PUTTING ENERGY RESEARCH INTO PRACTICE—WORKSHOP SUMMARY

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Workshop Summary

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Executive Summary

The two-day *Putting Energy Research into Practice* workshop, conducted on behalf of the General Services Administration Office of Federal High-Performance Green Buildings, resulted in a productive discussion on the process, barriers, and enablers in adopting energy reducing technologies, strategies, and practices. Through a series of breakout sessions and large group discussions, workshop participants identified an eight-stage adoption process with more than 30 stakeholders and multiple barriers. These conversations highlighted how the adoption process is a complex and interdependent system that requires more integration and collaboration. From this, we see that our efforts going forward should focus on these main enablers or levers of change:

1. Develop, deliver, and use integrated energy reduction solutions.
2. Improve education and training opportunities to advance workforce skills.
3. Influence the procurement, contracting, and finance processes.
4. Address organizational and cultural barriers.
5. Provide a safety net to mitigate tendencies of decision makers to be risk-averse.
6. Gear research toward outcomes and the Executive- and field-level people who can act on it.
7. Use life-cycle cost accounting.

The workshop underscored that communications should speak to the differing perspectives at play and focus on the desired outcomes. In addition, we will need to create an environment of collaboration and induce people to work together. This encouragement will require diverse approaches ranging from direct incentives to measures that are mandatory, prescriptive, or focused on performance.

Day 1 Workshop Activities—March 17, 2011

The workshop began with activities focused on identifying the pathway, roles, and influences that support the movement of energy reducing technologies, strategies, and practices from research to adoption. From the discussions, participants proposed an integrated adoption process, which consists of needs analysis, codes/standards/policy, research, production, marketing, delivery, procurement, and adoption.

The workshop group also identified the most influential stakeholders in the adoption process to be the occupant, operator/facility manager, procurement officer,

building owner/investor, asset manager, and building retrofitter. In addition, in terms of researchers versus non-researchers, we found that researchers have a low influence on marketing and an interest for greater influence on delivery and adoption. For non-researchers, their influence is in delivery and they want to be more influential on procurement.

Day 1 continued with dialogue on the gaps, challenges, barriers, and enablers present within the adoption pathway. The discussions led to the identification of approximately 40 barriers and 25 enablers, most of which are distilled into the seven topics mentioned above.

In the final session, workshop participants recommended and selected the lighting and thermal conditioning energy reducing technologies, strategies, and practices most ready for adoption. The group suggested that a decision maker should assess current energy use and implement low-cost measures before selecting an energy reduction solution. The final list of energy reduction solutions focused on bundling, verification, education, cool roofs, and monitoring.

Day 2 Workshop Activities—March 18, 2011

Identifying decision makers, influencers, and the synergies among them was the initial focus of Day 2. During the first session, workshop participants described how individuals and organizations are decision makers or influencers based on their perspective (technical, managerial, policy) and place in the decision-making hierarchy. The takeaway here is that categorizing decision makers and influencers based on their synergies is critical to understanding and developing effective outcomes.

This theme continued into the following session, where workshop participants addressed the audiences, messages, and mechanisms associated with Day 1's recommended technologies, strategies, and practices. For each item, participants reiterated the importance of a strategy-based approach and the absence of a single decision maker, message, or solution.

The next session focused on potential messages with some identification of communication mechanisms. Moving forward, participants' recommendations suggest that we consider the importance of framing communications while conveying the need for bundling mechanisms for portfolio-based implementation, mandatory performance requirements, and more use of benchmarking, verification, and monitoring.

The workshop concluded with a discussion on Web 2.0 capabilities. The conversation addressed using a web-based community of interest for internal communication between participants. It also addressed opportunities for external outreach to decision makers and end users with other web platforms to "crowdsource" or blog.

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Workshop Overview

The *Putting Energy Research into Practice* project seeks to use a change management approach to understand how we can bring knowledge about energy reducing technologies, strategies, and practices to the field in ways that are accessible and useful for implementation in building operations, maintenance, and small-scale renovations. The project's focus is on energy managers, facility managers, and project managers engaged in lighting and thermal conditioning projects.

This workshop involved researchers from the national laboratories and select universities, real estate professionals, association representatives, industry representatives, architects, and government agency representatives to help us:

- Clarify the process to move energy reducing technologies, strategies, and practices to adoption
- Uncover the roles, influences, and gaps present within the adoption process
- Examine the synergies among decision makers and influencers
- Pinpoint the key barriers and enablers to improve adoption
- Reach a consensus on "no-brainer" lighting and thermal conditioning energy reduction solutions.

We will use the results from the workshop to develop an effective communications strategy to aid in the dissemination of energy research and usage data to decision makers and end users.

Day 1 Workshop Activities—March 17, 2011

Breakout Session—Clarifying the Path from Research to Adoption

During the first breakout session, workshop participants separated into groups of researchers and non-researchers to discuss the process, roles, and influences that help move energy reducing technologies, strategies, and practices to adoption. Building upon the list of process stages and individual roles identified during the pre-workshop interviews, the groups identified 8 primary stages, as depicted in Table 1, and 20 roles, as depicted in Figure 1.

1. Needs analysis	• Assessing user needs for energy reducing technologies, strategies, or practices.
2. Codes / Standards / Policy	• Setting rules or goals to attain desired outcomes for energy performance or energy reduction solutions.
3. Research	• Analyzing building systems and energy reduction solutions to address issues and advance knowledge.
4. Production	• Manufacturing goods or developing services that provide energy reduction solutions.
5. Marketing	• Communicate the value of energy reduction solutions to potential customers.
6. Delivery	• Supplying energy reducing technologies, strategies, or practices to a customer.
7. Procurement	• Acquiring energy reduction solutions.
8. Adoption	• Purchasing or using an energy reducing technology, strategy, or practice.

Table 1. The primary stages within the process to adopt energy reducing technologies, strategies, and practices.

