Codes Don't Always Get Enforced, But Contracts Do: Changing the Procurement Paradigm to Drive Building Energy Performance

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ABSTRACT

New construction could account for more than 25% of the U.S. energy consumption by 2030. Millions of square feet are built every year that will not perform as expected – despite advancing codes, rating systems, super-efficient technologies, and advanced utility programs. With retrofits of these under-performers decades away, savings potential will be lost for years to come. Only the building owner is in the driver's seat to demand – and verify – higher-performing buildings. Yet our current policy and market interventions really target the design team, not the owner.

Accelerate Performance, a U.S. Department of Energy funded initiative, is changing the building procurement approach to drive deeper, verified savings in three pilot states: Illinois, Minnesota, and Connecticut. Performance-based procurement ties energy performance to design and contractor team compensation while freeing them to meet energy targets with strategies most familiar to them. The process teases out the creativity of the design and contracting teams to deliver energy performance - without driving up the construction cost. The paper will share early results and lessons learned from new procurement and contract approaches in government, public, and private sector building projects. The paper provides practical guidance for building owners, facilities managers, design, and contractor teams who wish to incorporate effective performance-based procurement for deeper energy savings in their buildings.

INTRODUCTION

The future of building energy use in the U.S. will become highly dependent on the decisions we make about our new construction projects today. Figure 1 shows future energy use expected for the built environment between now and 2040. As new and majorly renovated buildings start to replace our existing building stock, this subset of buildings will eventually take over the majority of building energy use. Since many new buildings do not undergo energy improvement projects for many years following substantial completion, operational inefficiencies that start on day one often get locked in for many years to come.

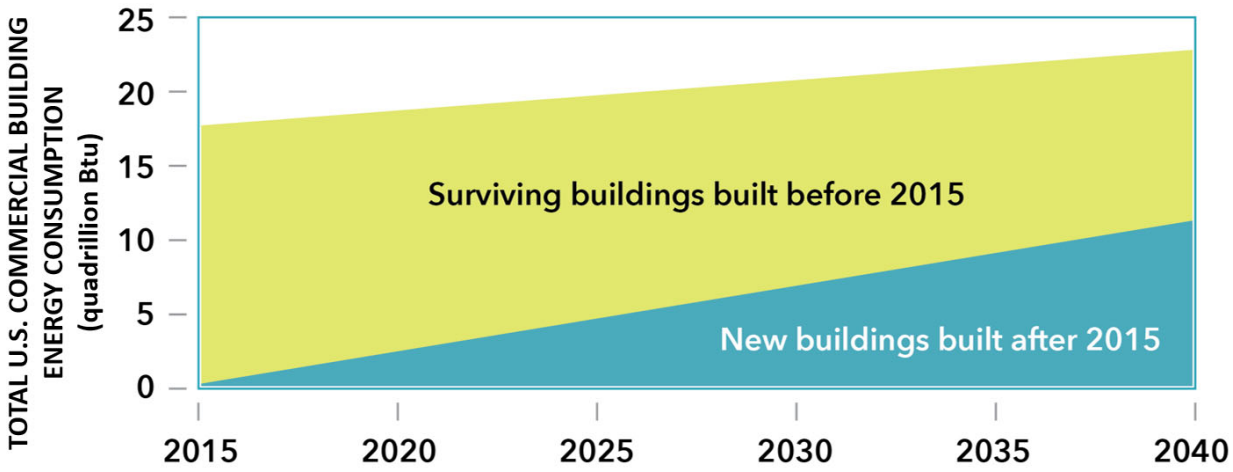

Figure 1. Future building energy use: new buildings will become the majority of energy use. (Graph derived by author from data found at http://www.eia.gov/oiaf/aeo/tablebrowser)

Our research and individual conversations with building owners also suggest that new projects often do not perform as expected. Many building owners look to voluntary standards or certifications in an effort to improve overall building performance, including energy. A study on a subset of projects that achieved Leadership in Energy and Environmental Design (LEED) certification noted that many projects operate much differently than the design models indicate. This study also showed that there is not a direct correlation between the pursued performance rating and actual performance of the new buildings. There was not a distinct correlation between higher levels of certification and higher energy performance (Turner and Frankel 2008).

