U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

BUILDING TECHNOLOGIES OFFICE

2014 Building Technologies Office Program Peer Review

November 2014

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(top to bottom)

1. Buildings in city setting; photo courtesy of the U.S. Department of Energy.
2. National Renewable Energy Laboratory research scientist manipulates ink-jet sprayer in glove box at the Process Development Integration Laboratory; photo courtesy of the National Renewable Energy Laboratory, images.nrel.gov, image 16937.
3. Residential home; photo courtesy of the U.S. Department of Energy.
4. Worker inspects building construction; photo courtesy of istock.com.

U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy

2014
Building Technologies Office Program Peer Review

SUMMARY OF RESULTS

April 22–24, 2014
Arlington, Virginia

NOTICE

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Letter from the Director

Dear Reader,

These continue to be exciting times in the field of building energy efficiency. Leaders throughout the public and private sectors are increasingly recognizing the pivotal role of energy efficiency in reducing energy costs, lowering carbon dioxide emissions, creating jobs, and securing energy supplies. In June 2013, President Obama made energy efficiency in homes, businesses, and factories one of the pillars of his Climate Action Plan. This plan calls for the U.S. Department of Energy (DOE) to lead the way in establishing efficiency standards for appliances and federal buildings that will reduce carbon pollution by at least 3 billion metric tons cumulatively by 2030; expand the Better Buildings Challenge to multifamily housing; and launch Better Buildings Accelerators, such as the high-performance outdoor lighting accelerator announced last year. Indeed, DOE has achieved significant successes in these and other areas. In 2014, we supported major advancements in light-emitting diode (LED) and refrigeration technology, spurred the market to adopt energy-efficient solutions through industry partnerships and home retrofit campaigns, and developed 10 final appliance and equipment efficiency standards that will lock in energy savings for years to come.

The Building Technologies Office (BTO) Program Peer Review is a critical process in working toward DOE's goal to develop and demonstrate cost-effective technologies and solutions that enable a 50% reduction in building energy use. At this important annual meeting, BTO partners describe their projects and progress toward developing high-impact, energy-efficient building technologies; accelerating movement of building technologies and solutions to the market; and supporting greater adoption of residential and commercial building energy codes. In 2014, 119 projects were evaluated at the peer review meeting, and 435 people participated. Seventy independent experts assessed the progress and contributions of each project toward BTO's mission and goals. These assessments will be used to gauge the effectiveness of projects and design future projects and programs. All presentations are located at www.energy.gov/eere/buildings/building-technologies-office-2014-program-peer-review. A summary of reviewer comments and the final score for each project is provided in this report's Summary Table; the program chapters include the detailed comments and the average score for each evaluation criterion. Our partners and stakeholders can also learn more about BTO projects and programs by reading this peer review report.

On behalf of BTO staff, I thank the reviewers who made the peer review possible and whose time and expertise are so critical to our success. If you are interested in participating as a reviewer in future peer reviews, please send your resume and contact information to btopeerreview@ee.doe.gov.

Sincerely,

Roland Risser
Director
Building Technologies Office
Office of Energy Efficiency and Renewable Energy

1. Introduction

The mission of the Building Technologies Office (BTO) is to develop and promote efficient, environmentally friendly, and affordable technologies, systems, and practices for our nation's residential and commercial buildings. BTO follows a three-pronged approach, which we call the BTO Ecosystem, to accomplish this mission (see Figure 1).

1. Research and Development: Develop high-impact technologies that have the potential to significantly improve building energy efficiency.
2. Market Stimulation: Accelerate technology-to-market by demonstrating technologies and system solutions and supporting market-priming measures to overcome barriers to widespread adoption.
3. Codes and Standards: Lock-in energy and cost savings through voluntary efforts and regulatory activities that lead to widespread adoption of highly efficient building technologies.

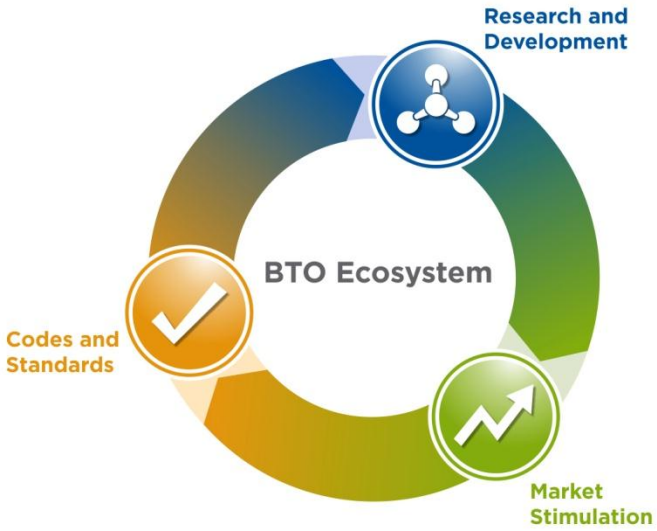


Figure 1. BTO Ecosystem

BTO's overarching goal is to develop and promote the adoption of cost-effective technologies and practices that, when fully deployed, will reduce U.S. building-related energy use by 50%, leading to significant cost savings for consumers and businesses as well as a significant reduction in CO_2 emissions.[1] BTO works toward this goal through five programs: (1) Emerging Technologies, (2) Commercial Buildings Integration, (3) Residential Buildings Integration, (4) Building Energy Codes, and (5) Appliance & Equipment Standards.

Independent evaluation of the quality and effectiveness of current projects is essential for enhancing existing efforts and designing future programs. Peer reviews are an important tool in providing independent, robust, and documented feedback for program evaluation and planning.

Program Peer Review

The BTO Peer Review was held on April 22–24, 2014, at the DoubleTree Crystal City Hotel in Arlington, Virginia. The review was attended by more than 400 participants and included presentations on 119

[1] BTO goals were updated after this report was generated. The updated goals will appear in the 2015 BTO Peer Review Report and in BTO's Multi-Year Program Plan, which will be published in the Fall of 2015.

projects: 62 from the Emerging Technologies Program, 34 from the Commercial Buildings Integration Program, 14 from the Residential Buildings Integration Program, and 9 from the Building Energy Codes Program. This report summarizes the scores and comments provided by the independent reviewers for each project.

The objectives of the peer review were to:

- Conduct an independent evaluation of current BTO projects and performers, their efforts over the past year toward BTO goals, and their future plans;
- Provide a forum to promote collaborations and partnerships among project performers and other stakeholders; and
- Communicate the value of BTO investments.

Reviewers were drawn from a variety of building-related backgrounds and included experts from industry, academia, government, and other stakeholder groups. The reviewers were screened for conflicts of interest and assigned to projects based on their area of expertise and interests. Appendix A provides a complete list of reviewers, and Table 1 indicates the average number of reviewers per project.

Table 1. Average Number of Reviewers per Project by Program at the 2014 BTO Program Peer Review

	Emerging Tech (62 projects)	Commercial Bldgs (34 projects)	Residential Bldgs (14 projects)	Building Codes (9 projects)
Average	3.85	4.68	4.79	5.56
Max	6	7	7	6
Min	2	2	3	5

Analysis Methodology

Reviewers evaluated projects by using five evaluation criteria and scoring them on a 1–4 scale, with four being the highest. In addition to providing numeric scores, reviewers were asked to provide qualitative comments and feedback regarding the project's strengths and weaknesses, and any suggestions relating to the scope of the work. For the full evaluation criteria document, please refer to Appendix B. Scores were based on the following criteria and weights:

Score 1: **Relevance (standalone metric)** – Degree to which the project supports BTO goals and objectives.

Score 2: **Approach (30%)** – Degree to which the project is focused on the critical barriers (15%), and the degree to which the project's design addresses the barriers identified (15%).

Score 3: **Accomplishments/Progress/Impact (40%)** – Degree to which the project has made progress towards achieving the stated project goals (20%), and the degree to which the project will significantly contribute to the achievement of its BTO Program's goals (20%).

Score 4: **Project Integration and Collaborations (20%)** – Degree to which the presenter has demonstrated an understanding of the key stakeholders necessary to accelerate the movement of technologies or practices into the market (10%), and the degree to which the project staff collaborates or coordinates with industry or other relevant stakeholders (10%).

Score 5: **Proposed Future Work (10%)** – Degree to which the project has effectively planned its future in a logical manner by incorporating appropriate decision points, considering impediments to its goals, and, when sensible, mitigating risk by providing alternate pathways.

For each project, relevance was assessed as a standalone metric and the other four criteria were used to calculate a weighted average for each project using the equation shown in Figure 2.

$$\left[\left(\frac{\sum_1^n Score\ 2}{n}\right)x(0.15)\right]+\left[\left(\frac{\sum_1^n Score\ 3}{n}\right)x(0.15)\right]+\left[\left(\frac{\sum_1^n Score\ 4}{n}\right)x(0.2)\right]+\left[\left(\frac{\sum_1^n Score\ 5}{n}\right)x(0.2)\right]+\left[\left(\frac{\sum_1^n Score\ 6}{n}\right)x(0.1)\right]+\left[\left(\frac{\sum_1^n Score\ 7}{n}\right)x(0.1)\right]+\left[\left(\frac{\sum_1^n Score\ 8}{n}\right)x(0.1)\right]$$

(n equals the number of reviewers per scoring metric)

Figure 2. Equation used to calculate each project's weighted average score

Organization of the Report

To align with BTO's organization, project comments and scores are grouped by program (Emerging Technologies, Commercial Buildings Integration, Residential Buildings Integration, and Building Energy Codes). The Summary Table in Chapter 2 provides an overview of reviewer comments and the final score for each project; the following chapters include the detailed comments and average score for each evaluation criterion.

Chapters 3–6 begin with a brief introduction of the program, followed by project summaries and results from the peer review. For each project, a graph shows the project's weighted average and how it compares with the other reviewed projects within its program area. A sample graph and explanation are provided in Figure 3.

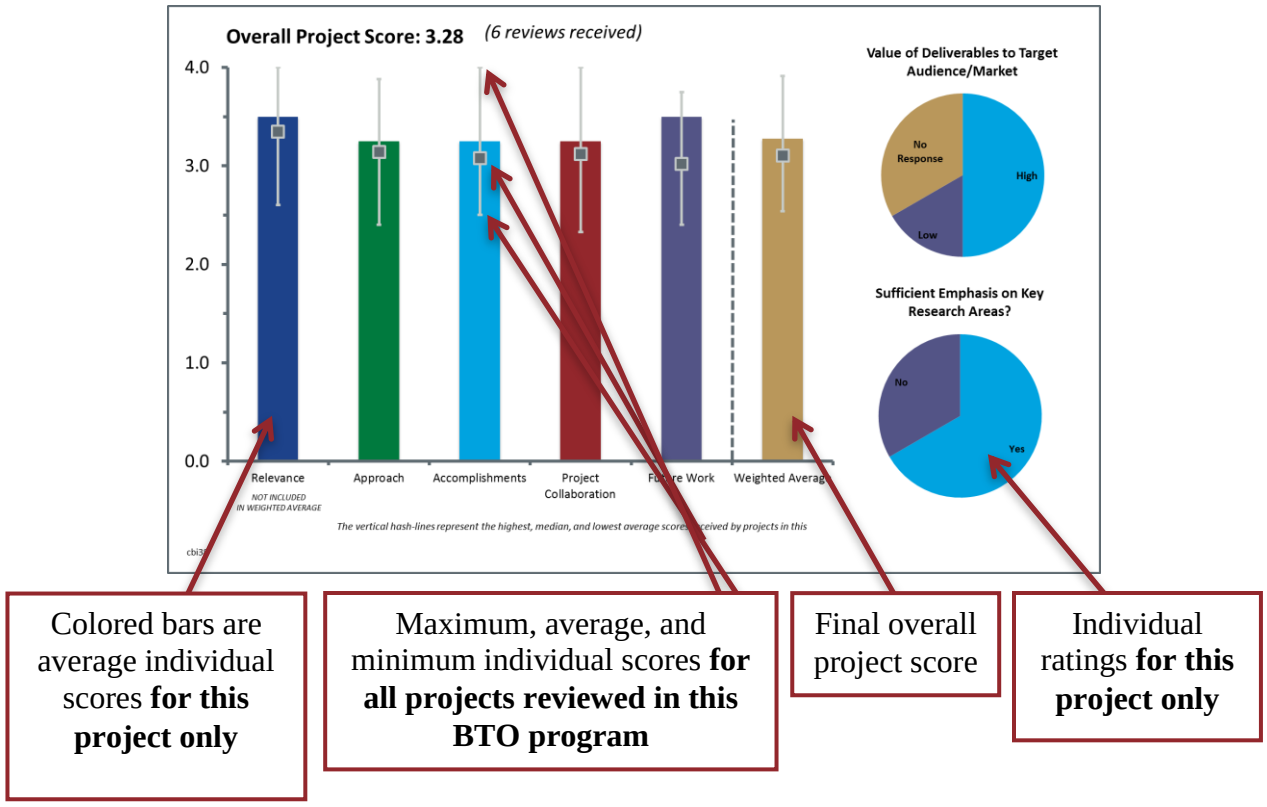


Figure 3. Sample project score graph with explanation

2. Emerging Technologies

2.1 Program Overview

The Emerging Technologies Program supports applied research to accelerate the development and initial commercialization of technologies and systems capable of substantially reducing primary energy use in buildings. The Program invests in the development of the following technologies and tools:

- Solid-state lighting
- Heating, ventilation, and air conditioning (HVAC)
- Water heating
- Appliances
- Building envelope
- Windows
- Sensors, controls, and the transactional network
- Building energy modeling

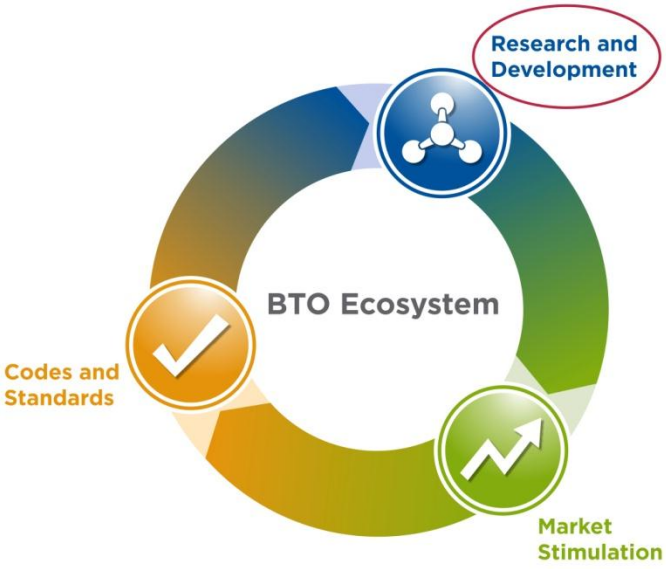


Figure 4. The role of the Emerging Technologies Program in the BTO Ecosystem

The Program's goal is to introduce technologies to the market that can achieve significant energy savings. Specific energy-saving goals for 2030 include 75% energy savings in lighting, 30% savings in water heating, 20% savings in HVAC, 25% savings in building envelope, 10% savings in windows, 20% savings due to sensors and controls, and 5% savings in appliances (compared to a 2010 technologies).[2] The Program will track its progress by monitoring technology cost and performance improvements, and by determining how much it has influenced the overall change in energy efficiency trends. To achieve its goals, the Program partners with industry, universities, national laboratories, and small businesses to develop technology roadmaps that identify cost and performance metrics, and through merit-reviewed research and development projects.

[2] BTO goals were updated after this report was generated. The updated goals will appear in the 2015 BTO Peer Review Report and in BTO's Multi-Year Program Plan, which will be published in the Fall of 2015.

