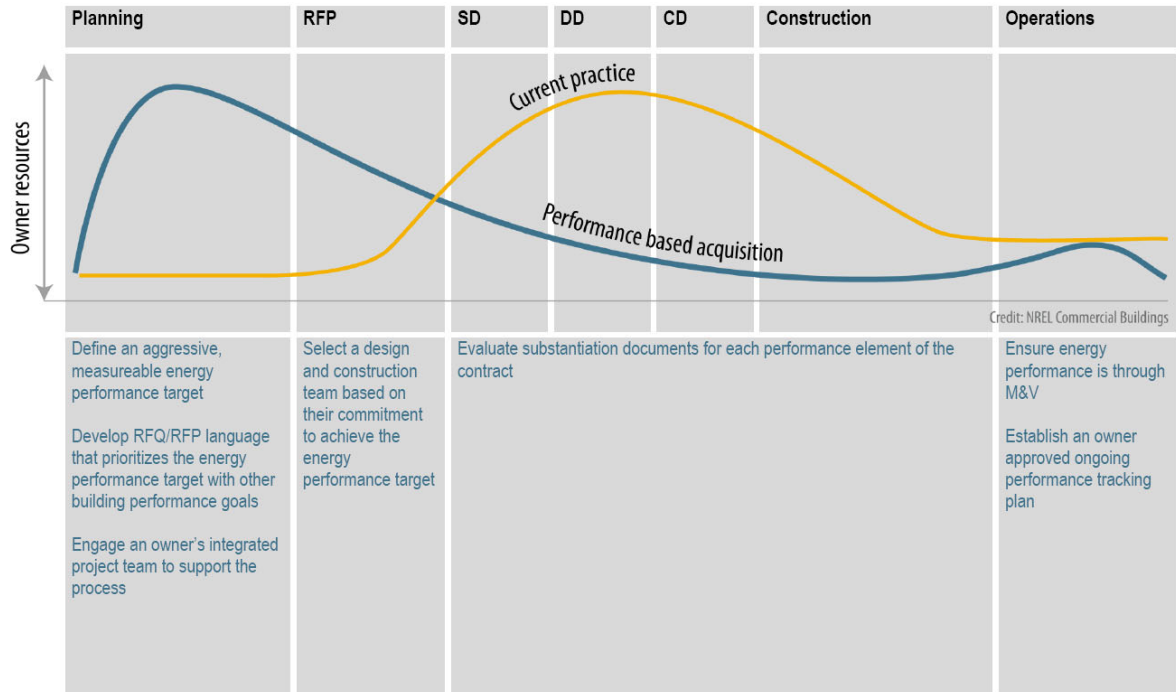


Figure 1. Performance based procurement compared to current practice. The acronyms describe the typical building design process: Request for Proposals (RFP), Schematic Design (SD), Design Development (DD), and Construction Documents (CD).

## Launching the Program

Utilities in Illinois and Connecticut have joined Seventhwave and the National Renewable Energy Laboratory (NREL) to launch performance based procurement pilots that will become part of their existing new construction program offers. In Minnesota, Seventhwave received a Conservation Applied Research and Development (CARD) grant from the Minnesota Department of Commerce to launch a performance-based procurement pilot through a partnership with Center for Sustainable Building Research and Xcel Energy.

In Illinois, ComEd launched a new construction energy efficiency incentive and technical assistance program in 2009 as part of its core portfolio. Since its launch, ComEd has adjusted its program design to accommodate changing commercial new construction market trends and to account for increasingly stringent building energy codes. The Illinois Energy Efficient Commercial Building Act (Illinois Public Act 093-0936) signed into law in 2004, was revised in 2007 to mandate the latest published addition, excluding supplements, of the International

Energy Conservation Code (IECC) within one year of its publication date. The IECC is a building code created by the International Code Council in 2000. It is a model code that establishes minimum design and construction requirement for energy efficiency and is adopted by many state and local governments.

Since 2009, ComEd has adjusted its program design to offset the decrease in potential savings due to code improvements (Cowan 2015). Additionally, ComEd's new construction program has maintained consistent kWh/ft<sup>2</sup> savings even with the advance of building energy codes. When Illinois adopted IECC 2013, the new code reduced potential energy savings by twenty percent. The program maintained kWh/ft<sup>2</sup> savings levels and in some sectors even increased kWh/ft<sup>2</sup> savings by enrolling buildings earlier in design, focusing on comprehensive technical assistance and capturing deeper savings from systems not impacted by building energy code changes, such as process loads or industrial refrigeration. When IECC 2015 was adopted by Illinois in 2016, potential savings were reduced by another ten percent. As ComEd and Seventhwave monitored advancing building energy codes, the message was clear: building energy codes were moving toward energy use outcomes based on building performance and ComEd's New Construction Service would need to evolve again. Launching an Accelerate Performance pilot in ComEd service territory to study the potential for increased, sustainable energy savings in a new construction program was a logical next step.