Many building owners are looking for new ways to focus on the actual energy performance they expect from their buildings. This is increasingly important to manage energy use, carbon reduction goals, and operational costs for individual buildings as well as their portfolios. It also helps them realize the expected return on investments in advanced technology on new construction projects.

Building energy codes and voluntary standards such as International Energy Conservation Code (IECC) and ASHRAE 90.1 have worked on prescriptive approaches to improve the specified efficiency of individual building systems. Each new version aims to create a baseline level of efficiency that is more aggressive than the previous version. As the prescriptive requirements become increasingly more stringent, code compliance becomes more difficult to achieve and takes more to time to analyze and document. Whole building modeling has become more common to assess interactive effects of these prescriptive systems and drive down whole building energy use within a simulated environment. This often manifests itself in trade-offs between the prescriptive requirements in an effort to show an overall reduction versus the base standard. In practice, teams can achieve savings by making the proposed building project look as efficient as it can with the energy model while also making the baseline energy model look as inefficient as ‘legally’ allowed by the code. On many projects, the baseline energy

analysis receives as much, or more, attention than the end goal sought by the owner; actual energy performance of the proposed, constructed building.

This practice often takes place along the timeline represented in Figure 2. This shows a typical level of effort by the project to assess energy performance. During the planning phase, the owner may include some project energy goals, desired certifications, or other metric. The teams compete for the project stating credibility by referring to past project successes. The team is then selected for the project and begins schematic design (SD) with some early energy analysis. This effort increases in scope, often peaking near design development (DD) and the end of the construction document (CD) phase when compliance models are often finalized. Upon successful review of this activity, often during the construction phase, the energy goals of the project are effectively deemed a 'success' and certification related to energy is achieved.

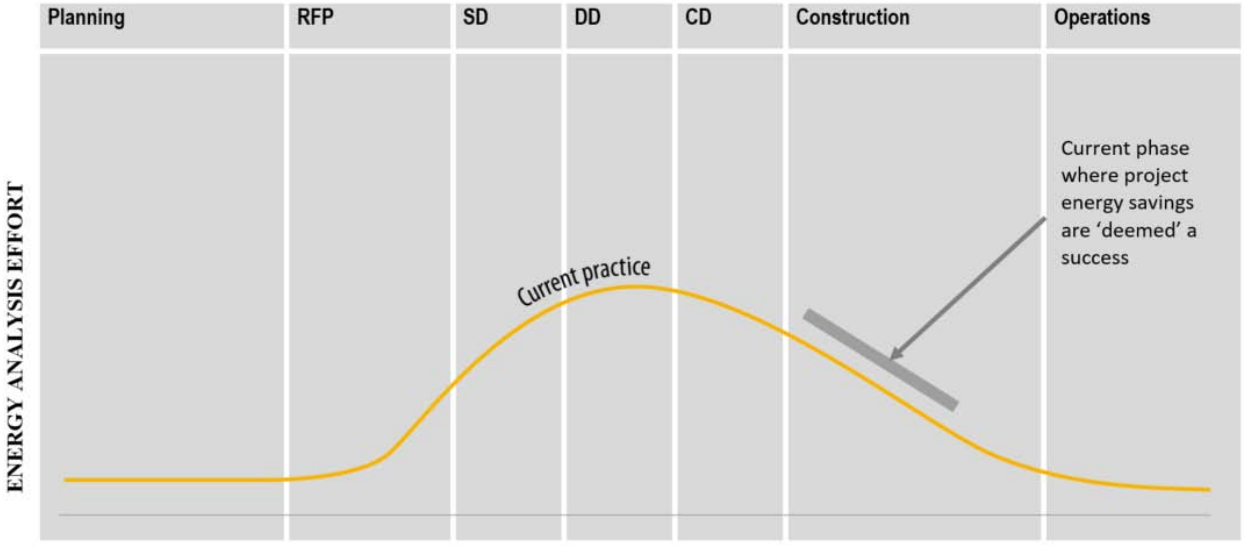

Figure 2. Energy analysis effort by project phase – current practice.

While effective to show code compliance or meet voluntary rating system requirements, this common practice often does not include an assessment of how the building actual performed in operations. It also does not include any feedback to learn whether it met, or did not meet, energy performance sought during the modeling phase. Functionally, many team contracts end at substantial completion so the opportunity to measure success is not part of the project. This represents a substantial gap in the industry where education and corrective action by the owner, design, and contract team could add the most significant value in achieving high performance buildings in the future.