2.2 Summary of Peer Review Feedback

Project # ET-01: EnergyPlus

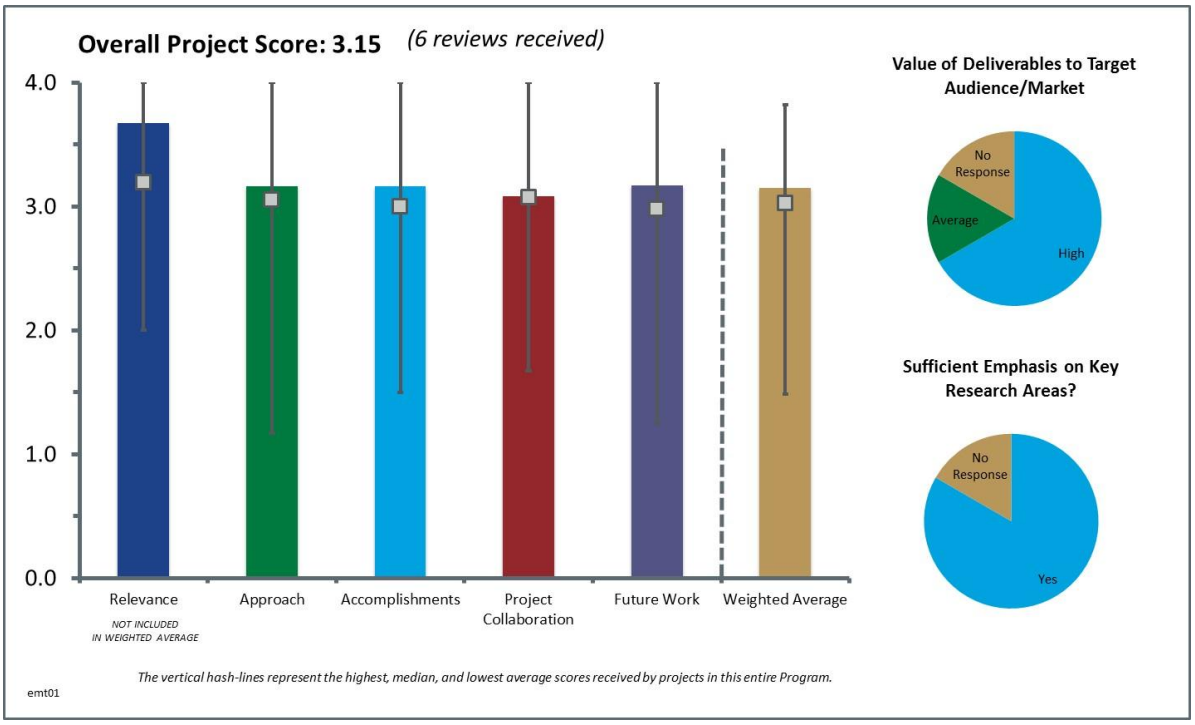
Presenter: Mike Witte, GARD Analytics, mjwitte@gard.com
DOE Manager: Amir Roth, 202-287-1694, amir.roth@ee.doe.gov

Project Description

EnergyPlus is the U.S. Department of Energy's (DOE's) whole-building energy modeling engine. It is an industry-leading product that not only supports the design of new buildings and retrofits, but also underpins the development of energy efficiency codes and standards, labels, and incentive programs, as well as the compliance, certification, and qualification processes for these programs. DOE will continue to deliver updates of EnergyPlus that enhance modeling flexibility, incorporate models for high-priority new systems (such as high-performance "challenge" rooftop units), and improve execution speed. DOE will continue to support both EnergyPlus modelers and third-party vendors.

Summary of Review Comments

Reviewers agreed that EnergyPlus is a fundamental effort with global recognition and use in energy-efficient building design, and they stressed the importance of energy modeling to Building Technologies Office goals. Reviewers also agreed that the project has great potential but must expand to cover new technologies; one reviewer noted that EnergyPlus is behind the current state of the industry and sometimes lacks performance data or validated modeling algorithms for emerging technologies (e.g., the reflective insulation model, attic model, and switchable building components model). Most reviewers praised the team's flexibility, citing the recent code base conversion to C++ (seen as necessary to support the needed expansion), and strongly supported future plans such as improving execution times, updating the algorithm for equipment sizing, and characterizing input uncertainty.



Project # ET-05: Multi-Function Fuel-Fired Heat Pump

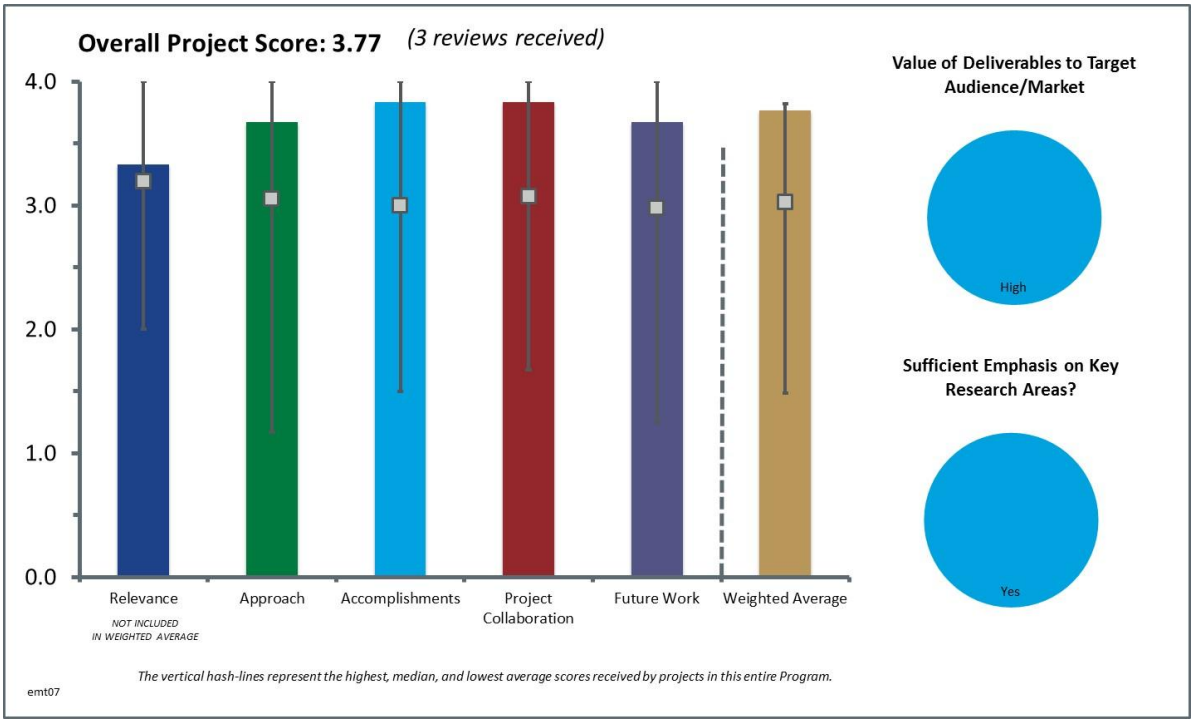
Presenter: Ed Vineyard, Oak Ridge National Laboratory, vineyardea@ornl.gov
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

Oak Ridge National Laboratory is developing and promoting the market introduction of a fuel-fired, multi-function residential heat pump that can achieve the 20% heating, ventilation, and air conditioning and 60% water heating energy savings required to meet the Building Technologies Office (BTO) goal of 50% reduction in building energy use by 2030. Specific objectives include (1) reducing primary energy consumption by 30%, with a cooling source coefficient of performance (COP) of 1.3 and a heating source COP of 1.5; (2) reducing water heating energy consumption by 80%; (3) improving the reliability of the electric grid by reducing peak power demand by 85%; (4) using natural gas, an abundant U.S. energy resource, as a fuel; and (5) reducing emissions of carbon by 30%, nitrogen oxide by 30%, and sulfur dioxide by 95%.

Summary of Review Comments

Reviewers made positive comments regarding the project's progress, noting effective collaboration as well as excellent energy-savings potential. Specified project strengths include strong relationships with utility partners, a focused approach, innovative methods for reducing heating and cooling energy, and overall alignment with BTO goals. In terms of project weaknesses, reviewers observed that there may be some difficulty with engine noise, and with facilitating acceptance of the new technology by future customers. One reviewer also questioned whether this project is the best approach, noting the project could possibly result in increased natural gas use and lower efficiency than offered by current technologies. However, most reviewers were highly supportive of the project, citing its marketable products and clear plan of action.



Project # ET-08: Advanced Variable Speed Air-Source Integrated Heat Pump

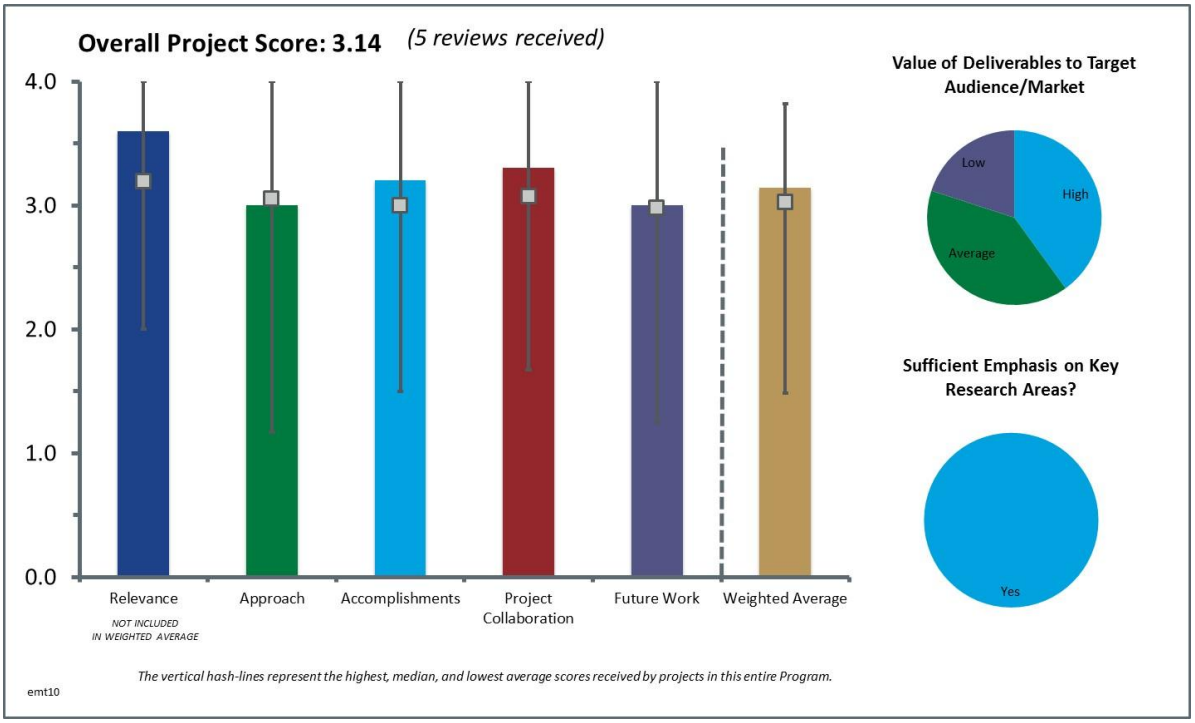
Presenter: Van Baxter, Oak Ridge National Laboratory, vdb@ornl.gov
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

Oak Ridge National Laboratory is developing and promoting the market introduction of an advanced, variable speed, air-source integrated heat pump (AS-IHP) with energy savings equal to or greater than 50% versus minimum efficiency systems. The AS-IHP would be introduced to the U.S. market by Nordyne, the cooperative research and development agreement partner. An IHP that operates at this level of efficiency can make a significant contribution to meeting the Building Technologies Office's (BTO's) goal of reducing building energy use by 50% by 2030.

Summary of Review Comments

According to reviewers, the project is poised for success despite minor delays in testing. Reviewers praised the project's alignment with BTO goals, potential for residential applications, and partnership with Nordyne. The project was described as practical and relevant, with significant energy-savings potential. There were some concerns expressed about delays in testing, as well as a lack of commercialization plans. In terms of market readiness, reviewers observed that there are not yet cost projections or manufacturing plans. However, reviewers seemed confident that the project will achieve its benchmarks, noting that future work is clearly outlined.



Project # ET-09: Absorption Heat Pump Water Heater

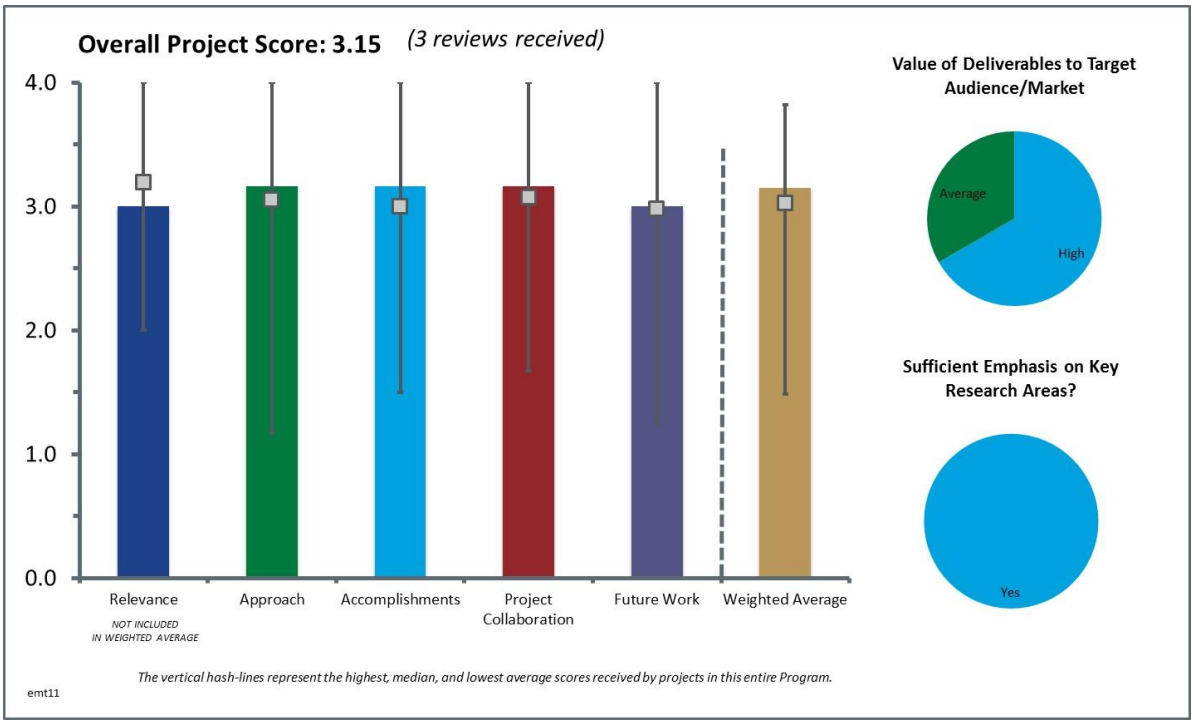
Presenter: Kyle Gluesenkamp Oak Ridge National Laboratory, gluesenkampk@ornl.gov
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

Oak Ridge National Laboratory is developing and promoting the market introduction of a residential absorption heat pump water heater that would use 40% less energy annually compared to a baseline minimum efficiency unit. These water heaters greatly boost water heater efficiency by transferring heat to the water from fuel and ambient air. However, absorption technology faces the barriers of high first cost and working fluid challenges. Absorption technology could result in naturally ventilated gas-fired water heaters that achieve an energy factor exceeding 1.0. This product can contribute to the 60% water heating energy savings required to meet the Building Technologies Office's goal of reducing building energy use by 50% by 2030.

Summary of Review Comments

Reviewers commented favorably on the progress made on the introduction of a residential absorption heat pump water heater, yet noted that there are still significant cost and reliability challenges to overcome. Feedback was positive regarding the project's collaborations and the clearly outlined goals. Some concerns were raised regarding the overall usefulness of heat pump technology, particularly in terms of cost, performance in actual building environments, reliability, and practicality. One reviewer raised concerns about the possible negative impact of indoor humidity and suggested constructing and testing a prototype. Reviewers agreed the project will be successful as long as the technology is cost effective.



