You Can't Beat the System: The Case for a Systems Approach to Commercial Building Efficiency

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ABSTRACT

Efforts to improve energy efficiency in commercial buildings have traditionally focused on individual building components or on whole-building performance. There is broad agreement that significant opportunities exist to achieve additional energy savings by focusing on building systems; however, there have been few attempts to quantify or develop strategies to achieve these savings. To explore this potential, in 2015 the Alliance to Save Energy launched the Systems Efficiency Initiative (SEI)—a collaboration of more than 50 private sector partners, utilities, government agencies, and research organizations. The goals of the initiative are to better understand opportunities for improving systems-level energy efficiency in (primarily commercial) buildings, make the case for investing in new approaches, and develop an action plan for incorporating systems-level efficiency in policies and programs. During the first year of the initiative, the SEI members conducted technical and policy assessments with a focus on mechanical systems, lighting systems, and multisystem integration. This paper summarizes the key findings from the SEI report—*Greater than the Sum of its Parts*—on the potential benefits of a building systems approach and priority areas for further research. It also outlines the SEI's preliminary recommendations for achieving this potential through: 1) creativity and collaboration among building designers, developers, and operators; 2) optimizing controls and the use of smart technologies; 3) integration both within and among building systems; and 4) exploring systems-level opportunities for miscellaneous electric loads (MELs) and beyond the building itself.

Systems Efficiency Initiative

Significant progress has been made on improving building energy efficiency over the past decades, by focusing on the efficiency of individual building components (i.e., appliances and equipment) and the efficiency of buildings as a whole. The energy efficiency of building components has improved substantially due to government and industry research and development efforts, minimum efficiency standards, and government, utility, and industry programs and incentives. Improvements in the energy efficiency and overall performance of buildings also have been driven by building energy codes and supported by voluntary programs that rate and certify the design and operation of more efficient and sustainable buildings, such as Energy Star Buildings and Leadership in Energy and Environmental Design (LEED).

Recently, industry experts and efficiency advocates have begun looking beyond these familiar energy-saving measures to consider new energy efficiency opportunities at the *building systems* level. The Alliance to Save Energy launched the Systems Efficiency Initiative (SEI) in February 2015, with corporate and foundation funding, to build on ongoing efforts in the industry and further investigate the significant untapped opportunities to increase energy savings by focusing on building systems. Based on the working thesis that a systems perspective will become increasingly necessary to achieve meaningful and cost-effective energy savings within the built environment, the SEI is designed to provide: (1) a collaborative analysis of systems-level savings potential, and (2) a set of strategies for achieving these savings. The initiative is governed by a Steering Committee of almost 50 industry stakeholders—including manufacturers, builders, utilities, government agencies and research organizations.[1]

During the first year, SEI Technical Committees investigated and summarized findings from systems-level research and demonstration activities carried out in the buildings industry and by government and research institutions within and outside the U.S. These SEI activities focused on: mechanical systems, lighting systems, multi-systems integration—including opportunities related to miscellaneous electric loads (MELs), direct current (DC) power, and building-to-grid (B2G) integration. The initial scope of the SEI is new and totally renovated commercial buildings.

Key SEI definitions

- *Building system*: A combination of equipment, operations, controls, accessories, and means of interconnection that use energy to perform a specific function.
- *Building system energy efficiency*: The ratio of (a) the services or functions provided by a building system to (b) the amount of energy that system consumes directly, taking into account the thermal load imposed on other building systems.
- *Systems-efficient building*: A building in which multiple building systems (e.g., lighting, HVAC) are designed, installed, and operated to optimize performance collectively with one another to provide a high level of service or functionality for a given level of energy use/input.

The findings from the first year of this effort are detailed in the May 2016 SEI report, *Greater than the Sum of its Parts: The Case for a Systems Approach to Energy Efficiency*. This paper encapsulates the main conclusions from the SEI report and discusses the topics prioritized for additional research, as well as the SEI's preliminary recommendations for policies, programs, investments, incentives, and other tools needed to transform the building market through a systems approach. These findings and recommendations are the products of a broad range of expertise and hundreds of hours of effort invested by close to 100 people over the course of the initiative's first year. The full list of SEI contributors is provided in the Report, which may be read at www.ase.org/sei.