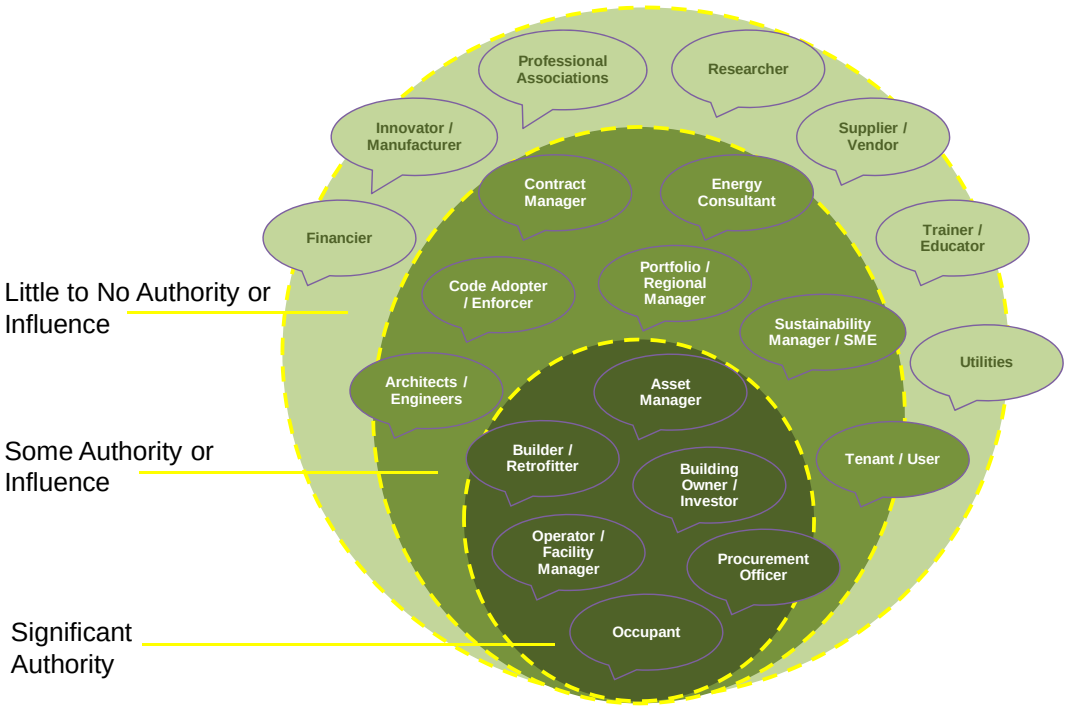


Figure 1. Roles and influences that help move energy reducing technologies, strategies, and practices to adoption.

During this breakout session, and in comments throughout the workshop, participants expressed concerns that the process to adopt energy reducing technologies, strategies, and practices tends to flow in a linear direction from needs analysis to adoption, as shown in Figure 2.

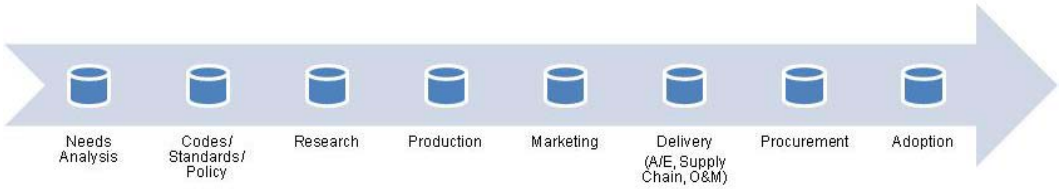
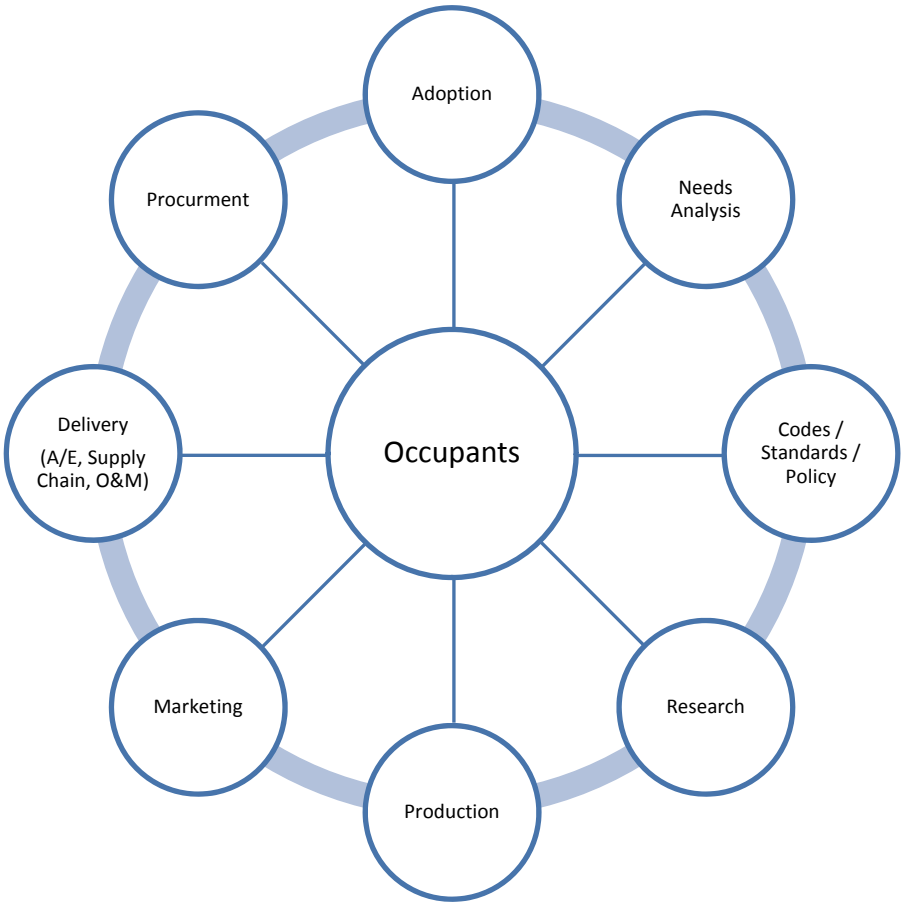


Figure 2. Linear "status quo" process to adopt energy reduction solutions.