Project # ET-11: Working Fluids Low Global Warming Potential Refrigerants

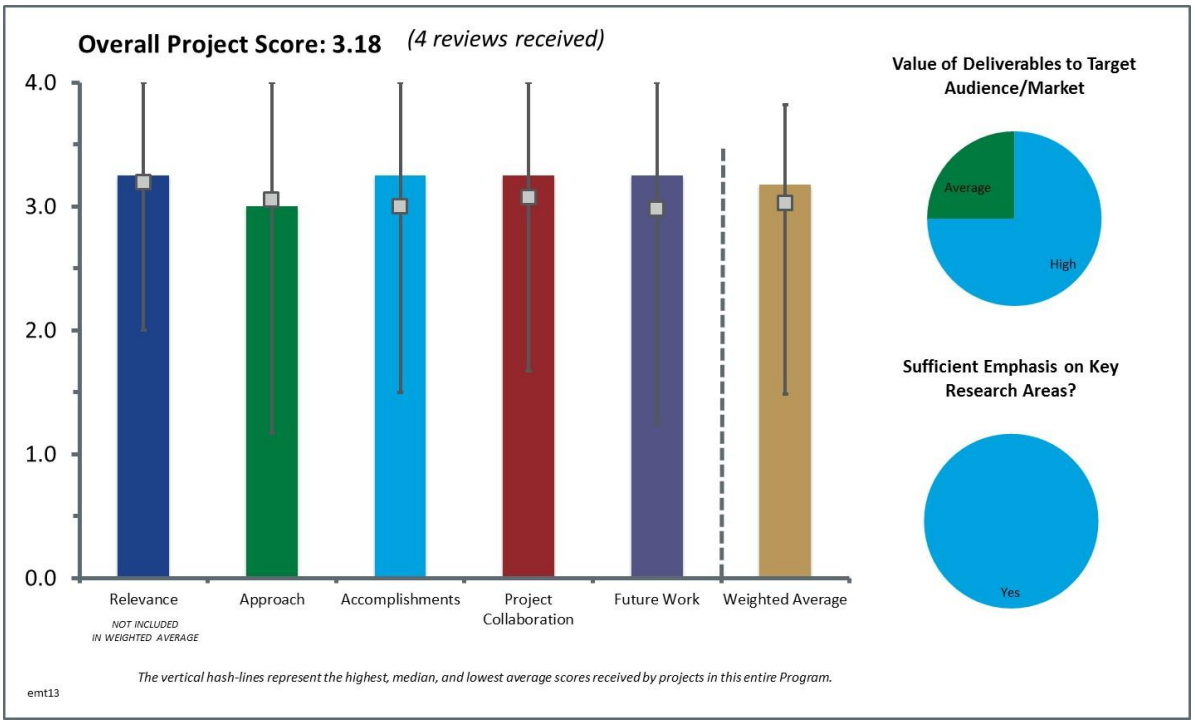
Presenter: Omar Abdelaziz, Oak Ridge National Laboratory, abdelazizoa@ornl.gov
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

This project will develop refrigerants with low global warming potential (GWP). The project will provide the residential and commercial heating, ventilation, air conditioning, and refrigeration industries with validated and standardized life cycle climate performance modeling tools to design equipment with lower life cycle greenhouse gas emissions. The project also will develop low-GWP refrigerants for use in new and existing systems. Current low-GWP alternatives may increase energy consumption, introduce safety risks, and require significant equipment modifications. Effective alternatives are required to achieve the Building Technologies Office's (BTO's) goal of reducing service equipment energy consumption and carbon emissions by 50% compared to current best practices.

Summary of Review Comments

Reviewers agreed that the project has made good progress and acknowledged the lower global warming potential of the new refrigerants, pending additional field testing. Reviewer feedback was positive concerning the project's overall relevance to BTO objectives, with one reviewer highlighting the development of the life cycle climate performance assessment tool. Reviewers praised the collaborations with Honeywell and the University of Maryland. Field testing is the main area reviewers felt needed improvement, suggesting that further testing, evaluation, and case studies may be necessary. Reviewers seemed confident in the project's future and potential market value, following more extensive research and field tests.



Project # ET-15: Data Analysis from Ground Source Heat Pump Demonstration Projects

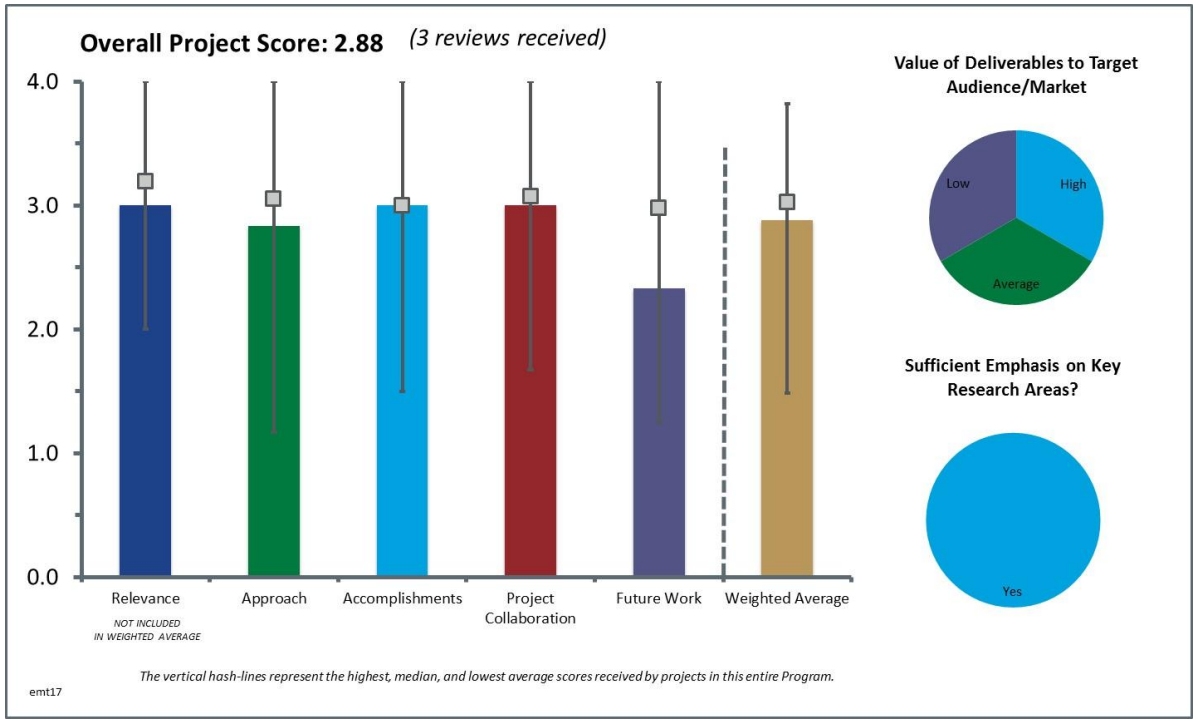
Presenter: Xiaobing Liu, Oak Ridge National Laboratory, liux2@ornl.gov
DOE Manager: Bahman Habibzadeh, 202-287-1657, bahman.habibzadeh@ee.doe.gov

Project Description

A recent assessment indicates that residential ground source heat pump (GSHP) energy savings have a technical potential of 4.2 quads per year. With improved design, reduced cost, and increased public awareness and trust, it is expected that GSHP systems will capture 10% of the target market segments by 2030. However, a lack of public awareness and trust is preventing rapid deployment of GSHPs. This project will analyze the costs and benefits of GSHP demonstration projects funded by the 2009 American Recovery and Reinvestment Act (ARRA). The analysis could identify cost, energy savings, design, installation, and operation practices, as well as lessons learned and best practices. This information is also essential for determining the economic viability of investments in GSHP systems for similar projects, which is vital for bringing in third-party financing to mitigate the systems' high initial cost.

Summary of Review Comments

Reviewers presented mixed views on several aspects of the project, including its impact on future GSHP design and operation, approach, and accomplishments. Reviewers praised the project for (1) assessing the impact of ARRA funding, (2) identifying lessons learned on designing and operating GSHP systems, and (3) documenting performance details of select GSHP installations. While reviewers agreed that collecting and disseminating data on GSHP performance is useful, some felt that many of the lessons learned about performance are already well known. They recommended that the project focus more on the critical barrier—translating already-known best practices into real-world installations—by developing guidelines for better designing and operating GSHPs. Reviewers also expressed concern about the project's accomplishments (six case studies in 2 years) and geographical distribution of the case studies (none in the Southwest or West Coast).



Project # ET-25: CERC: Materials that Improve the Cost-Effectiveness of Air Barrier Systems

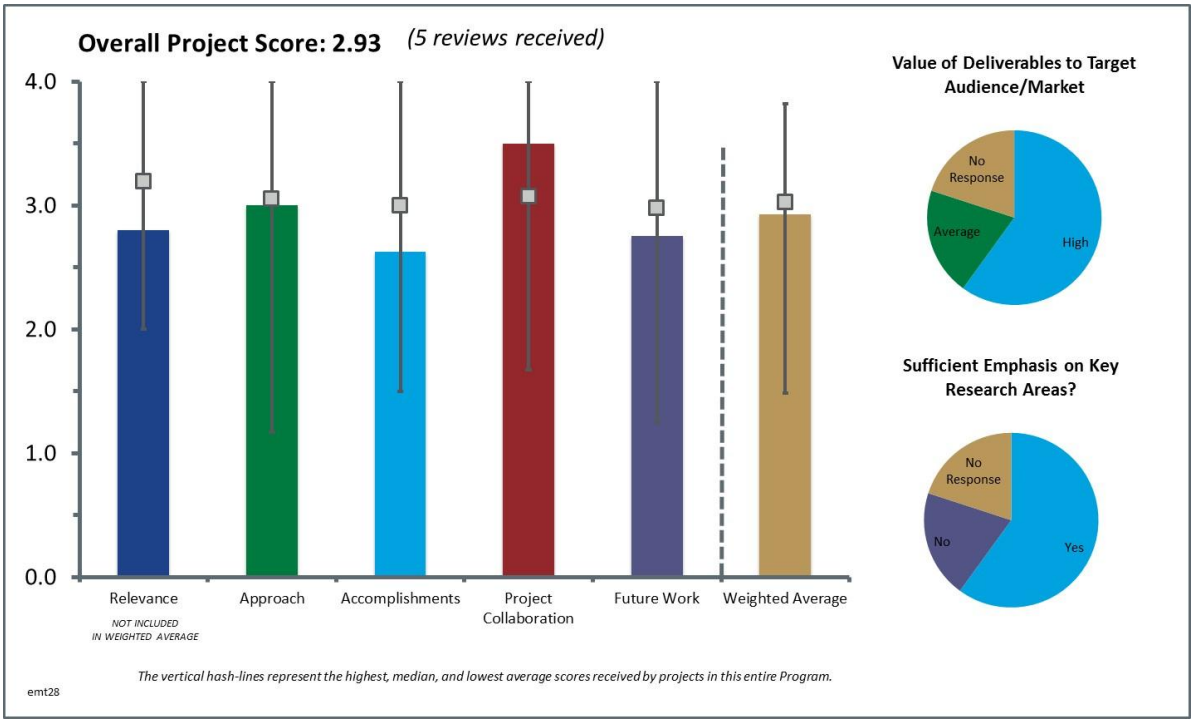
Presenter: Diana Hun, Oak Ridge National Laboratory, dehun@ornl.gov
DOE Manager: Karma Sawyer, 202-287-1713, karma.sawyer@hq.doe.gov

Project Description

This project aims to improve the cost effectiveness of residential and commercial buildings' air barrier systems by reducing installation time and cost, which are hindering air barrier installation rates. Current products are not cost effective because of the time required to install them. Two products that require less time to install are a sprayable liquid flashing produced by Dow and a primer-less self-adhered membrane produced by 3M. In the United States, 2.85 quads and 1.29 quads of energy are lost annually through residential and commercial buildings' envelopes, respectively. These two products could reduce that energy loss at an installed cost that is less than current technologies.

Summary of Review Comments

Most of the reviewers felt the project is relevant to Building Technologies Office goals, noting that addressing air leakage in buildings provides opportunities for energy savings and is potentially useful to the building industry. However, one reviewer felt that the project is lacking in innovation. Reviewers agreed that the project is achieving its stated goals; however, some felt the goals are too narrowly focused on energy savings and installation costs, without regard for material toxicity and potential environmental and health impacts. Reviewers also felt it is important for the project to consider building disassembly, address installation failure conditions, and compare this approach to other air-sealing processes.



Project # ET-30: Test Procedures for Building Energy Simulation Tools

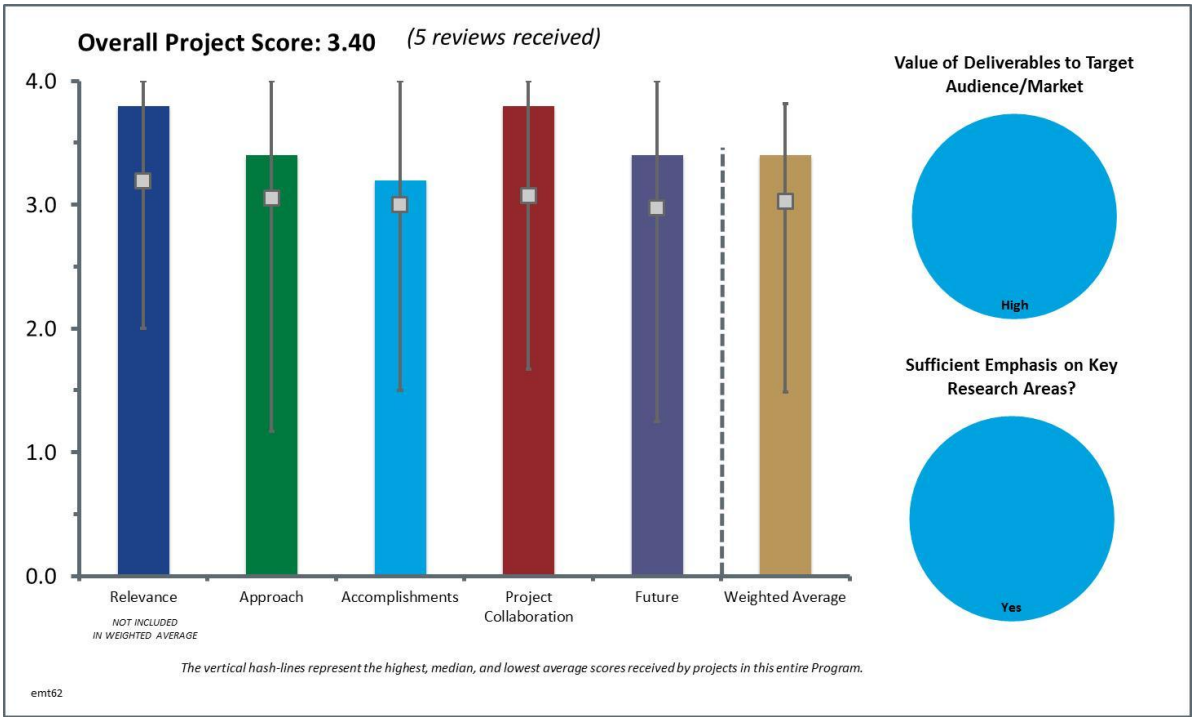
Presenter: Ron Judkoff, National Renewable Energy Laboratory, Ron.Judkoff@nrel.gov
DOE Manager: Amir Roth, 202-287-1694, amir.roth@ee.doe.gov

Project Description

The objective of the Building Energy Simulation Test (BESTEST) and ANSI/ASHRAE Standard 140 is to increase confidence in the use of building energy simulation programs by creating standardized and referenceable test procedures for validating, diagnosing, and improving the current generation of building simulation software, which may have more than 500,000 lines of code. The National Renewable Energy Laboratory (NREL) first initiated Standard 140 within ASHRAE in 2001, and updates were published in 2004, 2007, and 2011. Currently, NREL is working on several additional test suites. These include (1) a test suite for the air-side modeling of common mechanical equipment configurations, (2) an update to the original NREL/International Energy Agency BESTEST building thermal fabric test cases published in 1995, (3) a test suite for thermal exchange between the building and the ground, and (4) a test suite for multi-zone energy exchange.