Energize Connecticut<sup>SM</sup> is the branding name for Connecticut's rate-payer funded energy efficiency programs. These funds are overseen by Connecticut's Energy Efficiency Board and the programs are administered by Connecticut's electric utilities, Eversource and United Illuminating, and their associated gas utilities. Energize Connecticut's new construction program includes a number of offerings under "Energy Conscious Blueprint." Under Connecticut's 2016-2018 Conservation Load Management Plan, the utilities, in partnership with the Institute for Sustainable Energy at Eastern Connecticut State University, NREL, and Seventhwave, are offering performance based procurement as a pilot opportunity under Energy Conscious Blueprint. The goal is to achieve greater energy savings by specifying energy use targets for new buildings early in the planning process. Energize Connecticut utilities and partners are eager to learn from and showcase successful performance based procurement projects in Connecticut and to eventually incorporate performance based procurement more fully into the Energy Conscious Blueprint program offering.

Xcel Energy serves several states and offers whole building new construction incentive programs in Minnesota and Colorado. Each utility service territory is subject to different energy codes and regulatory requirements that may change at different times. With code changes in Colorado, Xcel Energy's new construction program has declined in cost effectiveness. Pending code changes in Minnesota may have a similar impact. Thus, Xcel Energy's program administrator and product development staffs are exploring options to continue to deliver high quality savings and a high quality experience for its customers. "Accelerate Performance presents an excellent opportunity for us to not only meet the increasing challenge of delivering a cost-effective new construction program, but also to test a promising strategy to transform the new construction market and reach deep levels of energy savings for our customers," said Drew Quirk, Product Developer with Xcel Energy. Xcel Energy is interested in exploring disruptive innovation to get to the next level of energy savings. They want to decrease program costs, decrease program complexity and extend their relationship with building owners beyond the end

of construction. Xcel Energy wants to know if Accelerate Performance can significantly increase energy savings and create an owner relationship that extends into the operational phase of the building.

## **Early Opportunity for Leadership**

While ComEd and Seventhwave contemplated a new direction for the utility's new construction incentive program, the University of Chicago, a key ComEd customer, expressed interest in applying a performance based procurement approach for a new residence hall. ComEd offered to support the project under its existing new construction incentive structure. This gave ComEd an opportunity to study the approach and to become a partner in Seventhwave's DOE-funded initiative. While the University's new residence hall won't be complete until later this fall, predicted results promise energy performance of less than 55 kBtu/ft<sup>2</sup>-year, which is about thirty percent less than the site Energy Use Intensity (EUI) required for ENERGY STAR<sup>®</sup> certification.<sup>1</sup> In an earlier effort, NREL developed and piloted the approach on a 220,000 ft<sup>2</sup> office building and on subsequent support and laboratory buildings on the NREL campus. While the process was premature for utility program piloting at that point, the projects offered an opportunity for Xcel, Colorado to learn about the approach and support the energy saving results through existing New Construction and Self Direct efficiency program options. The University of Chicago and NREL efforts are described in more detail in the following sections, highlighting the key actions that define these as performance based procurement projects. The process, from initial project planning through years of operation, can be replicated by other building owners and incentivized by utilities.

## **Accelerate Performance Empowers Owners: Case Studies**

### **University of Chicago**

The University of Chicago Campus North Residence Hall and Dining Commons (CNRHDC), at 390,000 ft<sup>2</sup> and 800 beds, is the first Accelerate Performance pilot project and will be the first building on campus to have a contractual performance goal specified as a site EUI energy target. Situated eight miles south of downtown Chicago in Hyde Park, the University campus includes around 160 buildings representing 15 million square feet. The University had many reasons for establishing an energy target for the residence hall project. A study focused on long-term planning for the campus' historic quadrangle led University planning staff to conclude future building design efforts would focus on important concepts such as maintainability, comfort, and energy performance. Additionally, the university's climate and energy plan focuses on reducing campus greenhouse gases even as the campus size is expected to substantially increase over the next thirty years. Given these factors, the university concluded that establishing