But because the process to adopt energy reduction solutions is more complex and interdependent, workshop participants stressed a need for a more integrated and collaborative approach with more emphasis on the occupants. Such an amended framework is shown in Figure 3. The illustration adapts the linear process into one that is continuous and cyclical. It also places the occupants—the primary reason for commercial buildings—at the core. When each stage directs attention to the center, the stages are able to collaborate in any number of combinations. For example, a needs analysis could influence changes in procurement that lead to adoption. Likewise, changes in a standard could make a manufactured good obsolete, requiring the producer to perform additional research to develop a new product while using existing marketing and delivery methods.



Note: A/E = architects/engineers; O&M = Operations and Maintenance.

Figure 3. Stages within the process to move energy reducing technologies, strategies, and practices to adoption.

The workshop facilitators also engaged the group members to identify their roles and influences within the adoption process on the basis of their current responsibilities, current influence, and where they would like to be more influential. Using sticky notes, the participants located themselves within five of the eight adoption process stages. Table 2 outlines the results of this exercise. Because the occupants and the stages for needs analysis, codes/standards/policy, and production were excluded from this activity, the results do not reflect positions or influences in these areas.

In general, we see that workshop participants lack influence in marketing and possess a desire to increase their influence in procurement. Specific to each group, the researchers aligned themselves primarily at the research and adoption stages, whereas the non-researchers pinned themselves to delivery and adoption. The researchers have a slightly stronger influence in research and procurement and prefer more influence on delivery and adoption. In the other group, the non-researchers believe their influence lies primarily in delivery with a lower level of

influence in procurement. The non-researchers want to exert more influence on procurement and have little interest in further influencing research or marketing.

Position

	Research	Marketing	Delivery	Procurement	Adoption
Research	14	1	0	1	8
Non-research	2	4	5	2	6
Total	16	5	5	3	14

Influence

	Research	Marketing	Delivery	Procurement	Adoption
Research	9	2	7	9	7
Non-research	5	5	7	3	4
Total	14	7	14	12	11

Desire to Influence

	Research	Marketing	Delivery	Procurement	Adoption
Research	5	4	6	5	6
Non-research	1	1	4	9	5
Total	6	5	10	14	11

Table 2. Positions, influences, and desires to influence adoption stages.

Large Group—Identifying Gaps and Influence Along the Path

The larger group discussion quickly diverted from the breakout session to a broader conversation on gaps within the adoption process. This brainstorming session honed in on four main areas, explained in more detail below.

- Stovepiped stages and a lack of feedback loops result in a dysfunctional adoption process
- Decisions to adopt energy reduction solutions do not focus on outcomes such as implementation or performance
- Energy research is not connected with facility-level implementers—focus is on the gadget
- Economics and asset valuations exclude important factors.

Adoption Process Is Dysfunctional

As discussed above, workshop participants rebutted the disjointed and linear status quo process to adopt energy reduction solutions in favor of a more integrated approach. They believe the process should be more integrated because the delivery of effective energy reducing technologies, strategies, and practices requires feedback loops. But the disjointed process that exists offers few incentives for the stages to work together. As a result, each component remains static in their operations, focusing only on their own measurements of success (for example, the pro-

curement officer buying the lowest priced product, while the architect adds costs to gain energy savings).

This stovepiping results in a clumsy handoff between each stage. Workshop participants believe the solution requires streamlining the exchanges by making everyone in the supply chain more sensitive to the upstream and downstream needs. Doing so may require:

- Assembling all the disciplines to coordinate handoffs
- Creating tools that reduce the number of handoffs in the traditional process
- Sustaining constant demonstration and feedback throughout the process
- Changing remuneration or contractual relationships among designers and builders to prioritize integration and a systems approach.

Participants voiced agreement that communication strategy and plans are also an important part of the solution. This communication should include all stakeholders, not just the decision makers, and must challenge cultural beliefs that buildings are disposable. It should also recognize that shifts in management paradigms and work practices (such as telework) could affect how we use buildings in the future.

Decision Making Should Focus on Outcomes

Another important topic from the large group discussion focused on a need for outcomes to drive the decision making process. Participants observed that decision makers currently focus on the energy reducing technologies, strategies or practices, instead of the modes of practices (how to implement a technology, not just install it) and performance (purchasing creative solutions and innovation to meet business needs). Changing this mindset would require groups to focus on the roles and processes differently, which affects how we communicate information to decision makers and stakeholders. Other factors—such as money, the people available for use, and code or mandate enforcement—also affect the outcome.

Research Focuses on Products, not Implementation

Workshop participants felt that adopting energy reducing technologies, strategies, and practices requires more than just researched or engineered products and tools for decision making. To put energy research into practice, the research should better connect with the people who will act on it, and it should be communicated in a manner that potential users know how to apply the information. This requires an emphasis on implementation and integration, and less on improving fundamental knowledge or developing gadgets that do not meet a specific demand. Research that focuses on accurately measuring building performance and providing real-

time data is one such example. Piloting projects at customer agency sites or performing research in cookie-cutter buildings are also possible solutions.

Economics and Asset Valuations Exclude Important Factors

Low energy prices and asset valuations that focus solely on financial metrics are speed bumps in the adoption process. A higher cost of energy theoretically will provide more incentive to invest in capital improvement projects due to an improvement in the return on investment. It remains theoretical because, as one participant explained, his experience shows that real estate owners and managers are unwilling to spend money to certify their buildings through the U.S. Green Building Council LEED® certification system, even though they know such buildings that meet these requirements sell at a 5 percent to 7 percent premium over similar buildings.

This observation leads into a second point that how we value our buildings may be a more important factor. Today, most valuations assess facilities "as-is," with little consideration for building performance, operations, and future required upgrades. Workshop participants support a transition to life-cycle accounting, which values buildings as assets, not commodities. It also affords the opportunity to engage stakeholders and align the use of buildings with management's mission. A life-cycle perspective may factor in specific energy performance metrics, such as "energy per person" or "Btu per person per product."

Breakout Session—Validating White Paper Findings of Challenges and Barriers

In the research and non-research breakout groups, workshop participants identified where barriers limit or prevent the adoption of energy reducing technologies, strategies, and practices. Each group also recommended levers of change that may help overcome these barriers. A complete summary of the barriers and enablers for each stage of the adoption process is in Appendix A of this report.