Summary of Review Comments

Reviews of the project were mostly favorable; however, one reviewer noted that it could be improved with empirical validation using data from more real-world controlled environments. Reviewers praised the focus on improving the quality of energy simulation tools within a commercial building, and the potential for more widespread integration of the tools in buildings worldwide. Specified weaknesses include a lack of focus on modeling components and too much focus on "forward models." Reviewers suggested adding a focus on passive and radiant strategies.



Project # ET-31: Solid-State Lighting—L Prize Competition

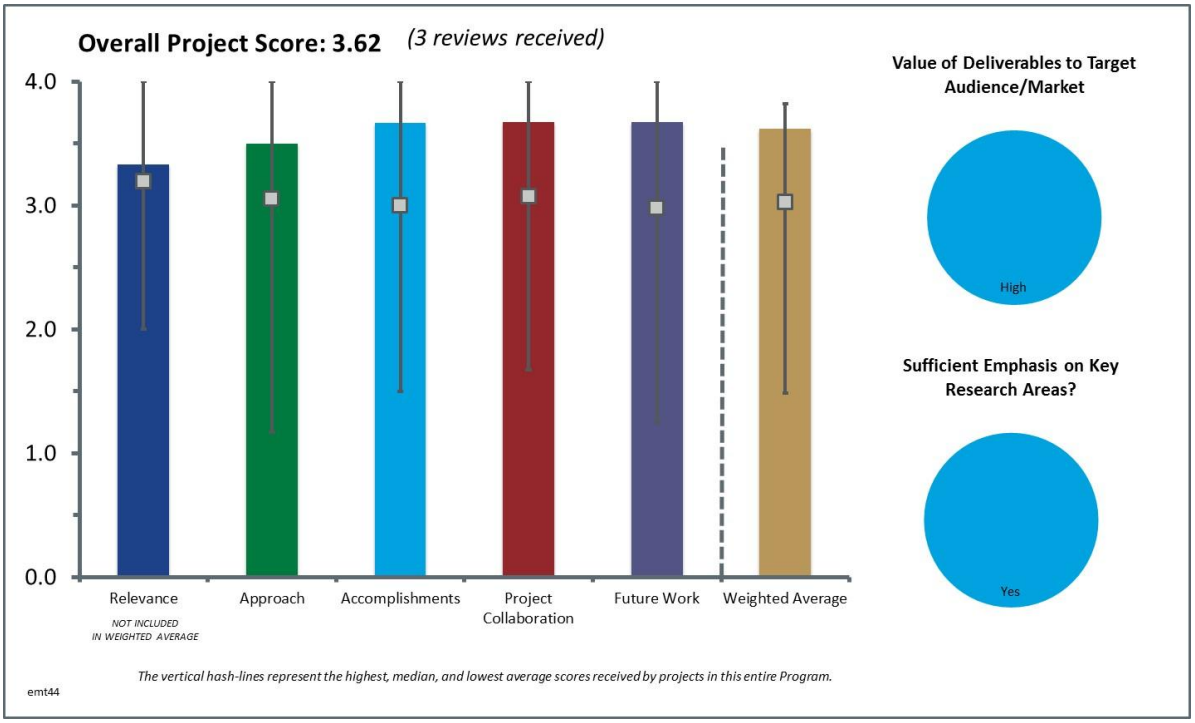
Presenter: Marc Ledbetter, Pacific Northwest National Laboratory, marc.ledbetter@pnnl.gov
DOE Manager: Jim Brodrick, 202-586-1856, james.brodrick@ee.doe.gov

Project Description

The L Prize competition spurs the development of new, ultra-efficient lighting products to replace common light sources, including the 60-watt incandescent bulb and the PAR38 reflector bulb. The goal is to realize significant lighting energy savings through widespread product adoption. Winning manufacturers receive significant recognition, and retailers, energy efficiency programs, and consumers benefit from energy savings and excellent lighting quality. The L Prize contributes to the goal of reducing building energy use by 50% and building energy costs by $2.2 trillion by 2030 by enabling products that use 80% less energy to provide the same amount of light as the incumbent technology.

Summary of Review Comments

Reviewers agreed that the L Prize competition project has driven innovation and yielded positive market impact. The specified strengths of the project include encouraging high-efficiency products and driving technology development. Reviewers also noted the effective collaboration with manufacturers and utilities. A specified weakness is the decreased visibility of the PAR38 category. One reviewer raised the concern that the lengthy competition process and only choosing one winner might at times hinder innovation. Another reviewer suggested that the overall process could be improved by working even more closely with stakeholders. Reviewers expressed enthusiasm for the 21st Century category and noted that the future prize requirements should be more specifically defined.



Project # ET-32: Solid-State Lighting—Lighting Facts

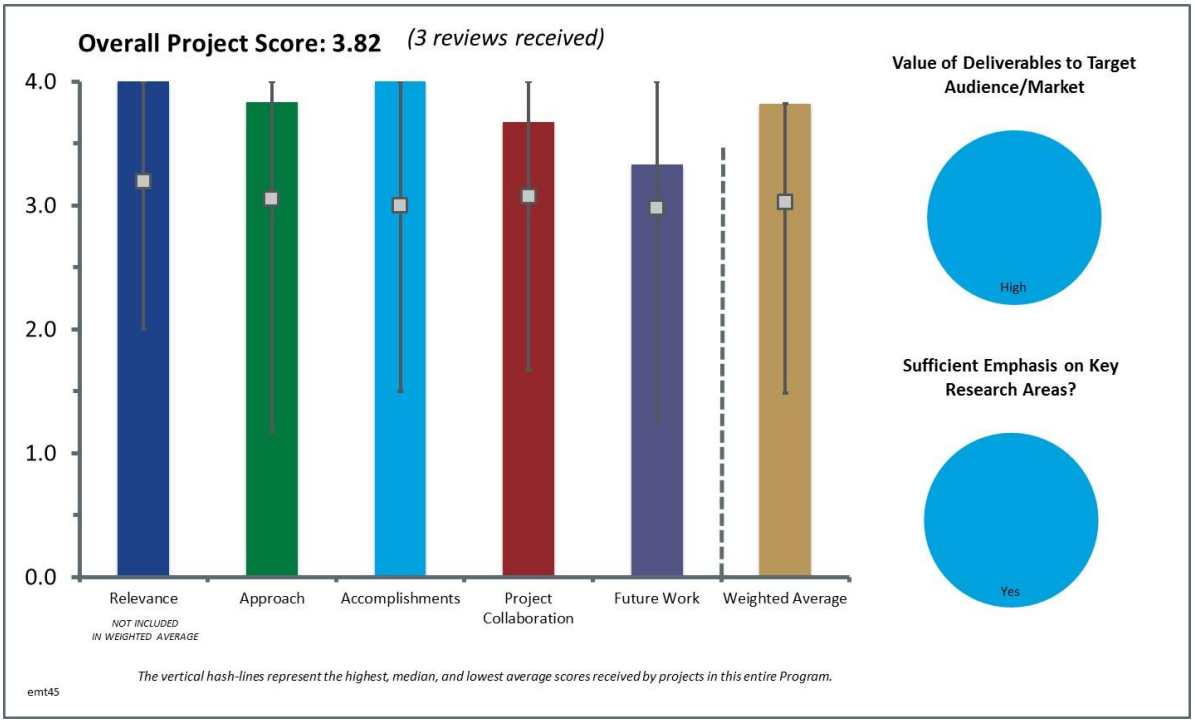
Presenter: Marc Ledbetter, Pacific Northwest National Laboratory, marc.ledbetter@pnnl.gov
DOE Manager: Jim Brodrick, 202-586-1856, james.brodrick@ee.doe.gov

Project Description

The LED Lighting Facts program provides credible, verified performance information about light-emitting diode (LED) lighting products to retailers, utilities, specifiers, energy efficiency program sponsors, and lighting users. The goal is to enable widespread market adoption of energy-efficient LED products by removing the lack-of-information market barrier. For the solid-state lighting market to grow, buyers must have accurate information that allows them to choose the right products for their applications. LED Lighting Facts is open to all entities that manufacture, sell, or recommend LED lighting. Manufacturers pledge to test their products and register them with LED Lighting Facts; partners pledge to use them. These activities support widespread adoption of LED technology, as well as the U.S. Department of Energy's goal of reducing building energy use by 50% and building energy costs by $2.2 trillion by 2030.

Summary of Review Comments

According to reviewers, the project has strong relevance to Building Technologies Office goals and is well on its way to becoming an industry standard. Project strengths noted by reviewers include (1) providing a useful tool and common testing procedure with results available on an open-access site, (2) driving development of a competitive lighting market, and (3) excellent communication with industry leaders and other government programs. Noted weaknesses are the (1) lack of clarity in communicating with potential users and (2) lack of pricing data. Two reviewers indicated there are no apparent weaknesses. Reviewers expressed confidence in the continued success of the project, recommending including pricing information and creating a feedback loop where users could comment on products.



Project # ET-33: Solid-State Lighting Consortia

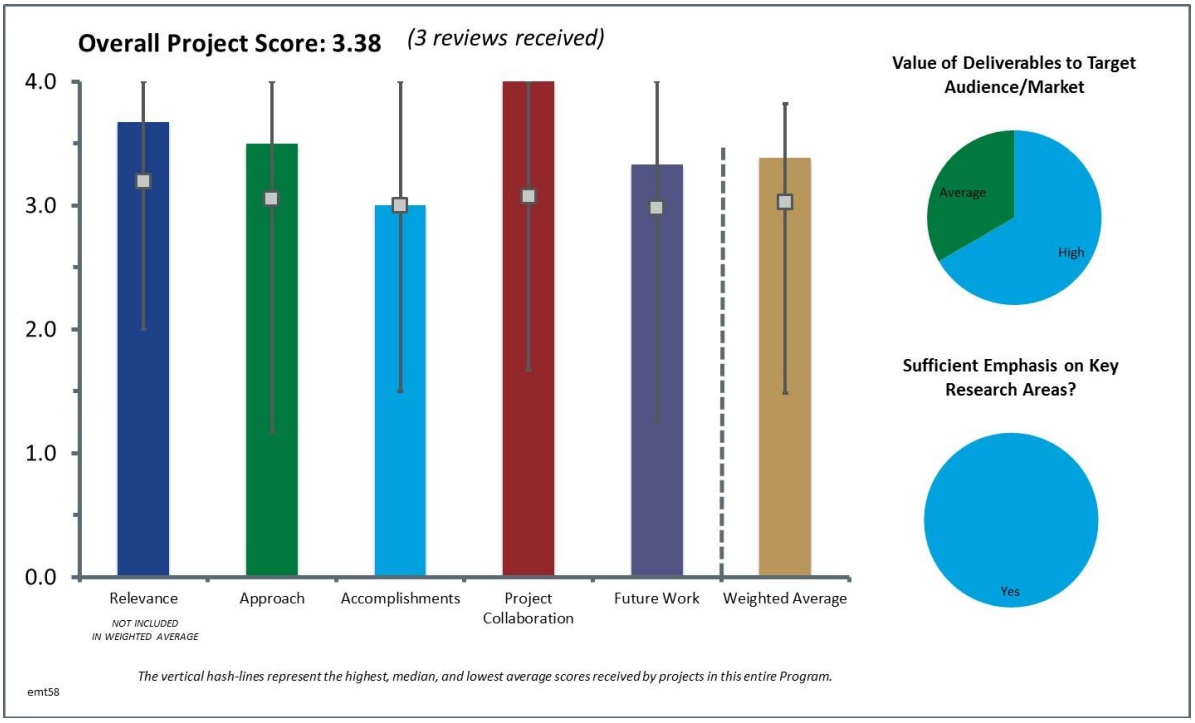
Presenter: Marc Ledbetter, Pacific Northwest National Laboratory, marc.ledbetter@pnnl.gov
DOE Manager: Jim Brodrick, 202-586-1856, james.brodrick@ee.doe.gov

Project Description

Most potential users of light-emitting diode (LED) lighting do not have large training budgets to independently educate themselves; participation in the Solid-State Lighting (SSL) Consortia is a low-cost–low-risk way to benefit from the knowledge and experience of others. The goal of the SSL Consortia is to help specific members of the lighting community—including municipalities, utilities, and energy efficiency program sponsors—implement LED lighting where applicable and beneficial to save energy and costs. The SSL Consortia serves as an education and information dissemination hub for utility and energy efficiency programs, which in turn educate their customers, retailers, and other stakeholders within their service territories. This on-the-ground education and outreach is essential to meeting the goal of widespread LED adoption as well as reducing building energy use by 50% and building energy costs by $2.2 trillion by 2030.

Summary of Review Comments

Reviewers commented favorably on the project's collaborations and noted that good progress has been made so far. The majority of reviewers felt that the project is aligned with Building Technologies Office goals; however, one reviewer stated that the project will not have a major impact on the transition to LED street lighting. In terms of the project's strengths, reviewers cited strong communication with stakeholders and helpfulness in encouraging municipalities to utilize LED lighting. They cited the project's decreasingly ambitious future plans as a weakness. Reviewers recommended that in the future the project work toward lowering long-term maintenance costs to encourage adoption of the new technology, as well as raising awareness of the benefits of owning street lighting.



Project # ET-34: High-Efficiency and Stable White Organic Light-Emitting Diode Using a Single Emitter

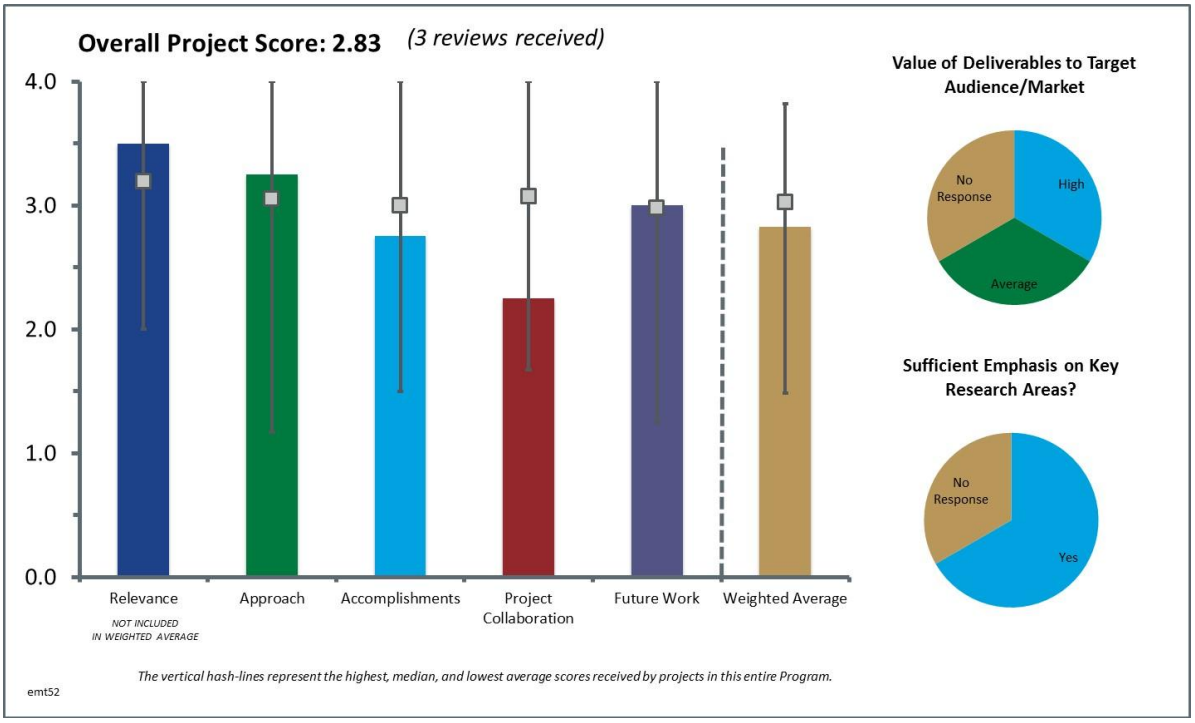
Presenter: Jian Li, Arizona State University, Jian.Li.1@asu.edu
DOE Manager: Jim Brodrick, 202-586-1856, james.brodrick@ee.doe.gov

Project Description

This project is demonstrating an efficient and stable white organic light-emitting diode (WOLED) using a single emitter on a planar glass substrate. Current WOLED technology requires the use of multiple emissive materials, which are expensive to manufacture and also generate color instability and color aging issues, affecting WOLED performance and operational lifetime. Simplifying device fabrication, increasing the robustness of materials, and providing more cost-effective alternates to current iridium-based phosphorescent emitters can reduce WOLED fabrication costs and improve performance. Nationwide, lighting buildings costs $58 billion a year and consumes about 22% of all electricity generated. A single-doped WOLED that addresses manufacturing and performance issues can help meet the targeted cost of organic solid-state lighting established in the U.S. Department of Energy Building Technologies Office (BTO) Multi-Year Research, Development, and Demonstration Plan.