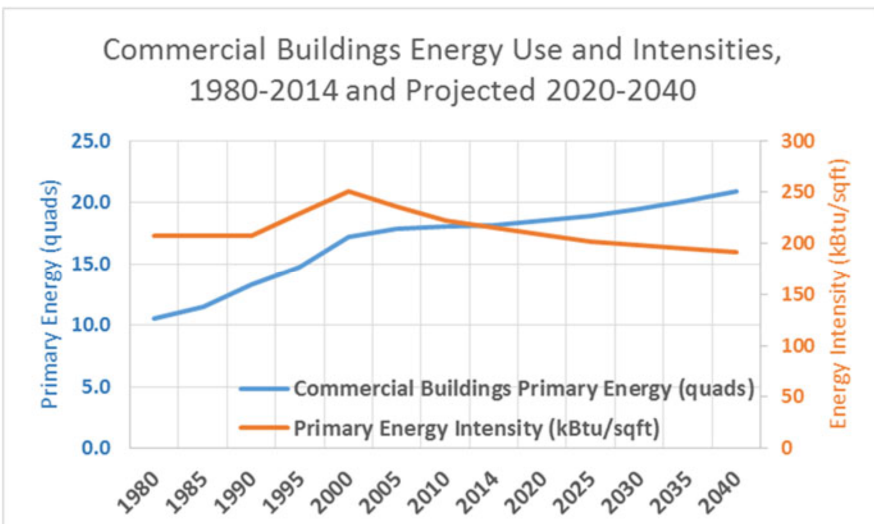
Need for a Systems Approach

During its initial discussions, the SEI Steering Committee identified the following compelling reasons for exploring and investing in a systems approach to building energy efficiency:

[1] SEI partners include representatives of: Acuity Lighting, AHRI, Air Movement and Control Association International, Airxchange, Alliance to Save Energy, ACEEE, American Gas Association, American Institute of Architects, ASHRAE, Appliance Standards Awareness Project, Bridgers & Paxton Consulting Engineers, Building Codes Assistance Project, Building Intelligence Group, California Energy Commission, Collaborative Labeling and Appliance Standards Program, Cree Inc., DC Fusion, Easton's Cooper Lighting Business, Edison Electric Institute, Emerge Alliance, Energy Foundation, Illuminating Engineering Society, Ingersoll Rand, International Association of Lighting Designers, Johnson Controls Inc., Lawrence Berkeley National Lab, Legrand, Lumencache Technologies, Lutron, Midwest Energy Research Consortium, National Association of State Energy Officials, NEMA, National Institute of Building Sciences, National Renewable Energy Lab, Natural Resources Defense Council, New Buildings Institute, New York State Energy Research and Development Authority, Nextek Power Systems Incl., Northeast Energy Efficiency Partnerships, Pacific Gas and Electric Company, Pacific Northwest National Lab, Philips Lighting, SAGE Electrochromics, United Technologies Corp., U.S. Dept. of Energy, U.S. Environmental Protection Agency.

1) ***Some types of building equipment—particularly single speed HVAC and other mechanical components—are approaching technical and economic limitations*** for achieving further efficiency improvements. As these limits are approached, the costs of marginal improvements at the component level will rise exponentially; a systems approach offers creative solutions to achieve further energy savings.
2) ***Highly efficient components do not necessarily result in an efficient building***. There is a need to look at complete systems—including the interactions among components and with the building—to truly optimize building efficiency.
3) Emerging opportunities for attaining significant efficiency gains—such as through the ***integration of smart grid and related control technologies***—ar***e optimally applied at the system level***.
4) Current regulations typically cover the efficiency of equipment and buildings as designed, but most do not address building performance. ***New systems-level strategies and tools could support the improved performance of building systems over the long term***, through system design as well as the commissioning of building systems.
5) Despite decades of improvement in equipment efficiency, driven in large part by minimum efficiency standards, the ***overall energy use of U.S. commercial buildings continues to increase***. As Figure 1 shows, the energy intensity (energy use per floor area) of U.S. commercial buildings is declining, but at a decreasing rate, while total primary energy use in this sector is projected to continue to grow steadily.