Large Group—Reaching Consensus on the Barriers and Enablers

The large group session focused on each group's summary presentations. As a whole, workshop participants concentrated their discussion on these seven topics:

- Delivering integrated energy solutions (for example, company partnerships that bundle energy reduction solutions)
- Improving education and training for decision makers and end users (for example, degree tracks that focus on facility management)
- Influencing the procurement, contracting, and finance processes (for example, setting energy performance requirements and ensuring accountability)

- Overcoming organizational and cultural barriers (for example, encouraging occupants to accept more "discomfort" to save energy)
- Creating a safety net to mitigate tendencies of decision makers to be risk-averse (for example, eliminating the disincentives to taking risks)
- Gearing research toward outcomes and the people who can act on it (for example, through real-world prototype demonstrations)
- Using life-cycle accounting (for example, incorporating operational costs, environmental consequences from ozone depletion, and net present value calculations of human benefits).

Breakout Session—Identifying Energy Reducing Technologies, Strategies, and Practices

In this breakout session, workshop participants divided into groups based on their experience with lighting or thermal conditioning. Each group discussed and added to the list of "no brainer" energy reducing technologies, strategies, and practices culled from the pre-workshop interviews and questionnaire. After all recommendations were made, the participants identified their top picks for the items they feel are ready for adoption.

The lighting group focused on the need for a lighting strategy that addresses the intended outcome and maintains ownership of the diagnostic. With an emphasis on the outcome, the group believes it will be clearer about which lighting solutions to adopt. It's also important for organizations to take ownership of identifying wasteful energy sinks, and to do so while being agnostic about the solution. Other participants also voiced the need for:

- Education
- Guaranteed accountability and reliability from the manufacturer or installer
- Improved standardization and adaptability of lighting products and systems
- Taking advantage of opportunities with no or low costs.

The thermal conditioning group also expressed interest in a strategy-based approach. Its members reached consensus that a cogent formula with a simple methodology will move adoption forward. This strategy includes the following steps:

1. Conduct benchmarking with total energy audits
2. Implement low-cost strategies or practices that shrink the base energy load
3. Deliver energy reduction solutions

4. Continue monitoring and verification.

The thermal conditioning group also emphasized that defining the scope is vital because the type or size of a project will affect how we approach thermal conditioning solutions. This is especially important for bundling opportunities that require significant costs to implement and that may exceed the federal government's maximum dollar limits on spending for a single project. It is also important where portfolio-based facilities management is in use. Other challenges should also be considered, such as a common practice to oversize thermal conditioning systems, and private- and public-sector requirements for a short-term payback period.

Large Group—Selecting Top Technologies, Strategies, and Practices for Energy Reduction

The large group discussion focused on the top five agreed-upon energy reducing technologies, strategies, and practices identified during the lighting and thermal conditioning groups. The results are presented below.

LIGHTING

As mentioned above, an important consideration for the lighting group is to develop a strategy that promotes an understanding of the benefits or added costs from implementing technologies, strategies, or practices. Based on its members' votes, these are the top approaches to focus on for lighting:

- Benchmarking with total energy audits
- Bundled lighting solutions
- Education
- Energy-efficient lighting fixtures and systems
- Occupancy sensors.

THERMAL CONDITIONING

Because thermal conditioning depends on several building components, the thermal conditioning group focused on bundling thermal conditioning solutions. Here are the top five selections from the thermal conditioning group:

- Cool roofs
- Deadband/personal-controlled conditioning

- Façade upgrades (improving building air tightness and using dedicated outdoor air systems, window replacement, wall installation, and perimeter HVAC upgrades)
- Monitoring energy comfort with standardized methods
- Retro-commissioning with continuous commissioning.

Day 1 Takeaways

The first day of the workshop validated that the problem of adopting energy reducing technologies, strategies, and practices is complex. The solution requires more than simply disseminating information about technology—it requires communication that helps get the technology, strategy, or practice adopted. The messages may be "this is a good technology," "here's how to fix your procurement process," or "here's what you need to understand." And as stakeholders in the adoption process, the solution requires us to influence the way decision makers and end users apply their thinking on a daily basis and recognize that collaboration throughout the cycle is pivotal.

In addition, more important than the product is a strategy to drive the adoption of solutions, with a focus on performance or outcome. Such a strategy should account for the differing perspectives at play and develop a process that allows us to install safety nets or create incentives for action. It also should recognize that some solutions will be replicable across the board, while others require analysis and a specific application.

Day 2 Workshop Activities—March 18, 2011

Breakout Session—Identifying Decision Makers

Workshop participants sought to identify the decision makers and stakeholders who influence the adoption of energy reducing technologies, strategies, and practices, as well as the best methods for influencing them. The discussions focused on identifying the decision makers and influencers, which increased from Day 1 to include over 30 entities. The outcomes are tabulated in Table 3, and shown in Figure 4 and Figure 5. The figures depict decision makers in the inner circle in green and the influencers around outer circle in orange.

Decision Makers	Influencers
Agency leadership	Agency policy makers
Architect/engineer services*	Architect/engineer services*
Building owner*	Building owner*
Client organization/building tenant*	Client organization/building tenant*
Codes and standards committees*	Codes and standards committees*
Congress*	Congress*
Consultant (specialized)*	Consultant (specialized)*
Contracting officer	Designer (specialized)*/constructor
Designers (specialized)*	DOE FEMP*
DOE FEMP*	Electrician
Facilities management	Energy Service Companies
Facility/property manager or contractor	Financier
Funding authority*	Funding authority*
Interagency Working Groups/Tri-Service Working Groups*	General contractor
Occupants*	Interagency Working Groups/Tri-Service Working Groups*
OMB Environmental*	National laboratories
OMB, GSA, or other executive agency	Lobbyists
Organizational energy manager	Occupants*
Procurement office*	Procurement office*
Professional engineer	Procurement policy makers (OMB)
Project manager	Professional associations
Unions	Public opinion
	PUCs/Utilities
	Researchers
	Supply chain—reputable manufacturer, vendor, supplier, distributor, installer
	Universities

Note: DOE FEMP = Department of Energy Federal Energy Management Program; OMB = Office of Management and Budget; PUCs = public utility commissions. Items with asterisk represent roles or organizations that may be both decision maker and influencer.