Summary of Review Comments

According to reviewers, good progress has been made on this project; however, they also noted there are still technological challenges to overcome. Reviewers identified the following strengths: (1) achievement of planned milestones, (2) sound research, and (3) alignment with BTO goals and objectives. Reviewers listed the prohibitive life span of the devices as a potential weakness because it hinders the devices' ability to compete in the marketplace. Reviewers recommended that collaboration with industrial partners should be considered as the project continues to progress.



Project # ET-35: Low-Cost Light-Emitting Diode Luminaire for General Illumination

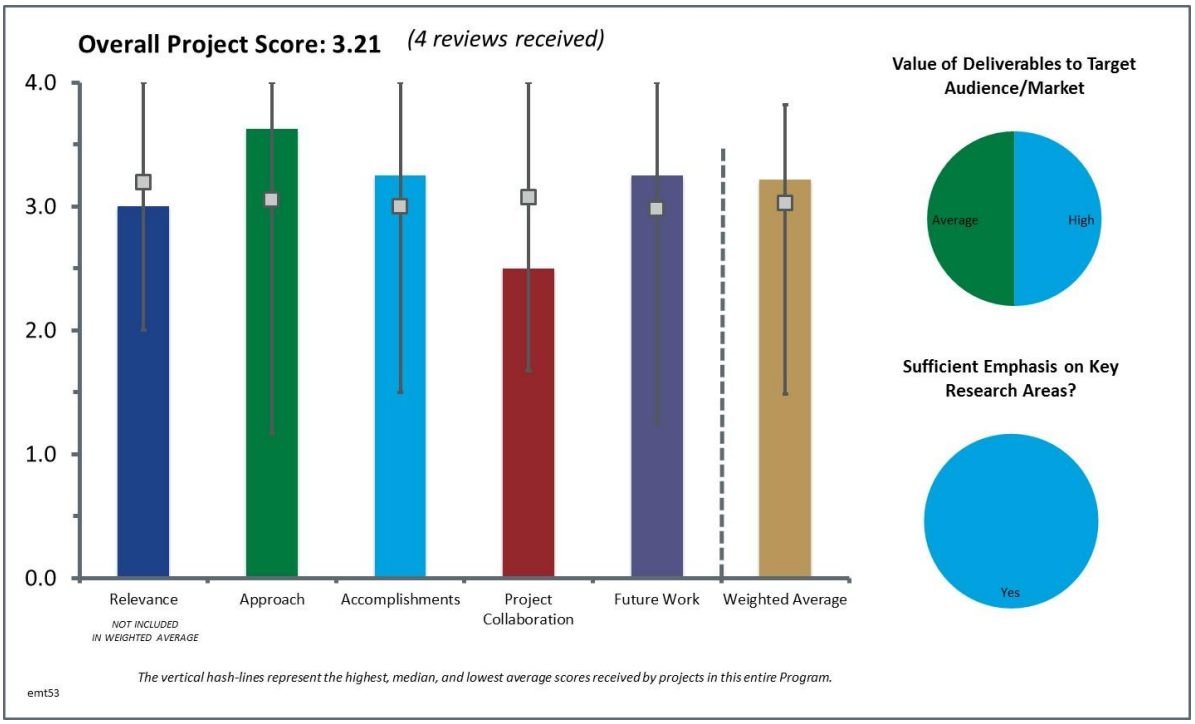
Presenter: Paul Fini, Cree SBTC, paul_fini@cree.com
DOE Manager: Jim Brodrick, 202-586-1856, james.brodrick@ee.doe.gov

Project Description

This project is developing a low-cost, high-efficacy light-emitting diode (LED) troffer suitable for indoor lighting. The troffer will cost 30% less than Cree's current troffer. The high quality of LED-based lighting has improved steadily, but action is needed to improve LED troffers that could replace current low-cost fluorescent fixtures. There are about 2.4 billion installed linear fluorescent fixtures in the United States, most of which are in troffer form. Replacing these with LED equivalents could yield 58 terawatt hours of energy savings by 2030. Nationwide, lighting buildings costs $58 billion a year and consumes about 22% of all electricity generated.

Summary of Review Comments

Reviewers agreed that the project has met all milestones; however, they also expressed concerns. They stated that the project is technically sound, includes strong work in lighting efficiency, and should help accelerate adoption of LED troffers. However, some reviewers felt that the project should have been funded by a private company, rather than the federal government. They also noted a lack of stakeholder involvement and collaborations outside of the project team. One reviewer recommended that a plan to communicate learnings to the lighting industry be applied more broadly.



Project # ET-36: High-Throughput, High-Precision Hot Testing Tool for High-Brightness Light-Emitting Diode Testing

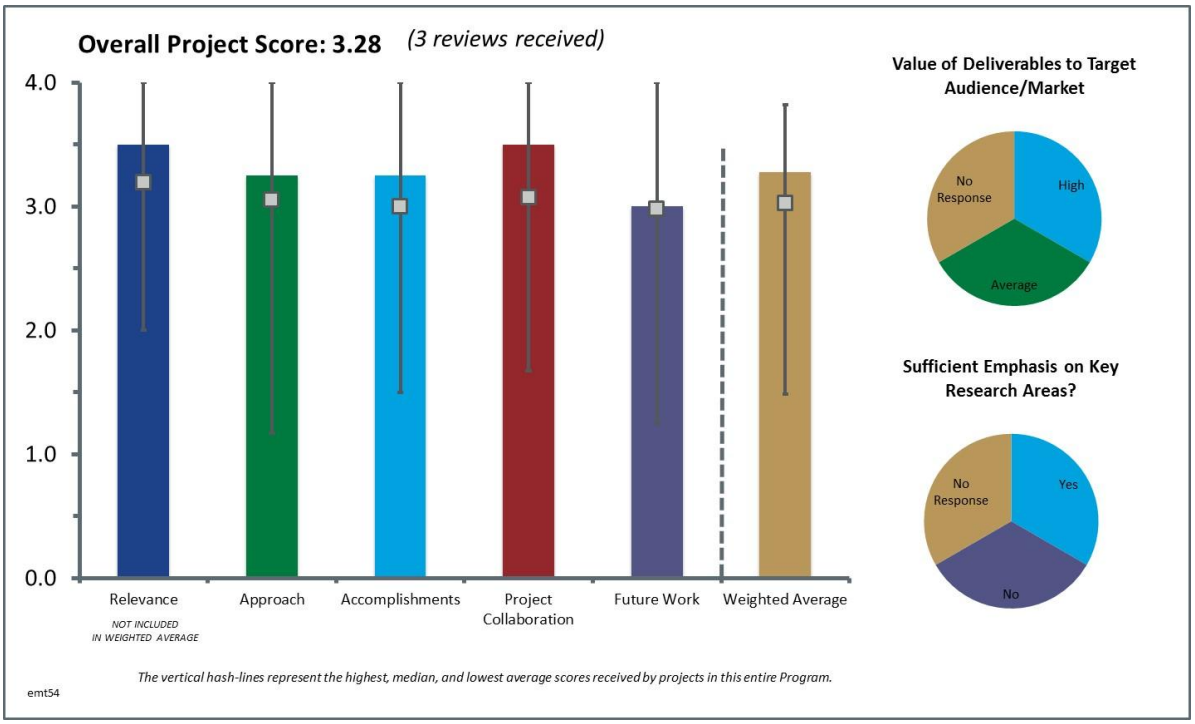
Presenter: Richard Solarz, KLA-Tencor, richard.solarz@kla-tencor.com
DOE Manager: Jim Brodrick, 202-586-1856, james.brodrick@ee.doe.gov

Project Description

This project is determining the requirements of the solid-state lighting industry for high-quality color coordination and flux characterization of high-brightness light-emitting diodes (HBLEDs) as well as demonstrating and testing a cost-effective hot test tool that meets the requirements. The market is the general lighting market, specifically the sectors demanding good lighting quality (which excludes the outdoor market). Current hot testing approaches only approximate actual use conditions and are very slow. By addressing these issues, the hot test tool will have an impact on the HBLED manufacturing process such that 2 quads of energy savings could be achieved at full market penetration. Nationwide, lighting buildings costs $58 billion a year and consumes about 22% of all electricity generated.

Summary of Review Comments

Reviewers noted that despite some missed milestones, the project has made strong progress and has demonstrated effective collaboration with manufacturers. Reviewers liked the project's focus on accurate color and intensity measurements, and on affordability. However, they questioned the tool's prospects in the market due to potential high cost and the lack of additional value propositions beyond improved accuracy. Reviewers recommended that KLA-Tencor provide a specific metric for the expected cost of the tool in comparison to current market offerings.



Project # ET-37: System Reliability Model for Solid-State Lighting Luminaires

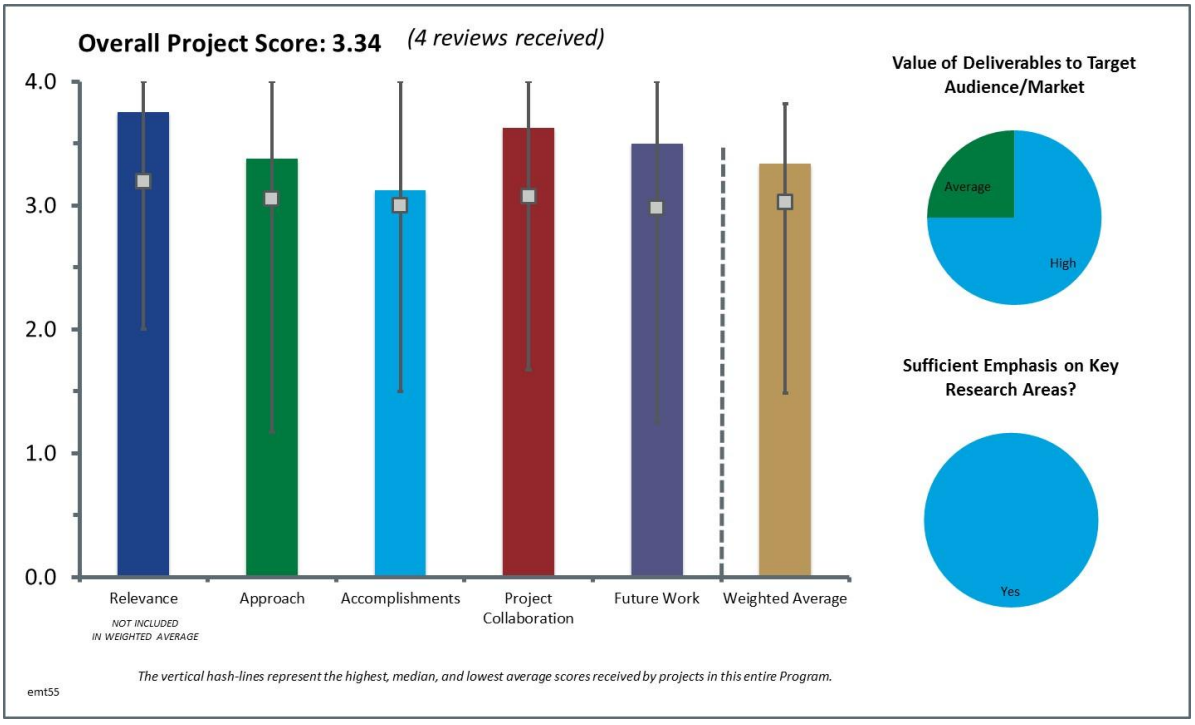
Presenter: Lynn Davis, RTI International, ldavis@rti.org
DOE Manager: Jim Brodrick, 202-586-1856, james.brodrick@ee.doe.gov

Project Description

This project is developing and validating a probabilistic reliability prediction tool, and accelerated life testing methodologies, to help lighting manufacturers and stakeholders answer two questions: (1) How can the promised reliability for a rapidly changing technology platform be ensured?, and (2) What will the usage and maintenance profiles be for a product that lasts 15 years? Solid-state lighting (SSL) is described as being highly energy efficient and having a long product lifetime. Testing can verify energy efficiency, but SSL product lifetime is generally not known, and there are no standard test methods. The target audience consists of manufacturers and SSL users that seek to justify higher first costs for SSL products over less efficient lighting technologies. This group annually consumes about 650 terawatt hours of electricity. Adopting SSLs can reduce consumption by about 30%.

Summary of Review Comments

According to reviewers, the project is useful because it explores a broad range of factors concerning light-emitting diode (LED) reliability. Cited strengths of the project include that it (1) addresses a critical component of new product development, (2) produces work that will support statements regarding product quality, and (3) includes good industry collaboration. Reviewers identified the following project weaknesses: (1) it is unclear how results can be applied to a wider range of products, (2) universal application might not be possible if the project is only developed using 6-inch downlights, (3) a lack of concise project conclusion due to the complexity of LED failure variables, and (4) a lack of specifics on actual project outputs. Reviewers recommended more clearly defining the nature of the final products and how they will be distributed to stakeholders, investigating issues related to color reliability, and sharing test results publicly.