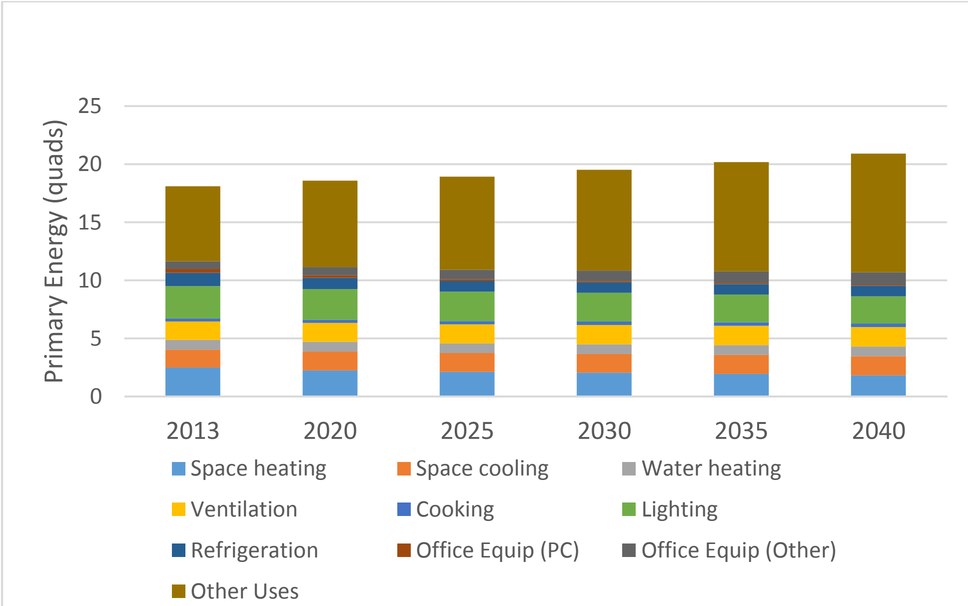
Figure 1 – Trends in U.S. Commercial Building Energy Use (per floor area and overall)



Source: U.S. DOE, 2015

One of the key reasons that building energy intensity is not falling more rapidly is the increase in plug loads and miscellaneous loads from the growing use of electronics and other electrical equipment in buildings; these not only directly affect the energy use of a building but also create additional cooling loads for mechanical systems. By 2035, miscellaneous end-uses ("other" in Figure 2) are projected to use as much energy as all other end-uses combined.

Figure 2. Projected U.S. Commercial Building Energy by End Use



Source: U.S. DOE 2015 Annual Energy Outlook, Reference Case, Table A5

The combination of these new loads and growing floor space means that new approaches to building efficiency will be needed to stem overall growth in building energy use.

6) Moving toward a ***systems approach provides opportunities to revise standards and metrics to more accurately represent actual system performance***. Building energy loads are highly dependent on ambient conditions, and change significantly as a function of the building type, season, and climate zone. Different building uses and climatic effects on buildings also can create opportunities to design systems approaches for saving energy in ways that consider typical building load profiles and regional climate conditions.
7) In addition to reducing energy use, a ***systems approach has the potential to achieve significant non-energy benefits***: reduced carbon emissions, improved grid reliability, water savings, and increased occupant comfort and productivity. The quantifiable non-energy benefits have been estimated to range from 25 to 50 percent of the total benefits of energy efficiency (Russell et al. 2015; Livingston et al. 2014).

Systems Efficiency Opportunities

SEI members have focused on efficiency opportunities in heating, ventilating, and air conditioning (HVAC) and lighting systems, which together account for more than half of total primary energy use in commercial buildings (USDOE 2012b), as well as on other areas of opportunity for building system efficiency—e.g., MELs, DC power, and B2G integration.

Mechanical Systems

Given the complexity of HVAC and other mechanical systems, the industry has been exploring a variety of efficiency approaches beyond the component level—focusing on mechanical subsystems as well as systems. Shifting to a systems approach that takes into account a diverse set of operating conditions can provide new opportunities for building designers and operators to maximize the efficiency of mechanical systems, including equipment, controls, accessories, and interconnections. For example, the use of variable speed equipment and control systems can result in system savings of 30–50 percent for HVAC systems (ABB Group 2014).