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<sup>1</sup> EUI is typically defined as annual energy use (in kBtus) per square foot of building area. The EUI can be expressed in terms of site energy usage or source energy usage. If measured at the building site, annual site energy usage is generally understood to mean the amount of energy that crosses the building property line during the course of a year (Peterson and Crowther 2010). Annual source energy refers to the primary energy used to extract, process, generate and deliver the energy to the site. From a practical point of view, site energy is easily measured by building owners and makes site EUI an attractive metric for assessing building performance.

energy targets for campus new construction projects would help mitigate overall increases in energy use and greenhouse gas generation. For the pilot, the University followed the Accelerate Performance procurement steps:

- Set a firm price for the project during planning
- Specified a whole building EUI target
- Aligned project metrics with the performance criteria by prioritizing goals in order of importance:
  - Mission critical goals – critical to the success of the project and absolutely required
  - Highly desirable goals – contribute to project success and owner satisfaction
  - If possible goals – highly beneficial if they are included in the solution
- Assembled the RFP document
- Invited design + construction teams to propose solutions that met their prioritized requirements and selected a team, in part, based on demonstrated ability to meet the EUI
- Reviewed energy analysis throughout project life
- Established a measurement and verification plan to assess energy performance after substantial completion.

The University utilized many resources, tools and approaches to establish the energy target. They enlisted Seventhwave and received support from ComEd’s New Construction Service to develop a preliminary energy model to demonstrate what energy performance was realistically achievable. Seventhwave chose TRNSYS as the primary modeling tool and used eQuest for initial calculations and for follow-ups to check EUI. Using ENERGY STAR Target Finder (EPA 2009) to analyze Commercial Building Energy Consumption Survey (CBECS) data informed the University on the energy performance of current, best in class, residence halls. Through this process, the University learned the new residence hall would need to achieve a site EUI of about 85 kBtu/ft<sup>2</sup>-year to receive ENERGY STAR certification. After the energy target study was performed and all the data was considered, the University set the residence hall energy target at a site EUI of 65 kBtu/ft<sup>2</sup>-year (738 MJ/m<sup>2</sup>-year), assuming campus steam was used for heating. If on-site boilers or if geothermal was used, the energy target would drop by 10 kBtu/ft<sup>2</sup>-year.

In addition to establishing the building energy target, the University wanted the building to be ENERGY STAR certified, achieve at least LEED silver (higher was preferred) and superb occupant comfort. These goals were absolutely required, or “mission critical,” and the University clearly expressed that in the RFP document. The University also established “highly desirable” goals which included passive design strategies, ENERGY STAR equipment, maintainability,

geothermal and visual displays of current energy efficiency. The more goals bidding teams were able to meet under the highly desirable list, the better their chances of winning the bid.

With the project goals established, the university issued a request for qualifications to 22 architects and 10 contractors with instructions to assemble design-build teams. Four teams were selected to complete a schematic design and compete for final selection for the building design. One owner concern about the performance based procurement process was that a hard energy target would stifle the architectural design, and result in four similar looking buildings. On the contrary, the competition resulted in four unique designs, all with modeled energy performance less than 55 kBtu/ft<sup>2</sup>-year (625 MJ/m<sup>2</sup>-year). (McMillen et al. 2015.)

### **National Renewable Energy Laboratory Research Support Facility**

The research, development, demonstration and deployment of cost-effective and energy efficient technologies and design processes are part of DOE's and NREL's mission. As such, DOE and NREL feel a sense of urgency about maximizing the energy efficiency of buildings on the NREL campus. At the beginning of 2007, DOE invested the funding needed to design and build the Research Support Facility (RSF), the first of six campus buildings required to accommodate new staff to support the growing demand for energy efficiency and renewable energy innovation and to move existing staff from off-campus leased space. The vision was for the RSF to be a showcase of sustainable high-performance design to demonstrate the integration of high-performance building design and practices in a replicable manner, show case technology advances, and capture the public's imagination for renewable and energy efficient technologies. (Pless, Shelton, and Torcellini 2011). In order to deliver the RSF, with its challenging performance requirements, on time and on budget, the NREL team opted for a performance based procurement process, which would become the basis of the Accelerate Performance pilot. NREL's work in procuring the RSF also provided a performance based procurement model that would be used by the University of Chicago as they planned for the residence hall.