Project # ET-38: Light-Emitting Diodes on Semipolar Bulk Gallium Nitride Substrate

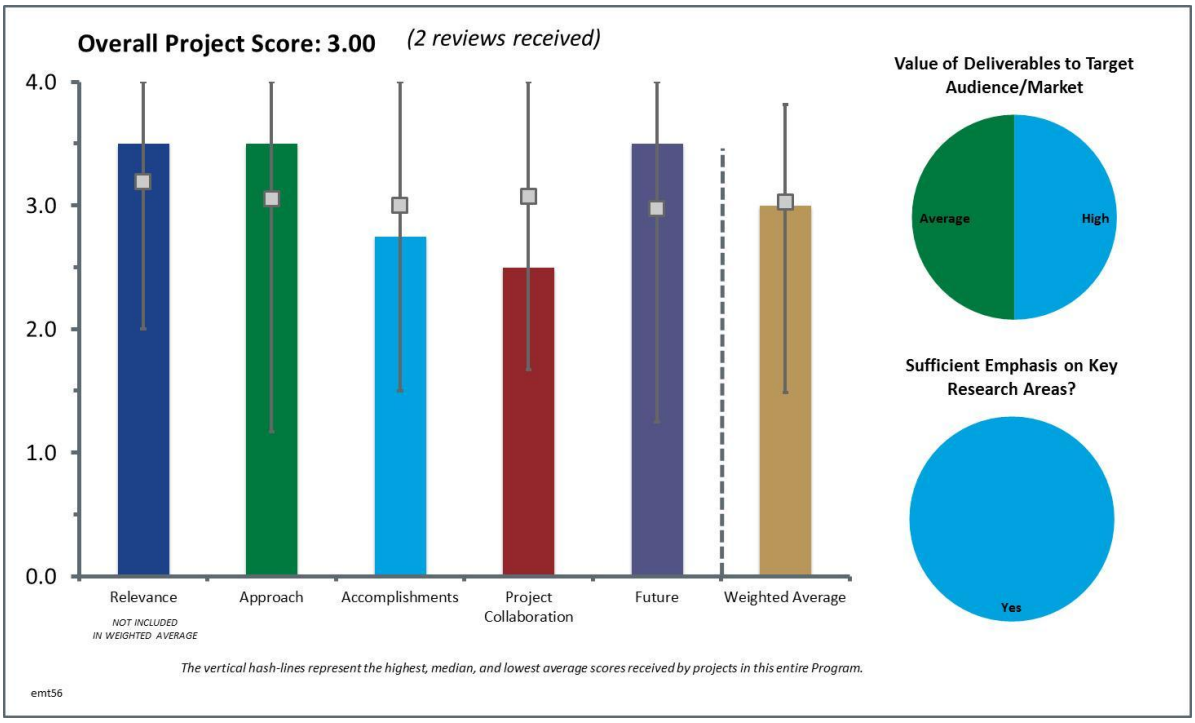
Presenter: Arpan Chakraborty, Soraa, Inc., achakraborty@soraa.com
DOE Manager: Jim Brodrick, 202-586-1856, james.brodrick@ee.doe.gov

Project Description

This project is producing high-efficiency semipolar light-emitting diodes (LEDs) on low-defect bulk gallium nitride substrates. Peak internal quantum efficiency (IQE) values of greater than 80% are achieved over a wide wavelength range at high current densities (J) and high junction temperatures (Tj). Phase I focuses on producing high-quality 405-nanometer (nm) semipolar LEDs and performing IQE measurements, with the goal of demonstrating greater than 70% peak IQE at high J and Tj. Phase I also explores the physical mechanisms behind IQE degradation at high pump densities by measuring the IQE of semipolar LED structures with varying active region designs. Fabrication of initial 405 nm semipolar LEDs is based on high-IQE structures identified by the experimental data.

Summary of Review Comments

Reviewers commented sparingly on this project, noting that it is mostly in line with Building Technologies Office goals. One reviewer observed that although the project focuses on an important technical issue, progress has been slower than planned. There are no partners involved in this project, according to one reviewer.



Project # ET-39: CERC: Research on Very-Low-Energy Building Operations and Management Methods

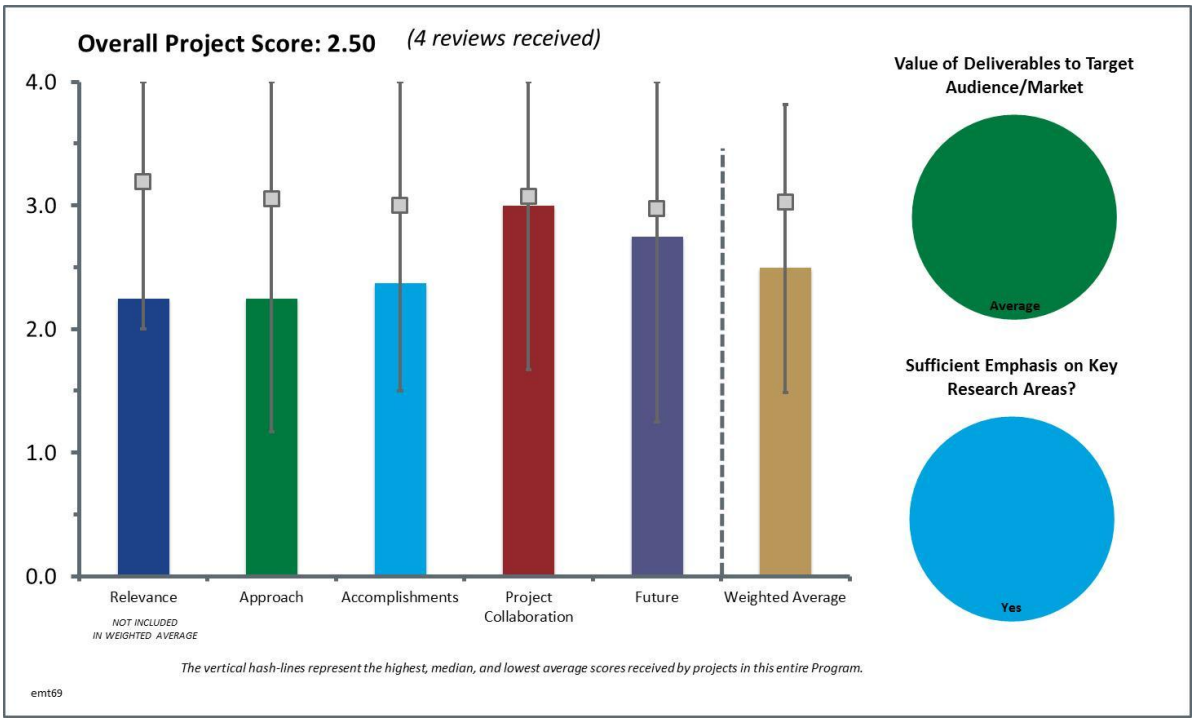
Presenter: Carolyn Szum, ICF International, carolyn.szum@icfi.com
DOE Manager: Karma Sawyer, 202-287-1713, karma.sawyer@hq.doe.gov

Project Description

The U.S.-China Clean Energy Research Center (CERC) is a pioneering research and development (R&D) consortium bringing together governments, key policymakers, researchers, and industry to develop a long-term platform for sustainable U.S.-China joint R&D. This CERC project aims to develop and pilot a national building energy database, benchmarking tool, and policy framework in China. In turn, these will drive energy and carbon-intensity reductions in Chinese buildings; the sale of U.S. energy-efficient technologies in China; and innovation in Chinese policy, such as inclusion of benchmarking in China's 13th Five-Year Plan. The United States can then inform its own building energy policy by drawing on lessons from China's real-time energy monitoring and innovations in building codes, standards, and policies. The project team has developed the first prototype comparative building benchmarking tools for hotels and commercial offices in China.

Summary of Review Comments

According to reviewers, the project could have a significant impact; however, they also noted it is only somewhat aligned with Building Technologies Office goals and is focused on a difficult market. Reviewers cited the collaboration between the Chinese and U.S. buildings industries and the focus on carbon dioxide reduction in China as the project's main strengths. Noted weaknesses include a culturally challenging market, apparent misunderstanding of important concepts, and doubt as to whether the benchmarking will produce the desired outcome. Some reviewers expressed the view that future efforts on this project should be reconsidered.



Project # ET-40: CBERD: Monitoring and Benchmarking

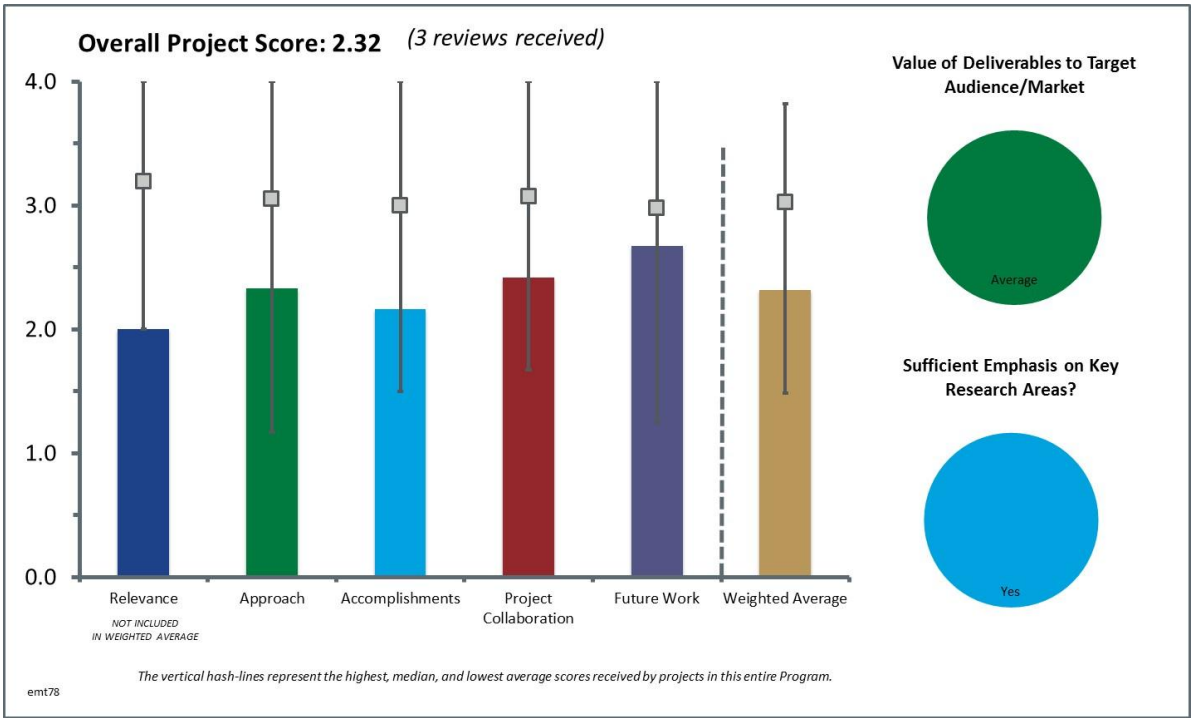
Presenter: Reshma Singh, Lawrence Berkeley National Laboratory, reshmasingh@lbl.gov
DOE Manager: Karma Sawyer, 202-287-1713, karma.sawyer@hq.doe.gov

Project Description

The U.S.-India Joint Center for Building Energy Research and Development (CBERD) conducts energy efficiency research and development with a focus on integrating information technology with building controls and physical systems for commercial/high-rise residential units. Advanced benchmarking and energy information systems (EIS) can enable up to 20% energy savings. However, there is a lack of scalable, cost-effective building monitoring tools to inform building design and operation. This CBERD project is tackling the problem in a few ways. First, it is developing new specifications for EIS solutions. The project team is also creating an integrated suite of benchmarking methods, tools, and practices, along with a plan to embed them into market deployment programs and policies. The project also gives U.S. EIS vendors the opportunity to strengthen their foothold in emerging international markets, such as India.

Summary of Review Comments

Reviewers were uncertain about the project's direct relevance to Building Technologies Office goals because the stated outcomes primarily benefit India. However, one reviewer noted that energy efficiency improvements in India would ultimately have global benefits. Reviewers also stated that the project could provide market opportunities for U.S. companies, but they were less than certain that the project could influence such a large and complex market, especially without addressing costs specifically. Two reviewers also noted that the project team is currently composed of mostly government agencies, and they recommended the project increase collaboration with other entities.



Project # ET-41: CBERD: Simulation and Modeling

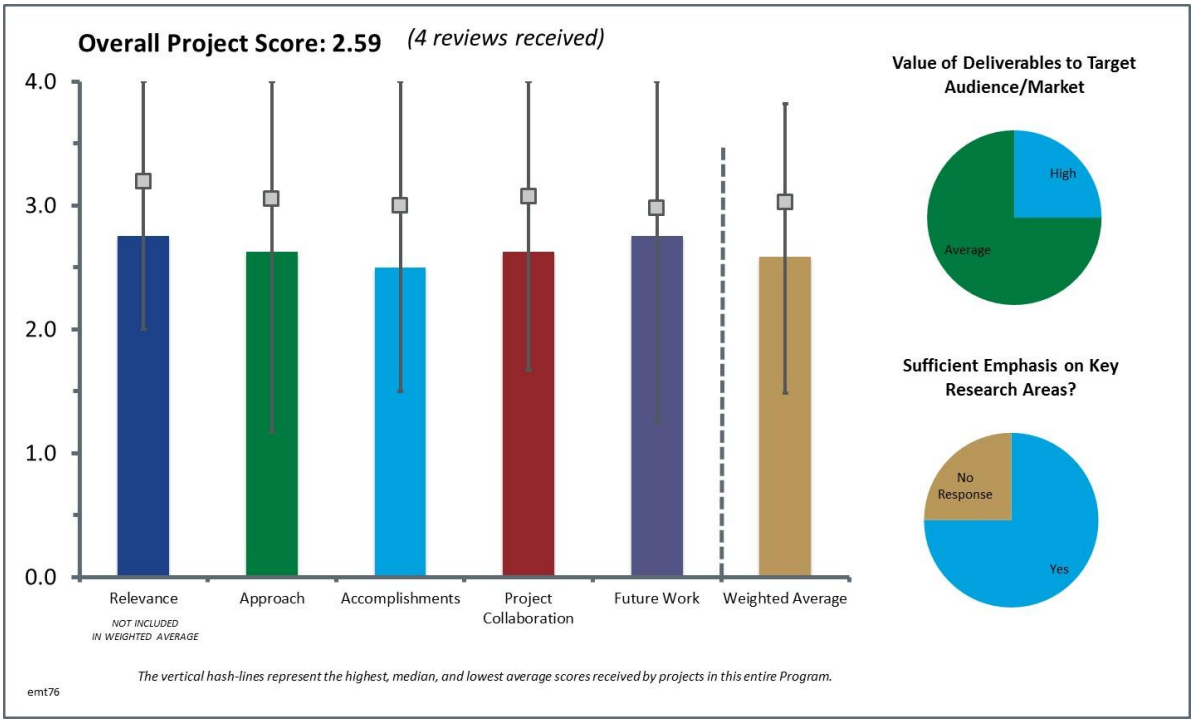
Presenter: Phil Haves, Lawrence Berkeley National Laboratory, PHaves@lbl.gov
DOE Manager: Karma Sawyer, 202-287-1713, karma.sawyer@hq.doe.gov

Project Description

The U.S.-India Joint Center for Building Energy Research and Development (CBERD) conducts energy efficiency research and development with a focus on integrating information technology with building controls and physical systems for commercial/high-rise residential units. Simulation tools do not fully meet the needs of practitioners throughout the building life cycle—from early stage design to operation. This CBERD project is improving simulation tools for building design and operation, which in turn improves energy efficiency. The project team has found significant gaps in early stage design analysis, code compliance tools, and control of passive thermal storage. Key milestones include developing a beta version of a code compliance tool, and implementing real-time Model Predictive Control strategies in a building or test bed equipped with a low-energy heating, ventilation, and air conditioning system.

Summary of Review Comments

Reviewers agreed that improved simulation tools are important to energy savings in buildings, and one reviewer wrote that integrating simplified model predictive control methods into EnergyPlus is a significant accomplishment. Some reviewers were less certain about project specifics and noted that the project plan is unclear, although one dissenter felt the project has an excellent plan and was enthusiastic about the efforts related to ASHRAE 90.1. Two reviewers thought the project duplicates or conflicts with other Building Technologies Office efforts (e.g., OpenStudio) and should be more clearly integrated with those efforts. Two reviewers did not understand the project's focus on radiant systems because those are not popular in India, and one felt that the California Energy Commission (CEC) task should be removed from the project scope because CEC is not providing funding for the project.