Table 3. Decision makers and influencers.

Figure 4. Lighting group's bulls-eye chart of decision makers and influencers.

Figure 5. Thermal conditioning group's bulls-eye chart of decision makers and influencers.

Large Group—Grouping Reports and Examining Synergies and Influences

The large group came together to discuss the synergies across lighting and thermal conditioning and explore possible messages. The main takeaways from this discussion are:

- Several roles or organizations may be both decision maker and influencer. The side they occupy affects how they relate to others (for example, occupants as decision makers versus influencers).

- Collaborative and hierarchical decision making approaches exist, and these tend to result from synergies amongst a group of roles and organizations. To capture these, it may be best to categorize the synergies, but take care not to oversimplify them into buckets. What will help the categorization will be an understanding of how the multi-layered process interrelates, who provides the funding, and the special interests at play. We can best address each through our communications. Some of these synergies or buckets may include the following:

  - Project manager, procurement department, contracting officer

  - A/Es influenced by codes, standards, reputable manufacturers, national laboratories, universities, suppliers, specialty designers

  - Consultants, building owners, national laboratories, professional associations

  - Occupants, facility managers, client organization, building operator

  - Congress, agency leadership, funding authority

  - Existing fragmentation between design and construction.

- Our messages should acknowledge that ground-level implementers need a well-informed outlook from top-level decision makers. Because top-level decisions determine what the reality becomes, the bottom cannot collaborate if it does not understand how to comply with high-level mandates.

- Some decisions are technical or managerial, while others are policy oriented—for example, a consultant may make technical decisions through recommendations, but the receiver of this information will use it to make a managerial decision. These perspectives on project versus process influence how people receive and use information to make decisions (see Appendix B for more details on sources of information). It will be useful to capture these variations in a matrix, which may resemble Table 4.

Decision	Owner	Implementer/Supplier	Occupant/User
Technical		Messages	
Managerial		and	
Policy		Mechanisms	

Table 4. Appropriate communication messages and mechanism are determined by the intersection of role and perspective.

- Procurement policy is about how to procure not what to procure. Setting technical or performance-based requirements may be the best way we influence the level of energy reduction that we want. Ideally, the buyers would procure what technical subject matter experts specify. But this is feasible only if technical requirements are clear and aligned with the desired outcomes, and if the buyer or contracts officer understand what the terms mean. Clearing up this communication may also help eliminate the substitution lane, which tends to makes it too easy to sign off on contract changes that do not align with the overall purpose of the project or agency mission.

Breakout Session—Aligning Technologies, Strategies, and Practices with Audiences, Messages, and Mechanisms

In this exercise, the lighting and thermal conditioning groups discussed the audiences, barriers, enablers, messages, and mechanisms associated with the top five lighting and thermal conditioning technologies, strategies, and practices they identified on Day 1. The main finding is that no single decision maker, message, or solution exists for each technology, practice, or strategy. The group members suggest that understanding and mapping the decision trees associated with each are critical to developing effective outcomes.

Each group also offered additional comments about potential mechanisms. In lighting, the group suggests a need to focus on developing a portfolio-based strategy and improving training and education. With thermal conditioning, the participants reiterated their thoughts on energy costs, outdated cultural or organizational norms, and verification, and added a portfolio-based strategic focus to identify buildings most ripe for bundling upgrades. Detailed information contained on the exercise sheets is not detailed here, but will be included in the communication strategy.

Large Group—Identifying Key Communication Mechanisms

In the final session on Day 2, participants assessed potential communication mechanisms. The discussion, however, focused less on the mechanisms and more on the messages, audiences, and goals. A summary list of items discussed during this session is in Appendix C. The communication mechanisms still need to be identified.

Day 2 Takeaways

On Day 2, the workshop participants strengthened their vision of a dynamic, complex system where every level is informing every other level. They continued to recognize that, in reality, most components are static, and any solution will require not only bridging the gaps, but also getting people to walk over the bridges. Such a solution requires a simple focus and expectations based on achievable and effective results. It also includes getting the right message to the right people at the right time. Some of the measures to do so will be prescriptive and others based on performance. Sometimes statistics may work; at other times, we may need to tell stories. Either way, the information obtained from the workshop, as well as other information we have or will obtain, will help us better understand the mechanism that support the adoption of energy reducing technologies, strategies, and practices.

Appendix A: Identified Barriers and Enablers

During the second breakout session on Day 1 of the workshop, participants identified additional barriers and enablers. These were then applied to fishbone diagrams associated with each stage of the process to adopt energy reducing technologies, strategies, and practices. We profile the results of this exercise for each stage below. This exercise did not consider the stages for needs analysis and codes, standards, and policy.

Research

Barriers

- Research does not typically target the needed outcomes. It may be tied to a policy-based perspective from an agency or design standard, but it does not specify what the benefits from the research will be, nor for whom.
- The interaction and communication among researchers is limited. This affects the dissemination of results and opportunities to merge skill and knowledge sets to collaborate on research.
- Researchers do not use the same methods and metrics in their experiments. This makes it difficult to compare and interpret results.
- Field and integrated product testing of energy reducing technologies, strategies, and practices is limited. The research focuses on product- or project-level analyses.
- Feedback loops to research are weak or nonexistent.
- The vehicles for disseminating research are limited. This results partially from tenure-track programs that seem to emphasize publication in peer-reviewed journals; field-level implementers do not use these as their main source of information.
- Some believe that the value of energy reducing technologies, strategies, and practices is unproven. As such, they are skeptical about the performance results.
- The education system does not provide a curriculum that gears students toward research, especially in the field of energy efficiency.

ENABLERS

- Tie research to the needed outcome. Before any demonstrations, researchers should provide clear guidance on why the research is being conducted and what are the expected results.
- Increase the number of demonstration prototypes that align with the real world in real time, and disseminate the results through the appropriate channels.
- Provide education and training to researchers to help them understand how to market to their audience.
- Develop partnering networks to share information, create teams of experts, and obtain joint funding.
- Improve our ability to measure energy performance and occupant satisfaction.