Setting efficiency targets at the system level can encourage the development of creative solutions. Opportunities exist for building designers, contractors, and operators to leverage the ways in which building equipment and systems interface with each other and with the electric grid. Building management systems and controls can be used to manage different building HVAC zones and systems separately to meet local loads and occupancy patterns, resulting in significant energy savings, peak demand reductions, and improvements in grid efficiency.

One major challenge to the implementation of a systems approach is the need to develop metrics and tools that reflect "real-world" operating conditions and account for system-level efficiency improvements. Most current efficiency standards and metrics for mechanical equipment have been designed based on an assumption that equipment will run at 100 percent load and under a single set of ambient conditions. Because HVAC systems operate differently under part-load versus full-load conditions, and at varying ambient conditions, rated and actual performance can differ substantially. Metrics designed to measure the efficiency of individual components also do not allow for creative solutions—including those involving controls and adjustable speed HVAC systems.

Recommendations. Selected SEI recommendations for moving toward a systems approach to improve the energy efficiency of mechanical systems are provided in Table 1.

Table 1. Systems Efficiency Initiative: Recommendations for mechanical systems

Mechanical Systems Recommendations
Design system-level metrics that reflect real-world operating conditions and accommodate hybrid technologies (e.g., systems that can use either electricity or fossil fuel); and carry out proof-of-concept tests to support a shift to these metrics.
Develop more accurate models to analyze mechanical systems at full and partial loads, over an entire operating range, and to better reflect more realistic building load profiles.
Create alternative simulation tools and approaches, using updated "benchmark" systems and buildings to establish better baselines against which to measure systems-oriented approaches.
Examine the potential for periodic commissioning over the life of a system.

A shift to systems-level metrics will take many years. Starting with lower-level subsystem approaches and demonstrating successes will help facilitate the transition.

Lighting Systems

While significant improvements have been made in the efficiency of individual lighting components, more energy savings can be obtained by focusing on lighting systems. A systems approach to lighting combines efficiency goals with lighting quality to meet the needs of the occupants and users of a space. An optimal lighting system consists of multiple components—including luminaires and other hardware (sensors and controls), software (scheduling, control algorithms, networking with other building systems), interior design (surfaces, furniture, colors and textures), and windows or skylights—designed and managed to minimize energy use while maintaining lighting quality. Key opportunities for improving the efficiency of lighting systems include the use of lighting controls, the integration of lighting systems with other building systems, and incorporating daylighting as part of a systems approach.

Lighting controls, such as occupancy sensors, light level sensors, and daylight sensors, take inputs from the external environment, process those inputs, and send the outputs to smart controllers, ballasts, or drivers that make decisions regarding the operation of the system. Wiring infrastructure and/or a communications backbone link the lighting system components together and enable them to operate in a manner that optimizes lighting and energy use in individual spaces and throughout a building, and to provide real-time information to facilitate energy management. Savings from the use of lighting controls vary widely but can be significant; one study in a General Services Administration (GSA) office building resulted in measured savings of 33 percent of lighting energy (Wei et al. 2015).

Incorporating daylight is one of the most challenging, yet effective, ways to optimize a lighting system. Introducing certain amounts of daylight into indoor spaces—e.g., by optimizing building orientation, or adding fenestrations, façades, or interiors—can greatly reduce lighting energy consumption and provide a more pleasing visual environment. The interaction between a building's lighting system and envelope is particularly important in any effort to maximize the benefits of daylight and daylight management systems. In a commercial building retrofit project in Washington DC, a combination of automated electrochromic windows—which create a "new load" in the building—and light dimming controls yielded weekday lighting energy savings of 91 percent compared to the previous lighting system, along with a 35 percent reduction in peak demand for lighting. Savings on an annual basis (including weekends and evenings) ranged from 39 percent to 48 percent (Lee, Claybaugh, and LaFrance 2012).

Barriers to improving system-level lighting efficiency include the complexity of controls and their configurations, the fact that many energy codes favor prescriptive approaches to compliance that do not encourage the use of lighting controls, and incentives for lighting equipment efficiency that often do not take into account lighting quality. Other factors include tradeoffs between the benefits of daylighting, glare, and solar heat gains that can increase a building's cooling load, and the potential for occupants to circumvent daylighting systems.