Project # ET-42: CERC: Human Behavior, Standards, and Tools to Improve Design and Operation

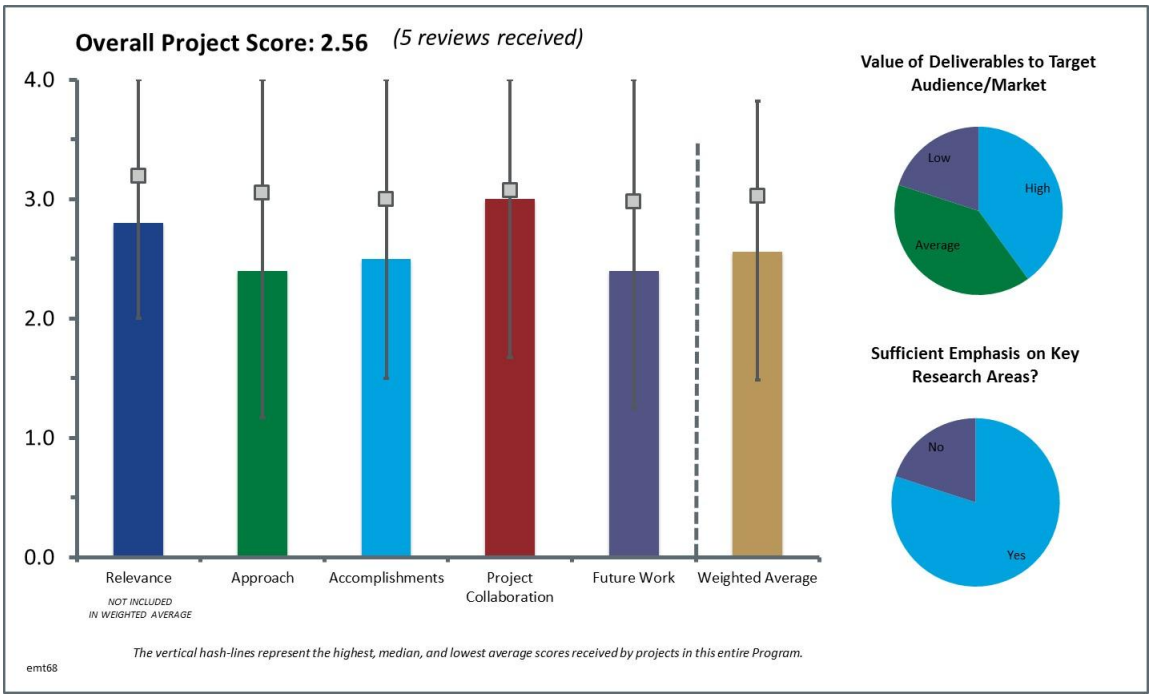
Presenter: Tianzhen Hong, Lawrence Berkeley National Laboratory, thong@lbl.gov
DOE Manager: Karma Sawyer, 202-287-1713, karma.sawyer@hq.doe.gov

Project Description

The U.S.-China Clean Energy Research Center (CERC) is a pioneering research and development (R&D) consortium bringing together governments, key policymakers, researchers, and industry to develop a long-term platform for sustainable U.S.-China joint R&D. The primary goal of this project is to gain a deep understanding of energy-related occupant behavior in buildings. Technologies alone do not necessarily guarantee that a building's energy use goes down; human behavior also plays an essential role in building design and operation. However, case studies and data are needed to understand human behavior's role in energy efficiency. This project aims to create that data, to standardize the description of human energy-related behavior, and then to integrate those behavior models into whole-building performance simulation tools. Achieving these goals can lead to 5%–50% energy savings.

Summary of Review Comments

Reviewers felt that the project addresses a very important and poorly supported aspect of building energy usage: the effect of human behavior on building energy efficiency. They were less positive about the project approach. Some reviewers stated that the project applies rational behavioral predictive models to non-rational behavior and noted that no human behavior specialists are on the project team. Another added that the models being developed are inappropriate because they focus on actions to change building functions rather than the actual thermal comfort level or air and lighting quality. According to reviewers, good progress has been made toward the stated work scope of software module development and data collection. However, there were varied comments about future work. One reviewer observed that the project outcomes will be influenced by whether the model is adopted voluntarily or via mandate, and by the political structure of the countries in which it is adopted. Reviewers expressed skepticism over the usefulness of a model that does not focus on human factors, concerns about data privacy, and objections to the project's overambitious scope.



Project # ET-43: Residential Cold Climate Heat Pump with Variable-Speed Technology

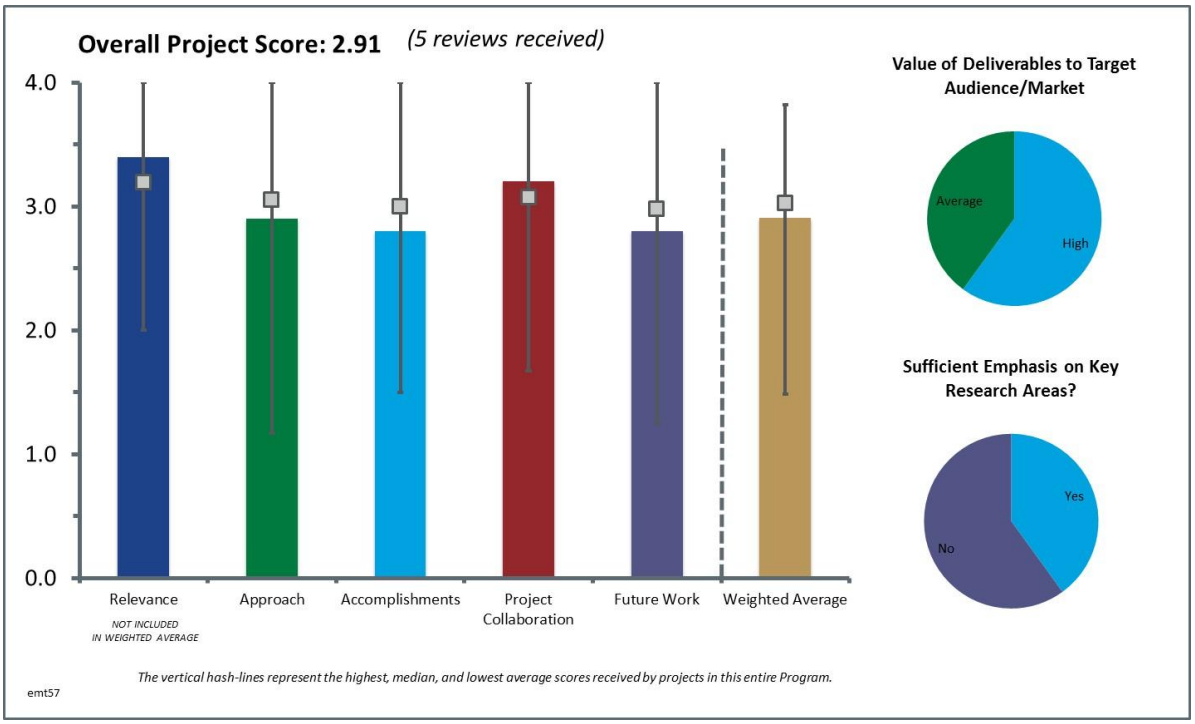
Presenter: Craig Messmer, Unico Systems, craig@unicosystem.com
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

The goal of this project is to develop a residential split-system 3-ton cold climate heat pump (CCHP) using boosted compression technology and variable speed motors. This project supports the U.S. Department of Energy's goal of developing CCHP systems that can maintain capacity and efficiency at low ambient temperatures. Unico will meet efficiency goals of 4.0 coefficient of performance (COP) at 47°F, 3.5 COP at 17°F, and 3.0 COP at -13°F with a simple payback of less than 5 years.

Summary of Review Comments

Reviewers stated that commercial viability of CCHPs is highly relevant to Building Technologies Office goals. One reviewer commented favorably that the project directly involved industry in manufacturing the prototype and establishing clear commercialization targets. One reviewer thought that the team was focusing on commercialization too soon and that a clearer research and development plan is required, while another felt the team's plans were clear and appropriate. Most reviewers believed the team to be very appropriate for the project, stating that the team comprises the necessary wide range of organizations, although one reviewer expressed concern about the primary team member's relevant experience and technical capabilities in developing new technologies. All reviewers noted project delays and identification of barriers, including an oil management issue.



Project # ET-44: Cold Climate Heat Pump

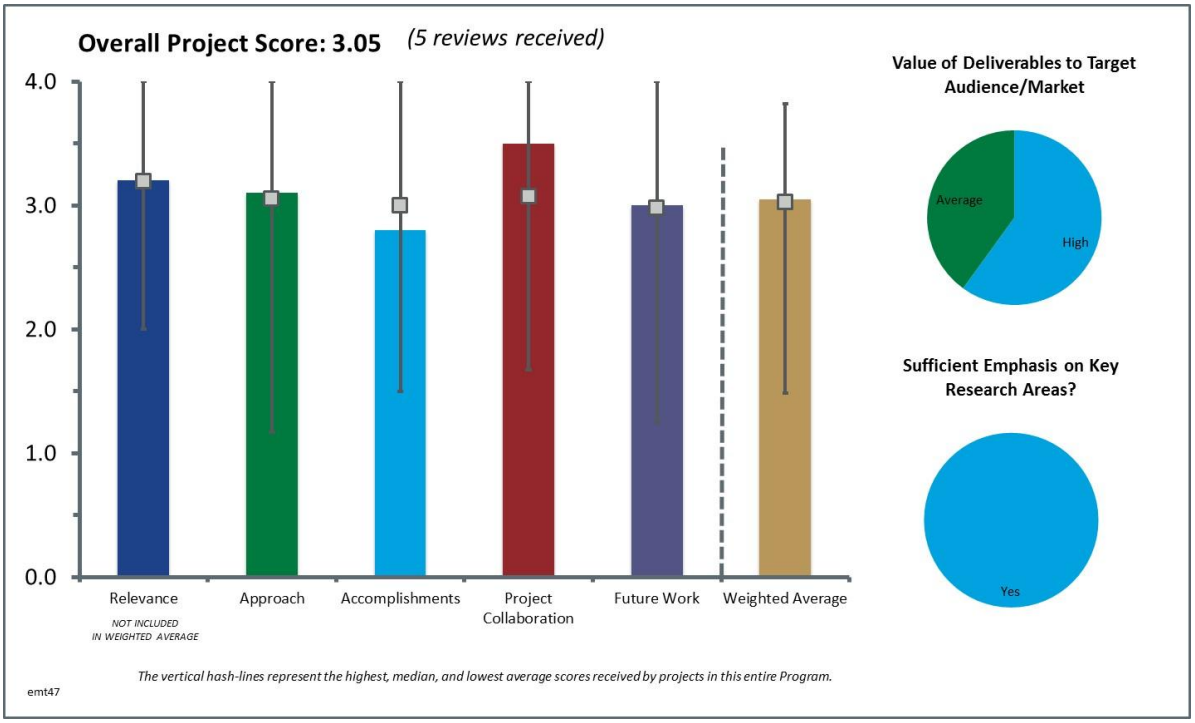
Presenter: Bo Shen, Oak Ridge National Laboratory, SHENB@ORNL.GOV
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

This project is developing a split-system cold climate heat pump (CCHP) that provides a heating capacity of 36,000 Btu/hour with a coefficient of performance (COP) of 4.0, a maximum efficiency degradation of 50%, and a capacity loss of 25% at -13°F ambient conditions. In the United States, approximately 14.4 million dwellings use electricity for heating in very cold and cold regions, consuming 0.16 quads of energy annually. A high-performance CCHP would result in significant savings over current technologies (greater than 70% compared to strip heating). The CCHP can result in annual primary energy savings of 0.1 quads when fully deployed, which is equivalent to a reduction of 5.9 million tons of annual carbon dioxide emissions.

Summary of Review Comments

According to reviewers, the project has taken an excellent, integrated approach by reviewing configurations of vapor compression systems; using results to identify an optimal system; and then designing, building, and testing that system. Reviewers felt that if the project is successful, it will be highly relevant to the Building Technologies Office goals of improved COP and reduced energy consumption. One reviewer felt the project could make greater scientific contributions by optimizing opportunities to increase fundamental understanding of compression technologies. Reviewers noted commendable technical performance and good progress overall, with some delays; one reviewer stated that the two-stage unit over-capacity issues may be due to flow control. Future plans were also met with approval, although one reviewer suggested conducting preliminary load-based laboratory testing prior to field testing. Most reviewers stated that the project team and collaboration efforts are excellent.



Project # ET-45: High-Performance Commercial Cold Climate Heat Pump

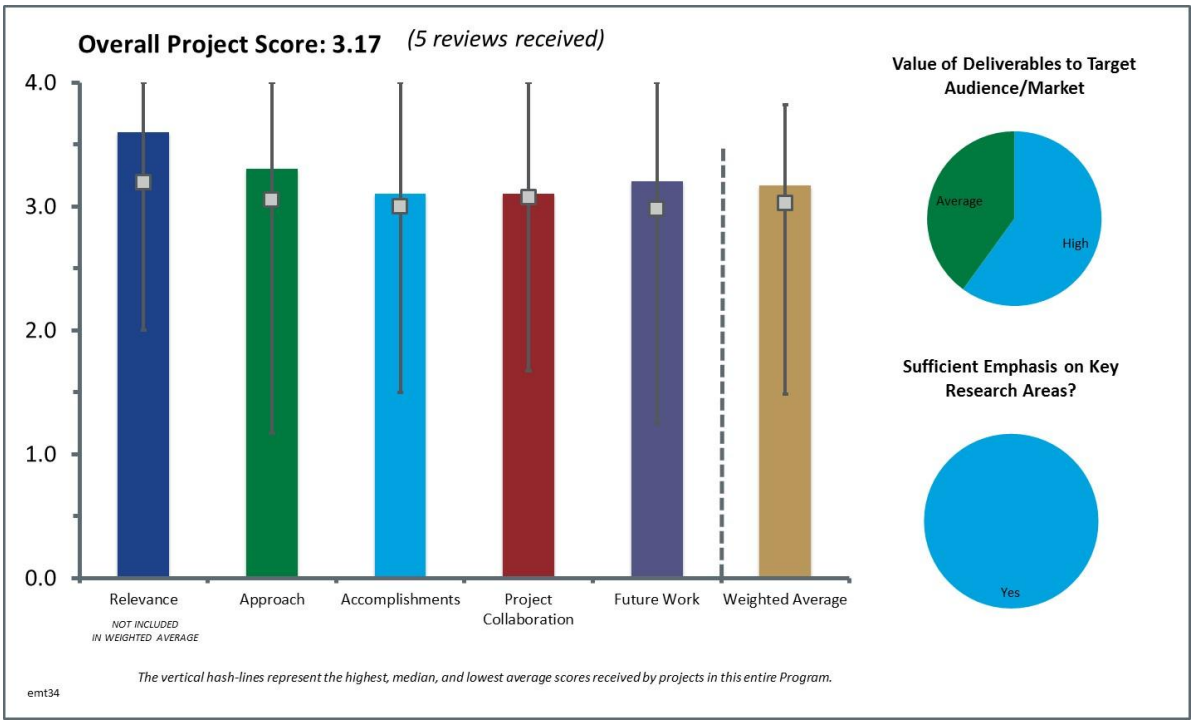
Presenter: Ahmad Mahmoud, United Technologies Research Center, mahmouam@utrc.utc.com
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

The United Technologies Research Center (UTRC) is developing a prototype 10 tons-of-refrigeration (TR) high-performance cold climate commercial heat pump system. The system improves on state-of-the-art heat pumps, which can degrade by up to 60% in capacity and 50% in system coefficient of performance (COP) at the -13°F ambient conditions targeted by the U.S. Department of Energy. The system's improved performance is achieved by utilizing compression with high efficiency over an unusually wide range of speed and pressure ratios, and with system-level design optimization for cold climates. The system is expected to be scalable beyond 40 TR, be cost-effective with a simple payback of less than 3 years, and enable annual electricity use for building space heating in cold climates to decrease by at least 25%.

Summary of Review Comments

Reviewers agreed that the project has high potential for energy savings. One reviewer felt that the project targeted a significant market (commercial heating, ventilation, and air conditioning systems and their retrofits), while another commented that it targeted a small market (commercial heat pumps in cold climates). Most admired the systematic six-step integrative approach, noting that project progress has exceeded targets to date, accelerating the proof-of-concept stage, although one reviewer thought the remaining timeline might be overly ambitious. Although reviewers felt the project team was robust and included the needed elements, reviewers commented that members are largely from within UTRC, and that the project should perhaps involve outside organizations to ensure widespread benefit.