A NEW APPROACH

To overcome these challenges, a new performance based procurement approach is being introduced into the market. The heart of this approach impacts the two most critical phases of a project life that are often left untouched by the current practice. Figure 3 below outlines the performance based procurement approach alongside current practice.

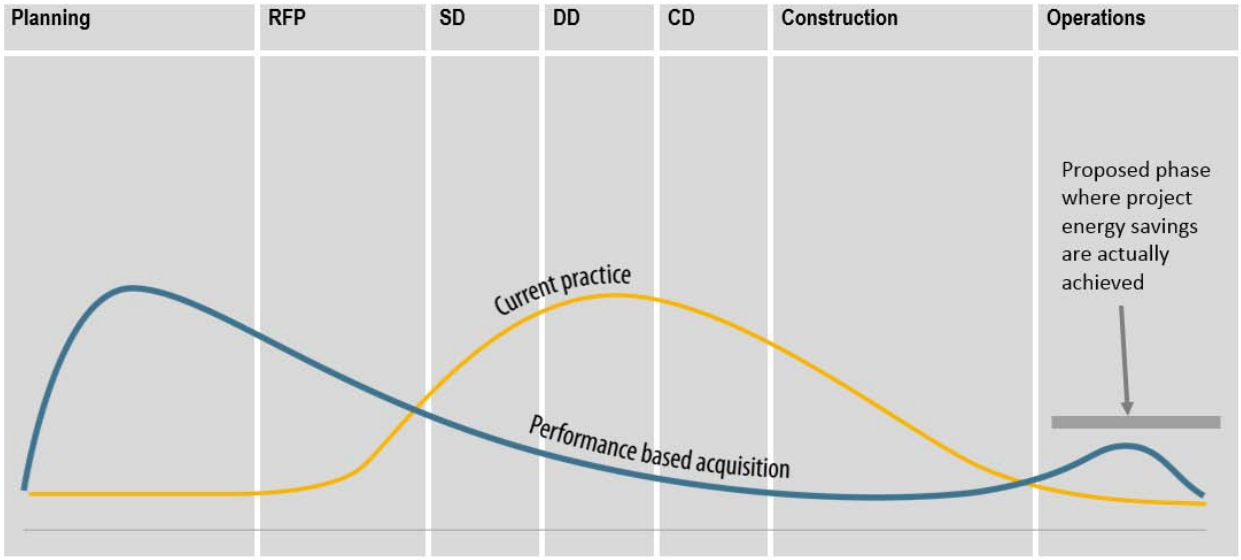

Figure 3. Performance based procurement compared to current practice.

Using this approach, the owner focuses on developing the energy performance requirements during the planning phase. This includes critical activities of benchmarking industry standard performance for the proposed building types, identifying existing performance of buildings that the owner has in the portfolio (where applicable), and developing early energy estimates to assess performance for the planned building using the expected programming and occupancy. Performance requirements can also include maximum energy thresholds needed to meet overall portfolio energy or carbon reduction goals. This provides the context needed for the building owner to target the desired performance and include it as part of the project requirements.

With the desired level of performance in mind, the building owner then includes contract energy performance requirements and other project related goals in the project's RFP and contract language. These goals are prioritized in a tiered structure to allow the responding design/construction teams to cost-effectively select the owner's goals that can fit within the stated budget (McMillen et al. 2015). For example, in Table 1, the energy performance requirement becomes more stringent from one tier to the next. This allows the teams to make decisions about how much efficiency they can provide within the stated budget.

Mission critical goals—required by contract and critical to success

Highly desirable goals—not required by contract and have influence on the recommended design

If possible goals—influence recommended design and are considered highly beneficial if included in the solution

MISSION CRITICAL	• Maximum energy target of 50 KBTU/gsf annually; lower is preferred • LEED NC version 4, Silver Certification • Architectural integrity • 100% of occupied spaces physically or visually connected to nature
HIGHLY DESIRABLE	• Maximum energy target of 40 kBtu/gsf annually; lower is preferred • Passive design strategies (i.e. daylighting, passive solar heating, etc.) • Low recycled air content • Strong HVAC response to quickly changing occupancy (limit precooling with air) • Usable daylight in all occupied spaces • Exceed LEED NC version 4, Silver Certification
IF POSSIBLE	• Living Building full certification • Net Zero Energy Design

Table 1. Tiered project requirements – focus on energy performance.