Under the performance based procurement approach, NREL/DOE set the project budget at \$64 million. NREL, with the support of a third-party consultant, then defined floating scope in terms of a broad list of project goals and categorized them as "mission critical," "highly desirable" and "if possible." Mission critical goals included those known to be achievable such as attaining LEED Platinum, using ENERGY STAR appliances and attaining safe work performance. There were fifteen highly desirable goals for the RSF including capacity for 800 staff (NREL expected 650 occupants), a normalized EUI target of 35 kBtu/ft<sup>2</sup>-year, architectural integrity, measurable 50% energy savings versus ASHRAE 90.1-2004, expandable building and flexible workspace. If possible, NREL wanted a zero energy design approach, the most energy efficient building in the world, LEED Platinum Plus, to exceed 50% savings over an ASHRAE baseline, a visual display of current energy efficiency, elements that support public tours, and to achieve national and global recognition.

Once the project goals and their prioritization were clear among the owner team, NREL and the consultant wrote a detailed RFP that included the energy target and the prioritized goals, or performance requirements, and set out to hire the design and contractor team that would meet their criteria. A short-listed group of design and contractor teams competed and their conceptual designs were evaluated based on their ability to achieve NREL's prioritized list in order, within the fixed price. While the zero energy design approach was considered highly desirable rather than mission critical, the successful bidder showed they could deliver a project with the potential to be zero-energy within the budget ceiling.

The end result was a 220,000 ft<sup>2</sup> research facility that uses half the energy as a traditional building of the same type and produces as much energy as it consumes, including the corporate data center located in the building. This figure is in the lower third of commercial office buildings built in the region during this time period. (McMillen et al. 2015.) The energy performance of the building is continuously tracked and tuned by NREL to realize the contractual EUI. The effort is an extension of the design and construction team’s commitment through the first year of operation.

## Early Learnings

Most utilities want deeper savings from their energy efficiency portfolios and they are seeking to build deeper, lasting relationships with customers. Some utility program administrators believe their existing new construction incentives and services provide a pathway to achieve those goals (Cowan 2015). However, present experience reveals utilities in the Accelerate Performance pilot may require customized approaches when bringing the pilot to market. Developing an Accelerate Performance utility incentive structure is a good example. ComEd would like to set the Accelerate Performance incentive slightly higher than its basic new construction incentive. In Minnesota, Xcel Energy wants the current new construction incentive structure to remain the same, offering no additional incentives for Accelerate Performance. In Connecticut, Eversource Energy offers \$3/ft<sup>2</sup> for buildings that are forty percent better than code and they would like Accelerate Performance incentives to align with that category. This discovery is not a barrier to implementation, but the experience demonstrates the importance of understanding each utility’s approach to market and internal constraints like budget, cost-effectiveness requirements and outreach strategies.

The Accelerate Performance team is learning that outreach and recruitment for the pilot requires several discrete discussions or “touches” – sometimes as many as eight – before an owner fully understands the offer and agrees to submit an application. Some pilot utilities want to develop Accelerate Performance marketing materials that their outreach teams can use for recruiting. Utilities want to communicate the offer’s features, customer benefits, value-proposition, participation requirements and potential incentives. While Seventhwave produced Accelerate Performance marketing materials, pilot utilities require feature sheets or sell sheets that are customized for their program offerings. Seventhwave is working with utilities to create feature sheets the utilities can brand and incorporate into their existing program offer.

Early discussions with owners have revealed a range of perspectives on this approach. Some are bound to their traditional procurement processes and view change as a risk they are not willing to bear, even with utility incentives. Owners in this category may need to see successful examples before trying Accelerate Performance. In this case our goal is to simply introduce the approach, update them on adoption progress and turn our attention to owners that are enthusiastic about integrating new processes that improve performance both in terms of energy use and first cost.

While recruiting owners in ComEd service territory, we engaged with an enthusiastic developer in an owner focus group and later in one-on-one discussions about how the approach could apply to their projects. In the focus group, the developer identified with the benefits of a performance based outcome. Theoretically, he could see how an owner could ask for a fixed performance level and then the utility could pay a higher incentive for specifying the requirement. It took several conversations to bring the developer on board and address his concerns. Early on, the developer thought the utility program would conduct the Accelerate