Recommendations. A systems approach can help address these barriers by promoting the use of energy-based metrics, monitoring energy use at the system level, and installing automated lighting control systems. Some of the specific actions the SEI recommends to move toward a lighting systems approach are provided in Table 2.

Table 2. Systems Efficiency Initiative: Recommendations for lighting systems

Lighting System Recommendations
Model the effects of reflective surfaces and other interior design aspects on energy efficiency (and associated non-energy benefits, such as minimizing glare); and the interaction of lighting and daylighting with heating/cooling loads to maximize efficiency.
Expand metrics and set targets based on energy consumption, using an outcome-based approach—e.g., Energy Use Intensity (EUI).
Refine system "boundary" definitions to reflect lighting system interfaces (the points at which lighting interacts with natural lighting and other building systems), and evaluate lighting

system performance based on multiple criteria, including energy consumption, energy efficiency, and lighting quality.
Establish and implement common technical system design and procurement specifications to accelerate the uptake of lighting controls in buildings.

Other Building Systems

Other building systems, including MELs and DC power, as well as the integration of multiple building systems and building-to-grid systems, are expected to have increasing impacts on building energy use. As a result, they offer opportunities to improve building efficiency.

Miscellaneous electric loads. MELs in commercial buildings, also often referred to as "plug" or "process" loads, are electric loads not related to HVAC, water heating, or lighting systems. They encompass a vast array of devices—ranging from computers and servers to security systems and medical equipment—and their mix, density, and share of total building energy use varies widely. MELs offer significant opportunities for efficiency improvements when in operating mode, and for reducing energy waste in "standby" or "sleep" mode. In the aggregate, MELs can account for 20–35 percent of total energy use in a commercial building and, by some estimates, can reach as high as 50 percent in otherwise efficient buildings (Kwatra, Amann, and Sachs 2013; McKenney et al. 2010). Because of their diversity and large numbers and, in some cases, the small wattage consumption, measuring energy savings from MELs is difficult—except at a circuit or whole-building level.

While addressing the efficiency of MELs at the equipment level will result in some energy reductions, potential exists to achieve even greater energy savings at lower cost by integrating MEL controls with other building systems. For example, on/off controls proposed for more than 240 vending machines, water fountains, computer monitors, printers, and copiers across several buildings of Salem, NJ Community College are expected to save an estimated 35 percent of building energy use (22,000 kWh/year) (pers.comm. October-November 2015).[2]

Challenges to improving MEL system efficiency include costs associated with MEL equipment upgrades, electrical and control system upgrades, data security systems, use of data analytics platforms, and technical support; data privacy issues; and occupant reluctance to accept controls on "their" MEL devices (e.g., controls that automatically transition the devices into low-power states). Significant staff time also will be necessary to service and maintain MEL control systems and to review and act on monitored data and diagnostics.

Direct current power. DC power systems within a building can reduce energy demand as well as contribute to grid balancing, expanded control options, and improved safety and reliability. DC distribution can deliver systems-oriented energy savings by reducing alternating current-to-DC (AC/DC) conversion losses and AC/AC transformer losses, in both active and "standby" modes; and by making it more feasible to replace AC-driven devices with "native-DC" devices for computers, telecommunications, and consumer electronics, as well as for lighting, control systems, and motors (especially those in variable-load applications).

[2] Sources are from phone interviews with manufacturers conducted in October-November 2015. For the SEI Report, the sources were "masked" because some data are proprietary or commercial-product specific.

Recent market growth and reduced costs of photovoltaic (PV) systems in the U.S., investments in battery systems (which also are DC power sources), and an increasing percentage of building loads that operate internally on DC are creating new potential to generate, store, and consume DC power in commercial applications (Kann et al. 2015). The largest opportunities for efficiency gains using direct current power are motors, light-emitting diodes (LEDs), office equipment, refrigeration appliances, data centers, and fast-charging of electric and hybrid-electric vehicles (Ton, Tschudi, and Fortenbery 2008). DC electrical distribution, combined with "smart" technologies that facilitate the multi-directional flow of power and communications, could help achieve additional system efficiency gains. Based on a study of DC and AC microgrids in commercial buildings, a recent NREL report found 2–5 percent electricity savings per building from switching to DC-powered lighting and ceiling fans (Fregosi et al. 2015).