Production

BARRIERS

- A lack of competition exists among reputable energy manufacturers, which in turn leads producers to preserve their present state as much as possible. The requirement for significant investments in new product development supports this inertia, especially since companies are unsure when an advanced technology will reach adoption.
- Manufacturers focus on products instead of delivering integrated performance.
- Although it is in the manufacturer's interest to develop reliable products to retain customers, few of them provide strong warranties on their products. Some argue that this focus on the customer is incentive enough for reputable manufacturers to develop lasting products, especially since failure to do so can carry legal liabilities.
- Manufacturers maintain proprietary rights over their products and systems. This can slow the adoption of advanced energy reducing technologies.

ENABLER

- Create corporate partnerships to deliver integrated energy reduction solutions. The Alliance for Sustainable Built Environments is one example.

Marketing

BARRIERS

- The language of research is not understandable to everyone. Outdated messaging practices do not target results to a specific audience.
- Marketers do not always know who they should market to and, as a result, oversimplify research or promise more than what the research says a product will actually deliver (for example, green washing). This is true of producers who cater to multiple audiences but tend to have a single marketing message.
- Public opinion assumes universality with methods, metrics, and messages. This results in the acceptance of myths and misinformation, which ultimately dilutes the messages for well-demonstrated energy reduction solutions. But because there is no systematic data gathering, feedback, or federal metrics, inconsistency continues to be accepted.
- Mixed messages, especially with disconnected rating systems, create challenges for understanding what's important and how to make the best decisions.

ENABLERS

- Publish research in plain English, and write to the end user of the information, not just the peer-reviewed journal reader. Research should also explain how it should or could be applied.
- Focus on realistic marketing, which targets a specific audience and conveys a factual message. This requires a marketing strategy that balances engineering data (facts) and marketing data (the sales story).

Delivery

BARRIERS

- Architects and engineers do not focus on energy costs during design and construction.
- The selection process for determining how the best products get to market is inefficient. Larger companies tend not to innovate but wait for others to create the next big advance, with the expectation that they will produce or suppress it. As a result, some deserving solutions may not receive the exposure they need to penetrate the market.

- A lack of accountability exists between the delivery and use of energy reduction solutions. A purchaser does not always receive what was promised.
- Communication and interaction between delivery and the end user is not sufficient. Education affects these relationships, in that it does not support project handoff between delivery (primarily A/E services), building operators, and occupants.
- Budget and resource constraints compel short-term decision making.

ENABLERS

- Improve enforcement and accountability so that contractors provide the energy performance they said they would deliver.
- Improve the flexibility of budgets to roll over surpluses or provide funding for multiple years.
- Develop a design or building team that focuses on an integrated systems approach.

Procurement

BARRIERS

- Procurement offices and buyers are resistant to change.
- Procurement is an inefficient process.
- The requirements for using energy reduction solutions stated in codes, standards, and mandates (policy) are inadequate.
- Procurement requirements are not stringent enough to prevent buyers from obtaining products or approving change orders that undermine project objectives. A lack of well-informed or strongly engaged contract technical advisors allows this problem to persist. These buyers often view themselves as purchasers of products, not solutions.
- Buyers lack the information or training necessary to purchase for performance specifications.
- The subject matter expert and the purchaser are on the same team, but they tend to act independently of one another.
- The "success" metrics for procurement do not align with energy performance goals. The procurement process almost solely focuses on upfront cost or initial cost savings. This means ENERGY STAR® qualified prod-

ucts may get overlooked even though management is pushing a climate change initiative.

- The federal government does not use its purchasing power to procure energy reduction solutions. One workshop participant argued that Wal-Mart is more of a driving force than GSA.
- Buyers who do not comply with what they are directed to purchase face few consequences.

ENABLERS

- Craft requests for proposals (RFPs) to strike a balance between flexibility and stringent procurement requirements based on energy performance. A prescriptive RFP will ensure that certain services or products are procured, and flexibility will limit the need for change orders.
- Develop a closer connection between procurement officers and technical experts.
- Provide training and education to help buyers understand how their purchasing behavior affects the overall process.
- Improve the federal government's procurement process and practices, and leverage its purchasing power to procure energy reduction solutions at bulk rates.
- Establish new metrics for "success" in procurement. This should align the selection criteria to what is valued.

Adoption

BARRIERS

- The fear of failure or adverse consequences is greater than the motivation to innovate or succeed.
- Codes, standards, and mandates (policy) are not adequately enforced.
- Americans tend to be less willing to accept more "discomfort" in order to achieve additional energy savings.
- The low cost of energy is a major economic barrier. It reduces the financial attractiveness of investing in energy efficiency.
- Conventional accounting frameworks do not consider all values. This makes it difficult to properly value energy efficiency, which is viewed as a cost savings, not a value-added effort. It also excludes how we value pay-

backs on occupant factors like satisfaction. First cost tends to be the decision metric.

- There is a perception that operators manage buildings to the loudest complainer or the lowest performing engineer.
- Education does not support project handoff between delivery (primarily A/E services), building operators, and occupants.
- Communication and interaction among those involved in adoption and the other process stages is limited.
- A gap exists between the people who understand buildings and those who do not. This divide is between experienced but apathetic building operators and energetic youth who care but lack a solid understanding of buildings.
- Rapid innovation in technology creates hesitation to adopt a new system that may be outdated within a few years.

ENABLERS

- Make codes, standards, and mandates (policy) drivers to adopting energy reduction solutions. This is one way to overcome the low cost of energy.
- Create a conduit or safety net that rewards individuals who are dedicated to adopting energy efficiency. Developing networks or teams that spread the risk by engaging all stakeholders is a possible solution.
- Decision makers should allocate cost savings from energy reducing measures to pay for other sustainability initiatives.
- Provide facility managers and decision makers with more complete data on building performance.
- Improve benchmarking and disclosure requirements.
- Adopt a life-cycle project focus to account for the value of energy efficiency improvements.
- Integrate the adoption stage with the adoption process.
- Improve occupant knowledge of building energy use to justify and obtain their buy-in.