Performance energy analysis to show that the project was meeting its specified target as the project progressed through the design and construction process. In each of three follow-up meetings, we explained that the design and construction team would need to do the energy analysis since they would be responsible for meeting the energy target ultimately specified in the contract. Having the utility incentive program provide an energy analysis in this case would not result in design team buy-in. For a successful Accelerate Performance project, the design team would need to ensure the energy model matched the expected operational and the as-built condition. While the utility could provide the energy analysis, it would not achieve the behavior change we are seeking. The developer stated he understood and he would submit applications for several projects. In a follow-up discussion, the developer again asked about the utility covering the energy analysis. Once we provided the actual RFP language that outlined how and when the team would submit their own energy analysis, the developer fully understood the value of the approach. He was not aware that he could ask for energy analyses from each of the teams as part of the qualifications to win the project. This realization resulted in further buy-in because the developer felt he could use the energy analysis requirement as a point of negotiation with the bidding teams. Also, under Accelerate Performance, the utility is able to provide an early estimate of the incentives, based on the contractual energy target. In turn, the owner can treat the incentive as a revenue stream and leverage it in contract negotiations. This strategy is not possible with the traditional utility incentive approach, which typically estimates the incentive about halfway through the project.

## **Owners and Utility Energy Efficiency Programs: Procuring Buildings that Work and Achieving Deep Savings**

New construction energy efficiency programs leave savings on the table for a variety of reasons, like not pursuing integrated design early enough and not fully claiming savings from interactive effects. These traditional approaches to new construction energy efficiency programs miss the opportunity to engage owners and design teams during the most influential stages of planning, design and operation.

Accelerate Performance provides a pathway to leverage design teams to create integrated solutions for deep energy savings using clear, concise goals developed by the building owner. This approach does not require changes to the conventional design approach, in fact, it allows designers to be just as creative while working towards the energy goal. The crucial change comes with the procurement process, where design teams must compete or think beyond typical practice to meet the intended energy targets of the project within budget. With Accelerate Performance utilities help drive and set energy performance targets, creating strong customer relationships that can extend beyond construction completion into building operation. Measured energy savings from Accelerate Performance are more reliable than deemed savings derived using conventional energy efficiency evaluation approaches. A key facet to Accelerate Performance is meeting an operational energy goal, which not only involves the upfront planning and ongoing confirmation of modeled energy results, but successful commissioning and operation of the building as intended.

## References

- An Act (Energy Efficient Commercial Building Act). 2004. II. General Assembly Public Act 093-0936 (passed August).  
<http://www.ilga.gov/legislation/publicacts/fulltext.asp?name=093-0936&GA=093>
- Cowan, C. “New Construction Service Strategic Plan, ComEd Smart Ideas for Your Business.” ComEd Energy Efficiency Program Implementation Documents, October 2015.
- EPA (Environmental Protection Agency). 2015. *Evaluation Measurement and Verification (EM&V) Guidance for Demand-Side Energy Efficiency (EE). Draft for Public Input.*  
[https://www.epa.gov/sites/production/files/2015-08/documents/cpp\\_emv\\_guidance\\_for\\_demand-side\\_ee\\_-\\_080315.pdf](https://www.epa.gov/sites/production/files/2015-08/documents/cpp_emv_guidance_for_demand-side_ee_-_080315.pdf)
- EPA (Environmental Protection Agency). 2009. *Target Finder: Set Goals for Energy Savings.*  
[https://www.energystar.gov/ia/business/tools\\_resources/new\\_bldg\\_design/2009\\_Target\\_Finder\\_Brochure.pdf](https://www.energystar.gov/ia/business/tools_resources/new_bldg_design/2009_Target_Finder_Brochure.pdf)
- McMillen, A., P. Torcellini, S. Ray, and K. Rodgers 2015. “Procurement Path for Energy-Efficient Buildings.” *ASHRAE Journal* April 2015: 12-26.  
<https://www.seventhwave.org/sites/default/files/ashrae-journal-mcmillen-april2015.pdf>
- NREL (National Renewable Energy Laboratory). 2011. *The Design-Build Process for the Research Support Facility.* <http://www.nrel.gov/docs/fy12osti/51387.pdf>
- Peterson, K., H. Crowther. 2010. “Building EUIs.” *High Performing Buildings* Summer 2010: 40-50. <http://www.hpbmagazine.org/attachments/article/12033/10Su-Building-Energy-Use-Intensity.pdf>
- Pless, S., D. Shelton, and P. Torcellini 2011. “Using an Energy Performance Based Design-Build Process to Procure a Large Scale Low-Energy Building.” NREL Conference Paper No. CP-5500-51323. [http://www.nrel.gov/sustainable\\_nrel/pdfs/51323.pdf](http://www.nrel.gov/sustainable_nrel/pdfs/51323.pdf)