By stating outcome based goals, this approach avoids a more traditional prescriptive approach that specifies requirements that may be unfamiliar to the team and results in unnecessary cost premiums. Instead, the team can simply select what they know from the owner's goals list while remaining within the project budget. They essentially self-select their own contract terms by drawing a line in the list and providing everything above the line and excluding those that have some owner desire but fall outside of the overall project budget. The key to success relies on the fact that teams make these decisions within a competitive environment. This forces the team to use creativity and trade-offs to provide the owner with the highest number of items within the stated budget while keeping in mind that their competition may well find a better, more cost effective solution: a true competitive process. With competing proposals in hand, the owner now has the ability to select the team based on their ability to provide the most features within the project budget.

This paper seeks to define a new narrative for the industry to close this gap and better define high performance for a building. Performance based procurement provides a framework for building owners to achieve actual energy performance on a building project. In this framework, owners have a role to play in clearly defining this goal before they ask their team to commit to meet the performance expectation within a given project budget. This approach outlines a process to set tangible success criteria in the beginning that allows the design and construction teams to deliver it at the end. For design and construction teams, this process allows

them flexibility to look at the owner project requirements and budget while competing to win the project and decide what strategies their team can most cost effectively implement to achieve energy performance and first cost criteria.

AUDIENCE

Early implementation of this approach has revealed that many owners are motivated to make the change to measured performance outcomes on their new construction projects. Some of the common motivations include the following:

- New buildings are not meeting performance expectations
- When new buildings use more energy than expected they 'wipe out' gains achieve from existing building improvements elsewhere in the portfolio
- Desire to meet campus/portfolio carbon reduction options
- Maintain project budget and keep energy efficiency on the table
- Want to get to net zero but need a process that can get them there over time
- Realize actual operations savings – ensure return on investment
- Desire to bridge a communication divide between capital planning and operation groups
- Keep design and contractor team focused on clear, measurable goals

In response to these motivations, Seventhwave, NREL, and the Institute for Sustainable Energy launched a three year project with the Department of Energy in August 2015. This project, Accelerate Performance, seeks to advance an industry wide effort to scale the performance based procurement approach that was created by the National Renewable Energy Laboratory for the Research Support Facility project the completed in June 2010 (Scheib, Pless, and Torcellini). The project includes partnerships with Commonwealth Edison, Eversource, United Illuminating, Lend Lease, and the University of Chicago. It seeks to integrate performance based procurement into 100 buildings over the next three years. This project will work with building owners through utility energy efficiency programs in an effort to establish a new procurement approach that achieves measured performance. These utility programs will introduce the new approach to building owners, provide direct technical assistance to help establish a new owner process, and provide financial incentives to projects that adopt the approach. It will leverage utility programs and large owner portfolios to scale this approach into an industry standard practice.

Accelerate Performance will adapt the performance based procurement model to a number of procurement methods. While the concept of performance based procurement was created for design build projects, it also demonstrates promise in Integrated Project Delivery (IPD) and Construction Manager (CM) at Risk approaches. The Accelerate Performance project will also test integration with a true Design Bid Build process, the primary barrier being a 'cold' hand-off between the design phase (and contract) and construction phase (with a new separate contract). Early experience with the process suggests that tangible and accountable cost estimation from the beginning of the project will be a key to the success of this approach.

Accelerate Performance will test these methodologies and share more conclusive findings as this project unfolds.

CASE STUDIES

We estimate that 15-25 projects have integrated some portion of this approach into their procurement process. This includes six projects at National Renewable Energy Laboratory (NREL) facilities in Colorado, public sector state projects in the Northwest, General Services Administration (GSA) projects in various locations, and private sector projects in the Midwest. (Scheib, Pless, and Torcellini 2014; Cheng 2015; McMillen et al. 2015). In the early stages of Accelerate Performance, our team has begun early work on eight projects. The remainder of this paper will outline early outcomes and lessons learned on these projects that have begun to integrate this approach. These sections focus on the process and behavior change that we have witnessed in projects that are currently adopting this new procurement approach.