Barriers to deploying DC power more broadly include installation costs, capital costs for equipment, limited availability of end-use DC products and DC distribution control equipment, and limited workforce training. To help overcome these barriers, the industry will need to develop products and systems that offer a better performance/cost ratio for standardized DC solutions across multiple building applications.

Multi-system integration. Achieving a systems-efficient building requires advanced controls and feedback that optimize the performance of multiple building systems and help buildings operate at peak efficiency. The processes and tools provided through systems integration also provide a path toward improving performance over time. However, optimizing integration across building systems is a complex challenge. For example, a study of the joint control of HVAC systems and variable-daylight window systems in four U.S. climates found a wide range of savings from the advanced controls, from no savings (and, in a few cases, losses) up to approximately seven percent savings in lighting and cooling energy (Coffey 2012).

Barriers to multi-systems integration include a lack of common standards and communications protocols, suppliers' preference for proprietary rather than open-systems software, and an industry structure and delivery system with few crossover points among systems for lighting, HVAC, envelope, office electronics, and plug-in equipment. Other challenges include obsolete control systems, lack of "intelligence" capabilities to facilitate integration with other systems, and up-front costs and uncertain returns on investment.

Building-to-Grid Integration. As a result of the convergence of "smart" sensing, metering, and control technologies with remote and wireless connectivity, enabling the multi-directional flow of power and information, and "big data" analytics for buildings and the grid, buildings can now act as distributed energy assets.[3] B2G integration also will empower building owners, operators, and tenants to better manage their energy use and dynamically participate in energy markets.

The SEI considers B2G integration to be both an important system in and of itself, one that extends beyond the building's boundary, and a key method of integrating other building systems, including HVAC, lighting, and MELs. Ideally, much of the same communications and control infrastructure needed to integrate system- or building-level monitoring and controls can provide a foundation for B2G interactions—such as demand response and "ancillary grid services"—that both improve grid reliability and create an added source of revenue to a building

[3] "Big data" refers to extremely large data sets that may be analyzed computationally to reveal patterns, trends, and associations, especially relating to human behavior and interactions.

owner. Benefits include energy savings from improved efficiency on both the customer and the utility side of the meter; peak demand savings, and grid reliability.

Building owners and operators are not likely to invest in B2G-capable end-use devices in the absence of utility "smart-grid" infrastructure, standardized communications protocols, and rate-setting policies and market mechanisms that provide a suitable sharing of benefits between the utility (or grid operator) and the customer. B2G integration also may be challenging for small- to medium-sized buildings, given the level of investment likely required.

Recommendations. Key SEI recommendations for promoting a systems approach to these other building systems are provided in Table 3.

Table 3. Systems Efficiency Initiative: Recommendations for other building systems

Other Building System Recommendations
Miscellaneous Electric Loads
Enhance open-system protocols to help integrate MEL device controls with building management systems—e.g., use occupancy sensors to turn off computers and printers (or put them in "sleep" mode).
Investigate cost-effectiveness of MEL control methods at different levels of aggregation (i.e., single device, multiple MEL devices, and with other building system controls).
DC Power
Develop techno-economic models of hybrid AC/DC distribution network types for building classes with critical decision paths and financial impacts.[a]
Expand existing power and communication standards—such as Power over Ethernet (POE) or USB Power Delivery (PD)—to support DC system designs.
Multi-Systems Integration
Develop common protocols to enable communication among various building systems.
B2G Integration
Develop open architecture platforms to facilitate interoperability of systems.
Increase workforce training on building science, systems integration, and diagnostics.

a. Techno-economic modeling is a type of modeling carried out to help ensure that market-driven prices for new technologies can be achieved.

Market Barriers and Solutions

Existing market barriers to adopting a systems efficiency approach can be addressed through a variety of solutions—including market-based strategies, industry-developed standards and metrics, training and certification, and changes to codes, standards, and other policies and programs. The main market challenges and recommended solutions identified by the SEI team are summarized below.