Appendix B: Sources of Information

Although the workshop did not discuss sources of information, the International Facility Management Association (IFMA) ran a question on behalf of this project in its most recent *Facilities Snapshot* poll. The question asked 2,700 professional members from around the world what sources, in the past 6 months, they found useful for information on how to improve their facility's performance. The question received more than 350 responses from people with roles such as facility director, manager, coordinator, contracts administrator, and engineer; vice president of real estate and facility/property management; and construction manager. The results are shown in Figure B-1.

	Source	Frequent source of information	Infrequent or not a source of information	Response Count
Useful	Web searches	68%	32%	357
Useful	Installers / maintenance staff	65%	35%	360
Useful	Other facility managers or building operators	59%	41%	362
Mixed	Training	47%	53%	361
Mixed	Salespeople / vendors	43%	57%	361
Not widely used	Social networking	34%	66%	363
Not widely used	Building owner / portfolio manager	32%	68%	354
Not widely used	Association mailings	31%	69%	357
Not widely used	Building tenants	28%	72%	358
Not widely used	Technology demonstrations	25%	75%	352
Not widely used	Manufacturer mailings	15%	85%	356

Figure B-1. Survey responses on useful sources of information to improve a facility's performance.

Appendix C: Identified Messages, Audiences, and Goals

The list below summarizes the discussion from Day 2's final session focused on identifying key communication mechanisms. Although few mechanisms were mentioned, workshop participants did identify messages, audiences, and goals that are important to the communication effort. The following are their suggestions:

- Buildings are getting older, and their infrastructure will require capital upgrades to maintain their integrity.
- Bundling mechanisms may be better than a solo approach. Such an example might be the development of new policy and standards with the addition of more training and education.
- Experience has shown that if you tell someone to do something they resist. But if you tell them what the desired outcome is, this challenges the person to be creative in their approach and determine for themselves how they will get there.
- Focusing on the micro-components will help us make strides toward the macro goals. For examples, using smaller zone-based controls, understanding how worker comfort affects productivity, and commissioning the people are all possible steps.
- It's important to think about region, building type, load breakdowns, the generation of buildings, urgency, and an "it's easy, it's good" messaging perspective.
- Mandatory performance requirements are potential mechanisms for change, which may allow us to solve multiple performance goals simultaneously.
- Plug loads are the fastest growing loads in buildings and should be up there with lighting and thermal conditioning.
- Staying up on technological advances is challenging. (No recommendations were provided on how one should stay up to date; however, see the survey results in Appendix B).
- Although we have real knowledge about "building in practice," we are unable to quantify the opportunities to improve building energy performance. As such, benchmarking or total energy auditing is the important first step. A supplementary approach may improve design to focus on performance

in practice, not the theoretical knowledge that an A/E tends to design into a building.

- We need common agreement on the overarching themes. There will be differing perspectives, but we should all be working toward the same vision—it starts with a strategy. We need to focus on where we are going, and then keep centering and focusing on the vision. We should not trap ourselves by the fashion of the day.

- We should consider an integrated design process to figure out how to bridge the gaps between the different processes. This will require getting the right professionals in the room and using a whole-building approach when developing strategy.

- Work practices are changing, and rapid growth can result in on-the-fly decisions.

Appendix D: Using Web 2.0 Technology

There are opportunities to use Web 2.0 technology for internal communication among the workshop participants and external outreach to decision makers and end users.

Internal Communities of Interest

For effective information sharing between workshop participants, we might use a web-based virtual community of interest. This platform would allow for scheduling, document sharing, archiving, continuous commentary, and feedback. The drawbacks of this approach are the need for version control of documents, a tendency to use e-mail for collaborative authoring, content overload, and a potential data dump (Figure D-1).

Figure D-1. A Web-based community of interest.

Web-Enabled Outreach

For external outreach, there are opportunities to "crowdsource" for feedback, set up a working group, or push messages out through micro- or traditional blogs. Frameworks and examples for each are shown below.

CROWDSOURCING

Figure D-2 and Figure D-3 illustrate the concept of "crowdsourcing." The term was coined in 2006 by Jeff Howe in an article published in Wired magazine[1] and is defined as "the act of outsourcing tasks, traditionally performed by an em-

[1] http://www.wired.com/wired/archive/14.06/crowds.html

ployee or contractor, to an undefined, large group of people or community (a "crowd"), through an open call." Government now uses "crowdsourcing" as a means of identifying good ideas effectively and efficiently from a broad stakeholder base. "Crowdsourcing" is continuing to evolve and numerous web platforms now exist to enable it (Crowdspirit, Crowdbrite, Ideascale).

Figure D-2. Crowdsourcing.

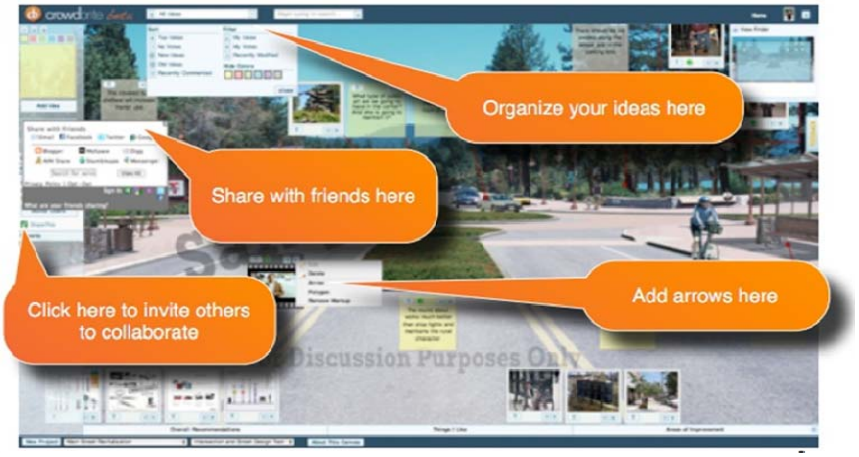


Figure D-3. Crowdsourcing example: Crowdbrite.

MICROBLOGGING

Figure D-4 and Figure D-5 illustrate microblogging. Microblogging is a broadcast medium whereby users publish "small elements of content such as short sen-

tences, individual images, or video links."[2] Over the past several years, Twitter has emerged as the prominent global microblogging platform and it is now a globally recognized broadcast medium. The concept of hashtags now augments microblog entries by providing a layer of metadata through which end-users can search for specific of information channels.