The University of Chicago campus includes around 160 buildings that comprise 15 million square feet. In 2008, the university's capital planning, facility operations, and office of sustainability engaged in a long term planning study for the campus's historic quadrangle with a focus on maintainability, comfort, and energy efficiency. The university was also evaluating the impact that their 30 year capital plan would have on campus energy use. It was important to understand how a considerable increase in campus size and persistent reduction in existing building energy use would impact campus energy and carbon goals. A key study question that emerged was to explore the option to reduce existing building energy use, add more square footage, and use no more energy than the campus does today. Throughout the months of planning, the team arrived at the conclusion that the only way to approach that goal was to 'cap' the total energy use that new buildings could use so that it did not effectively 'wipe out' the savings achieved through investments existing building efficiency projects. Further research uncovered the performance based procurement approach pioneered by NREL on its Research Support Facility project outlined in Pless et al. (2012). The University used this framework to test this idea on two of their next new construction projects.

The first was a 390,000 square foot, 800 bed campus residence hall project. They partnered with NREL, Seventhwave, and the ComEd New Construction Efficiency program to integrate the performance based procurement approach on this project. This included setting a competitive procurement process and amending RFP language to include a maximum energy performance requirement of 55 kBtu/gsf/year as outlined in McMillen et al. (2015). The result was a request for qualification to 22 architects and 10 contractors with instructions to assemble design-build teams. The University then selected four teams to compete in a design competition that would select on team that satisfactorily met programmatic, budget, schedule, and energy performance requirements.

The University then launched a second project in 2015 using the performance based procurement approach. This project is a 100,000 sf speaking forum facility that is being delivered using a design-bid-build, CM at risk procurement method. It maintained a competitive procurement process with amended RFP language and an energy performance requirement. This project chose a more aggressive energy target; building off the success of a somewhat less stringent requirement from the previous project. This project established a three tiered energy

requirement of 45 kBtu/gsf/year, 35 kBtu/gsf/year, and net zero. In this framework, the teams could self-select their own energy efficiency level based on what that they felt would fit within the project budget. At the time of this writing, the project has just entered the design development phase.

The team has also engaged with three design-build warehouse projects, one healthcare renovation project, one multi-family, and one new office building project. In total, these represent about 2 million gsf. Two of these projects have owners that will maintain long term ownership while the others will be constructed by a developer and sold or leased to long-term tenants. In general, the institutional owners are interested in energy savings and strong building performance. The initial interest by developers is due in part to the potential for increased utility program incentives.

EARLY LESSONS LEARNED

As we have launched this initiative, we have had the opportunity to discuss barriers with a number of the institutional building owners and developers listed above. This dialogue has already generated a wealth of knowledge around the true and perceived barriers to achieving deep energy savings on new building projects. A primary theme is that most owners/developers and their design/construction teams are risk averse. Any new approach needs to rely on some grounding in what they have traditionally done while lowering the bar for the new ideas to generate traction and advance their approach.

The procurement phase of these projects have introduced a number of new dialogues and perspectives that the owners had not experienced on previous projects. Some of these perspectives include the following:

- One concern was that a hard energy target would stifle the architectural design, and result in four similar looking buildings. In practice, the competition from one project resulted in four unique designs, all with modeled energy performance less the energy performance requirement. Performance based procurement did not prove to limit architectural creativity.
- Teams proposed their own solutions from the list of owner-preferred performance parameters. Teams were consistently evaluating what they could add to their proposed design that met the energy goals without increasing the project budget. They were concerned that the competing teams could indeed find a solution and win the project – a true competitive process. On one project, the owner witnessed teams downsize the mechanical systems after improving the envelope – something discussed but rarely seen in early cost estimations.
- Teams were concerned that they could not commit to a performance requirement since plug loads and operable window usage could not be known. The owner responded that while that this is a potential unknown, the project measurement and verification should make this obvious in the actual measurement so it could be addressed in an effort to maintain the project energy requirement. Discarding the entire energy performance requirement for the sake of a few variables was not an acceptable solution.