Addressing fragmentation and process disconnects. The majority of the buildings sector is not structured to generate systems-focused building solutions. The industry is highly fragmented—with design decisions, construction practices, and building operations divided into distinct disciplines with little consultation among the various actors. Related process disconnects exist in procurement. Because the prevailing "design-bid-build" project delivery method separates the design from the construction functions, the potential performance benefits and life-cycle cost reductions that could be realized in building systems through closer collaboration across the design and construction teams are lost. An alternate model, "design-build" contracting, addresses this disconnect by combining design and construction in the same contract. Integrated Project Delivery and other integrative processes, whereby parties establish goals in a team environment for a project's design, construction, and operations phases, also can help promote a systems-oriented approach toward efficiency (Cheng 2015; SeventhWave 2015).

Government policies and programs. Because the federal government is one of the largest building owners, policies and efforts to improve efficiency in federally owned buildings can influence the overall building market. In addition, policies and programs implemented at the federal, state, and local levels—e.g., tax incentives, energy efficiency labeling, building codes—can promote a systems approach during the design, construction, and operation of all buildings. Challenges facing the development and adoption of systems-focused and outcome-based code requirements include the need to develop tools and guidance for the architecture, engineering, and construction (AEC) community on design and construction methods to meet these requirements (Colker, Frankel, and Edelson 2015).

Energy benchmarking and disclosure. Building energy benchmarking—measuring a building's energy use and comparing it to the average energy use for similar buildings—is an important process for monitoring facility energy use and understanding overall building performance. Building energy benchmarking and disclosure programs, whether voluntary or mandatory, are beginning to have impacts on the building market: When building owners collect and report energy performance information, prospective buyers or tenants can factor energy use into their market evaluations. Benchmarking also is important to help monitor facility energy use, understand overall building performance, and allocate capital investments for owners of a portfolio of buildings. Benchmarking typically is conducted at the whole-building level. To the extent practical, however, sub-metering and benchmarking at the systems level would be extremely valuable for measuring and comparing the efficiencies of various building systems.

Recommendations. Specific recommendations for addressing market barriers to promoting a systems approach are provided in Table 4.

Table 4. Systems Efficiency Initiative: Recommendations for overcoming market barriers

Market and Policy Recommendations
Use Integrated Project Delivery in building design, construction, and operation.
Increase the focus on actual, measured building and system performance through voluntary energy rating and disclosure, and advances in codes, policies, and practices.
Support the expanded use of system commissioning.
Require public building renovations to incorporate building system efficiency upgrades.
Design performance metrics, testing and rating methods, and mechanisms for third-party certification of systems energy performance to support code compliance.
Incorporate systems-level requirements and operations-focused criteria into baseline codes, "stretch" codes, and rating systems.
Promote the adoption of sub-metering requirements and system-level energy benchmarking at the state and local levels.

Provide training and certification for state, city, and county agencies, as well as design professionals, on system-level building commissioning.
Encourage utility and other programs that provide incentives based on actual, measured reductions in energy use by selected building systems.

Next Steps for the Systems Efficiency Initiative

The April 2016 SEI Report, *Greater than the Sum of its Parts*, is the result of a year's worth of meetings and research, prompted by a recognized need for industry consensus around systems efficiency. The report provides preliminary recommendations for achieving the next level of efficiency in buildings by optimizing building systems.

During 2016–2017, SEI Working Groups are carrying out additional analysis (including modeling exercises) to further quantify the benefits from specific system-level measures, and will develop system-level policy and program recommendations for U.S. DOE, Congress, or industry associations. In addition to the Year 1 SEI focus areas, research topics during Year 2 may include dynamic and passive envelope systems, combined heat and power (CHP) and heat recovery, on-site energy storage, integrated project procurement, and systems opportunities in existing buildings. The SEI members will carry out a roadmapping process to vet proposed recommendations with a range of experts at industry events, and at roundtables organized on Capitol Hill and other venues. The resulting SEI Roadmap will focus on areas of highest potential gains for systems-level energy savings, possibly including development of new systems metrics; training curricula; proposed changes to standards, codes, and building rating systems; and tax incentives to support systems efficiency.

Industry experts and efficiency advocates agree that improving the efficiency of building systems is an important strategy for achieving the next level of efficiency in buildings. The SEI provides a critical forum for understanding the energy savings potential of a systems approach and for developing strategies for moving the market in this direction.

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