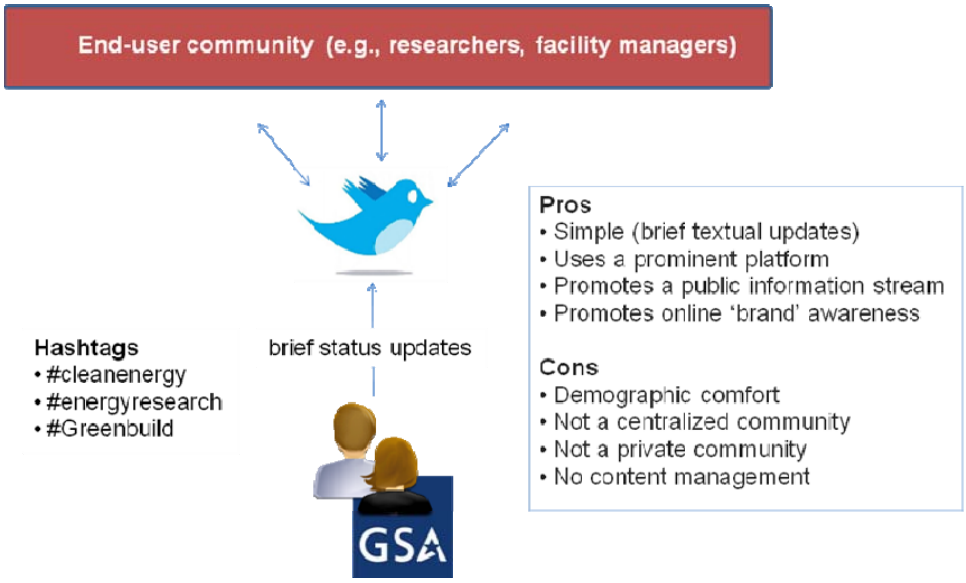


Figure D-4. Microblogging.

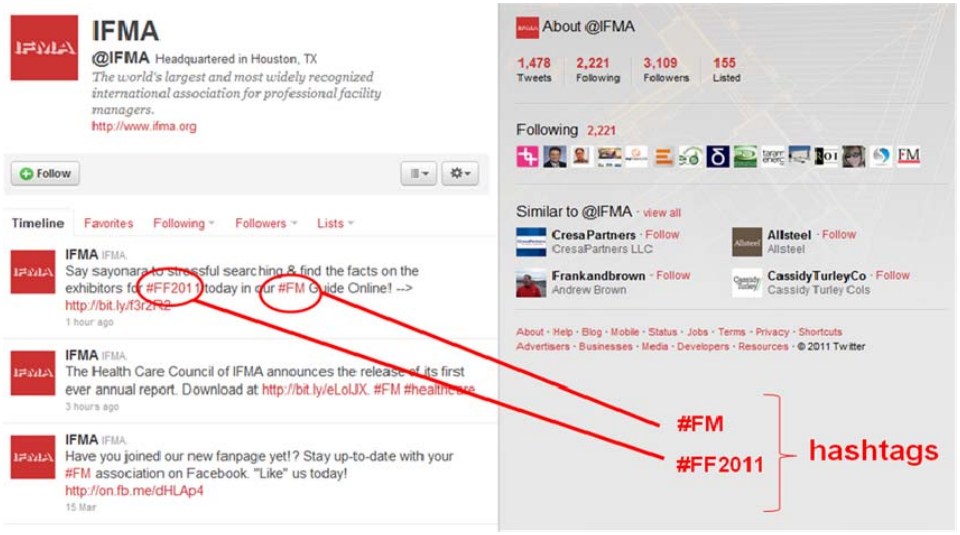


Figure D-5. Microblogging example: IFMA on Twitter.

[2] http://en.wikipedia.org/wiki/Micro-blogging

TRADITIONAL BLOGGING

Figure D-6 and Figure D-7 illustrate traditional blogging. Blogging is now mainstream and many web sites publish content in this form. One primary advantage of a blog is that the format lends itself to less rigorous publication requirements such that authors can readily and quickly publish their ideas in a timely manner. Also, blogs typically provide a feedback mechanism for readers on the web to weigh-in with their own comments, which can be beneficial by way of bringing them 'into the conversation' and giving them a sense of involvement.

Figure D-6. Traditional blogging.

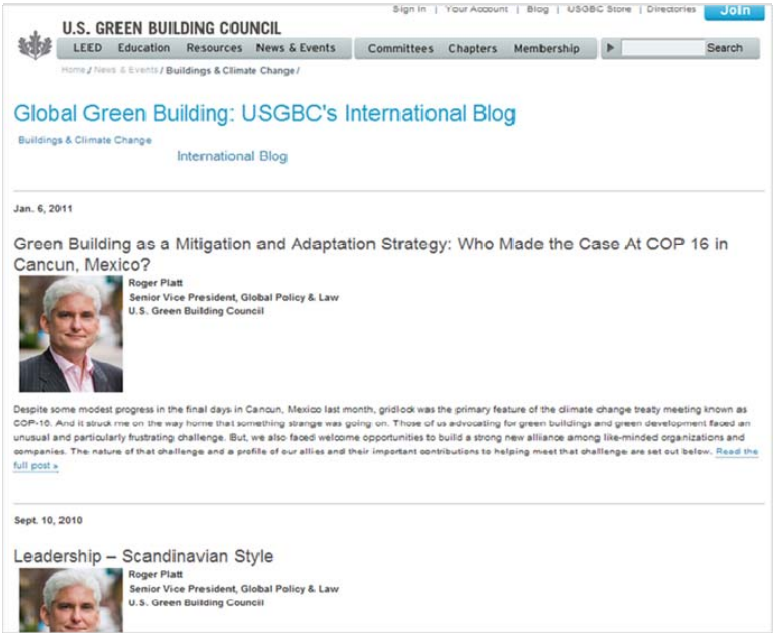


Figure D-7. Traditional blogging example: U.S. Green Building Council.