- In one project, all teams found a solution that ultimately met energy performance requirements within the stated budget. The solutions were comprehensive enough to clearly outline what was to be included in the design before the design build contract was signed. In prior experience, these decisions were usually made in design development or later (and often associated with value engineering exercises).
- The ability to cite a single number to communicate the energy requirement provided a lot of leverage and clarity. It represents actual equipment selection and the final, as designed, building. Following up with a measured outcome that includes a breakdown of major end use will aid in identifying the root cause of any future 'drifting' of energy performance (McMillen et al 2015).
- Cost estimates were much less thorough for most teams than previously seen using the design build approach. Most were based on rule of thumb in lieu of actual component pricing; some were incomplete. This suggests that the project may have benefitted from include the prospective CM in the design competition phase.
- After the teams were selected, the owner did adjust some sustainability and certification goals. The energy requirement, however, was intentionally maintained and repeatedly reinforced. This can be attributed to the simplicity of the outcome based definition and a general understanding of how the performance of this building contributes to energy use of the overall campus energy goals.
- The value of including the CM at Risk from the very start of schematic design became very clear on one project. Early massing studies, for example, were greatly informed by the respective impact on first cost. As stated by one team member, the balance between first cost and energy only made the energy performance better. This was due in a large part to reduced window to wall area (this reduced first cost and energy) but also due to changes in lighting and mechanical system approach. In practice, each design decision now has an additional column for consideration: EUI impact.
- The energy requirement highlighted the decision between the use of centralized campus heating systems and de-centralized, more efficient on-site boilers. While cost was somewhat neutral, maintenance decisions became a distinct talking point. The decision on this one project now plays an important role in overall campus direction on this topic; this discussion may have been deferred if a distinct energy requirement was not so clearly defined.

Accelerate Performance is introducing some new opportunities and challenges by testing alternative procurement approaches. Procurement is not a one size fits all approach; even within the same ownership team. For performance based procurement to become an industry-standard approach, it will have to evolve into a framework that can hold the primary principles of performance based procurement constant while allowing flexibility to adapt to other external circumstances. The goal of the Accelerate Performance project is to test a number of strategies, apply it to actual projects, and emerge with a tested framework that can scale throughout the various procurement approaches in the industry.

NEXT STEPS

In the short term, Accelerate Performance will scale performance based procurement to pilot projects in Illinois, Connecticut, and Minnesota. Utility new construction efficiency

programs are being leveraged as a primary channel to provide technical assistance and financial incentives to projects using rate payer funded programs. These program implementers have familiarity with energy analysis and will be leveraging contract language, process protocols, measurement and verification planning, and substantiation criteria that is being developed by this initiative. This provides the opportunities for utilities to support owner energy efficiency goals in a new way. The energy efficiency programs are quickly becoming a primary engagement tool for utilities to drive high customer service with their ratepayers.

Building owners will also benefit from additional technical support and internal process development for capital planning, project management, and operations staff. This approach provides an opportunity to bridge gaps in communication among these various stakeholders. Writing down energy and building performance goals and measuring success at the end will require discussion from the earliest planning phase until well into operations.

We will explore a number of key questions as we refine this approach throughout the life of the project. Some of the early interactions and direct testimonials have led to some of the following questions:

- Many owners have preferred architects and contractors. How do they leverage a competitive or incentive based process while working with their preferred partners?
- Some owners are required to accept lowest bid. What happens when the lowest bid does not show credibility in meeting the energy requirement?
- Owner X: “We need to contract project planning and programming to scope the project. The energy requirement cannot be conceived until the base programming has been developed.” How do we include this in the initial scope?
- Developer X: “Our entire profit margin is based on our current procurement process and we have an army of people who work on only that; you are asking us to change that process. How do I convince my investors that adding a new contract requirement will not increase project first cost?”
- Developer Y: “The follow through to measurement is the missing piece. This requires us to extend our traditional contract with these parties.” How do we address that in the contract and mitigate impact on soft costs?
- Architect X: “We have toyed with the idea of making the targets part of the contract. Teams are scared of it. So much of the challenge is cultural and personality – we are stuck in our rut. Would like to find a way to move it forward.” How do we create an RFP/contract framework that design and construction teams are not only willing to sign a contract for, but also leverage as a competitive advantage for them to win new projects in the future?

The next leap into deep building energy efficiency and net zero design is likely to rely on new processes and behavior in the same way that it relies on technology improvements. The case studies discussed here demonstrate the need for highly functioning team work and communication. We need clarity in goal setting that embodies clear, succinct, and measureable outcomes that will help process and communication flow throughout the owner, design, and construction teams. With national net zero goals coming to reality and the future of building

energy use 30 years from now depending on the decisions we make today, it is critical to overcome these barriers and re-invent the way we procure our buildings.

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