Project # ET-46: The Natural Gas Heat Pump and Air Conditioner

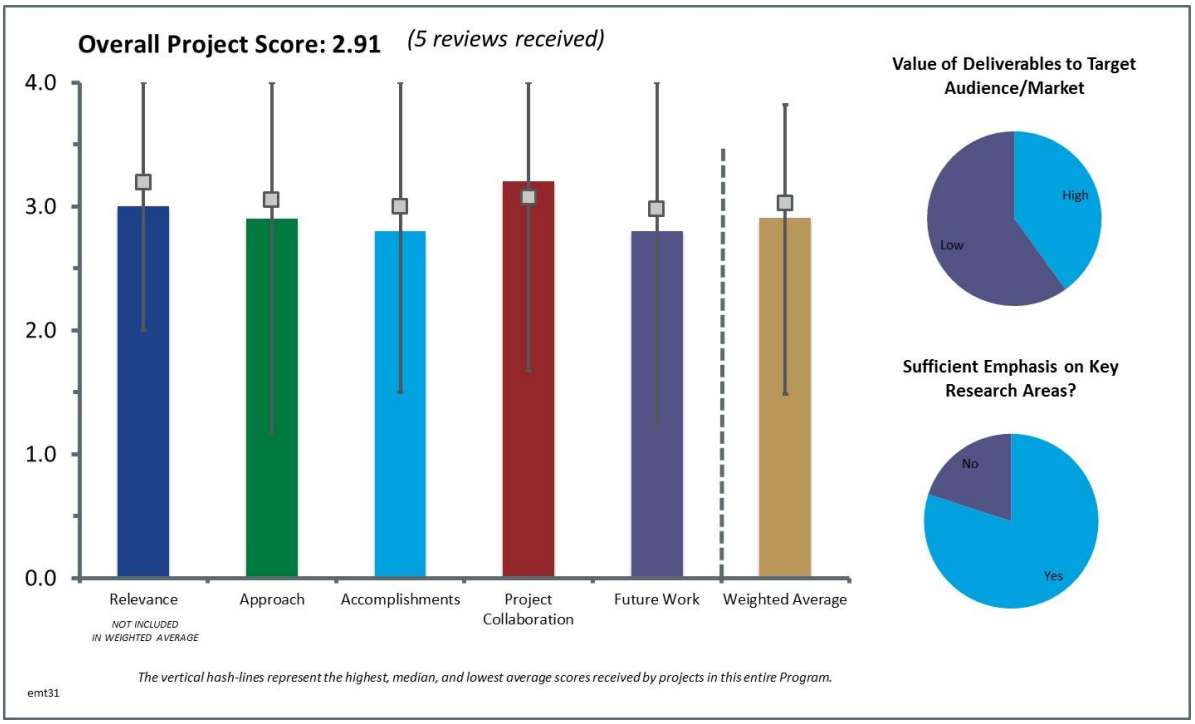
Presenter: Paul Schwartz, ThermoLift, Inc., pschwartz@tm-lift.com
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

Thermolift is developing the Vuilleumier heat pump (VHP), which uses natural gas to provide space heating, space cooling, and hot water for residential and commercial buildings. This project will design, build, and test two VHP prototypes. The VHP incorporates an ultra-low-emission combustion burner, electronically controlled actuators for cycle efficiency improvement, and innovative heat exchangers. The VHP does not use refrigerants yet will still be cost-competitive and outperform current state-of-the-art equipment. Reduced energy demand will contribute to a more reliable energy grid, lower energy costs, fewer greenhouse gas emissions, and increased domestic energy independence. VHPs will be manufactured in the United States, improving employment and the trade deficit.

Summary of Review Comments

Reviewers stated that this project is pursuing a high-risk, high-reward technology with great potential to reduce energy usage and greenhouse gas production. Some reviewers noted the competence and dedication of the project team. Reviewers stated that the technology is at an early stage of development, making its potential difficult to evaluate at this time. While reviewers noted that the team has identified the primary barrier—heat transfer—two reviewers felt the team has made limited progress in addressing it. One reviewer felt strongly that the plan for commercialization is unrealistic, noting that the technology could not be commercialized in 3 years. One reviewer recommended more emphasis on a system-level assessment to analyze how the technology will be used. Another warned that computational fluid dynamics results should be validated with experimental testing.



Project # ET-47: Natural Refrigerant High-Performance Heat Pump for Commercial Applications

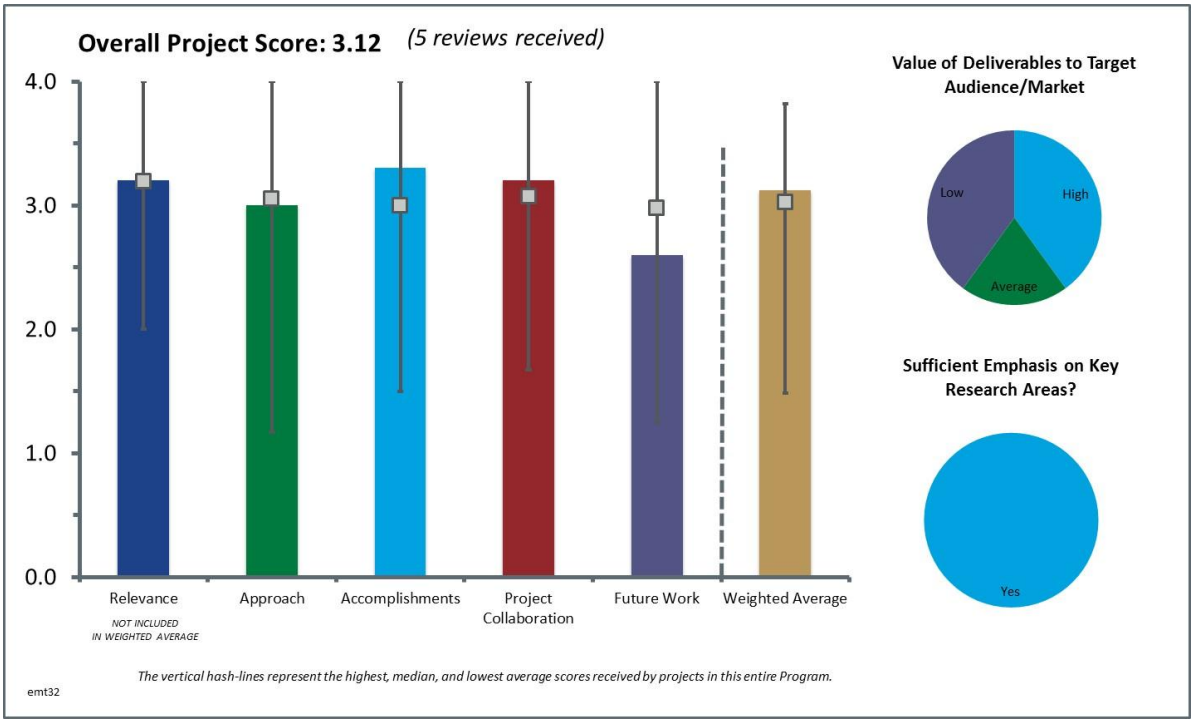
Presenter: Lee Jestings, S-RAM Dynamics, lee@S-RAM.com
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

This project aims to develop a regenerative air source heat pump for commercial and industrial heating, ventilation, and air conditioning (HVAC) applications. By using air as the working fluid, the heat pump eliminates all use of hydrofluorocarbon refrigerant—a major greenhouse gas. The heat pump will operate over a temperature range of -40°F to 210°F, enabling excellent performance in both cold climates and industrial applications. The initial units will have a 20-ton cooling capacity and a 240,000 Btu/hour heating capacity—a 50% improvement over existing state-of-the-art technology. The efficiency improvements from this heat pump are expected to create a payback period of 4 years for the target markets.

Summary of Review Comments

Reviewers generally felt that the project involves sound and innovative technology, with a particularly positive focus on use of a high-efficiency patented expander to improve heat pump performance. Although reviewers noted that technology development is in the early stages, most were impressed with the results to date and saw potential for the technology to contribute to Building Technologies Office energy savings goals, noting the possible high return on a low-cost project. Most noted strong collaboration with industry and a national laboratory, although one reviewer felt the team should include major companies in the HVAC market, such as Trane. The same reviewer expressed some concerns about the project's limited plan for commercialization, stating that this should be built in early.



Project # ET-48: 13–Energy Efficiency Ratio Window Air Conditioner

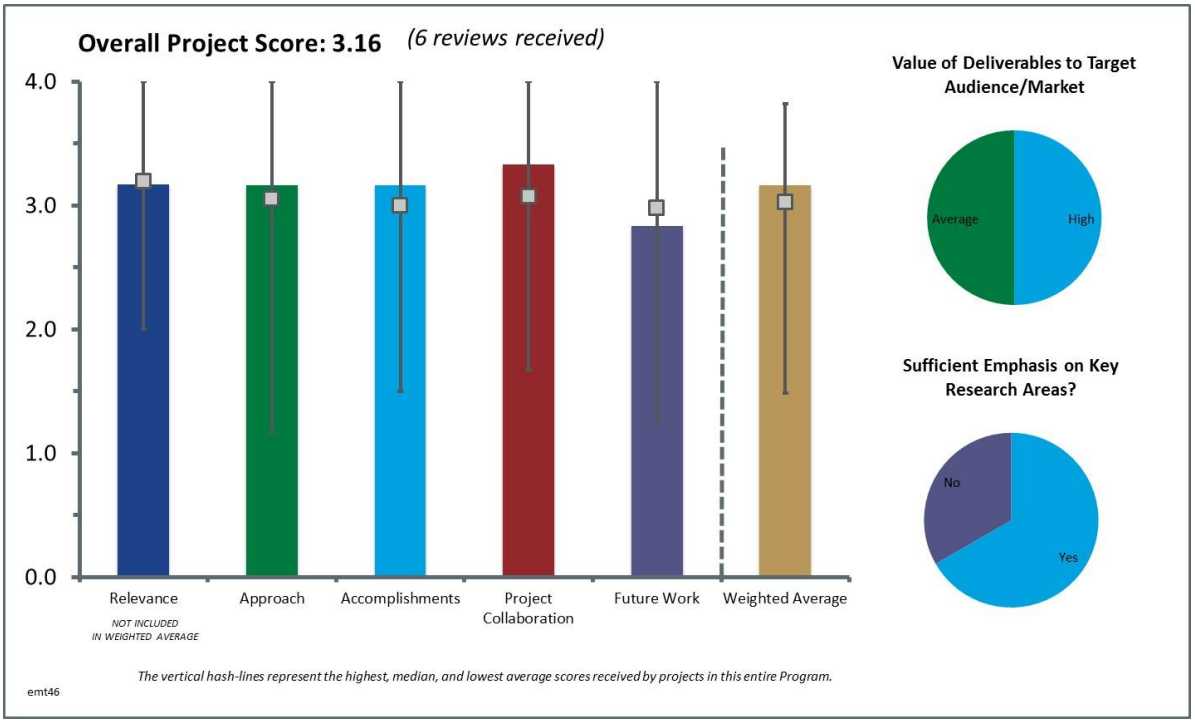
Presenter: Pradeep Bansal, Oak Ridge National Laboratory, bansalpk@ornl.gov
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

This project is designing and developing a high-efficiency 13 energy-efficiency-ratio (EER) window air conditioner (WAC). The technology will be used in single-family and small, low-rise multifamily residential buildings and certain types of small commercial buildings. There are approximately 57 million installed WAC units, with an annual energy consumption of 0.33 quads. With more than 8 million units shipped each year, high-efficiency units could make a significant impact on sector energy use in a short amount of time, given the known replacement rate. Business case analyses estimate a cumulative energy savings potential of 1.1 quads for the period 2015–2030 for a 13 EER WAC, compared to a typical new unit with an EER of 9.8.

Summary of Review Comments

Reviewers generally agreed that WACs represent a large market share and have received limited attention in terms of energy efficiency; therefore, the reviewers felt the project's relevance and impact are potentially great. Dissenting opinions were that existing products are already low-cost and well engineered, and that energy efficiency improvement is limited by strict product and marketing constraints, leaving little room for a major impact unless more radical changes are implemented. There was overall consensus that the approach is reasonable, the team is strong, and research and progress toward established objectives are excellent. Reviewers were impressed with the achievement of 13 EER, although one reviewer stated the achievement entails sacrificed capacity with no plan to regain that capacity. Collaborations with a national laboratory and two industry organizations were mostly seen as strong, although it was suggested that stakeholder involvement could be broadened to accelerate market adoption, such as by including innovation-friendly industry partners and utility energy efficiency program sponsors.



Project # ET-49: Heat Exchanger Research at Sandia National Lab

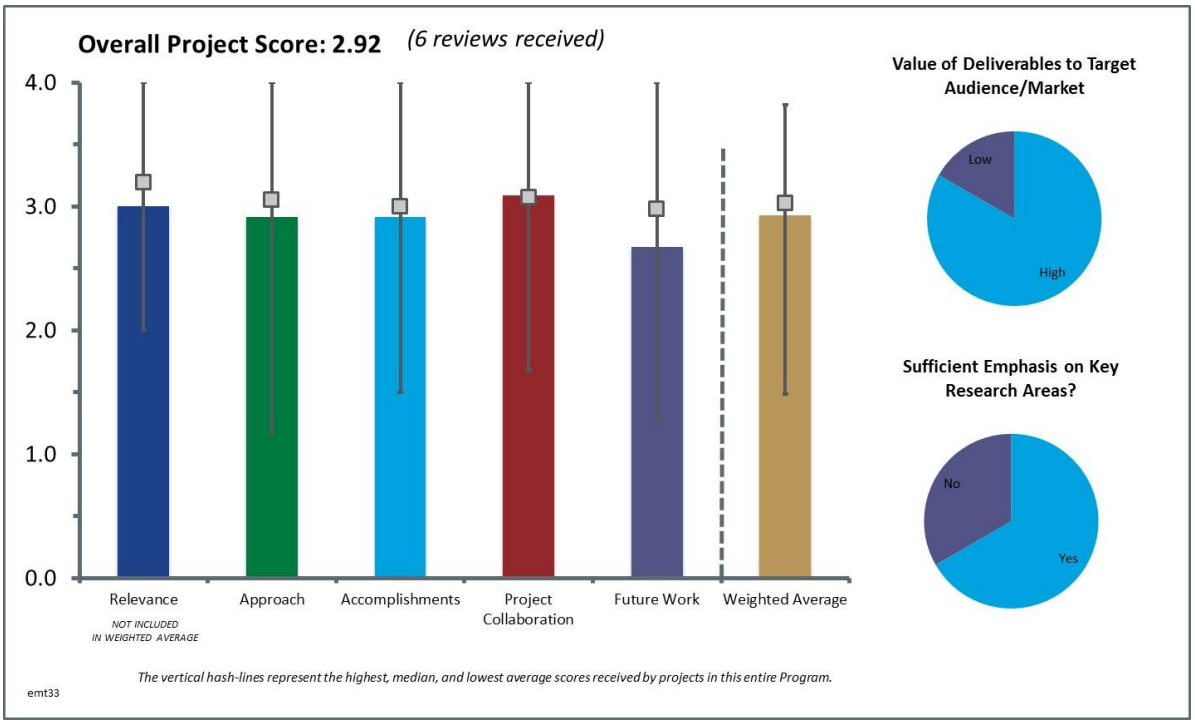
Presenter: Jeff Koplow, Sandia National Laboratories, jkoplow@sandia.gov
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

This project is developing rotating heat exchanger technology —for potential use in commercial refrigerators, thermoelectric heat pumps, and residential heat pumps—that can reduce electrical power consumption in heating, ventilation, air conditioning, and refrigeration (HVAC&R) by 15%–20%. In addition, the project is building and testing an axial flow heat pump that builds upon the advances in the radial flow cooler (the Sandia Cooler) but is scalable to building HVAC&R applications. The axial heat exchanger design eliminates any requirement for heat transfer across a fluid bearing. The objective for the axial design is to create a new de facto standard for cost-competitive, high-efficiency HVAC&R technology.

Summary of Review Comments

Reviewers had different views on many aspects of this project. Some reviewers felt the technology's applications are unclear (e.g., air- or water-cooled systems) and that the technology is too early in its development to assess its potential. Other reviewers felt the project is innovative and ready for commercialization by the heating, ventilation, and air conditioning industry and that the 10-times reduction in boundary-layer thickness has the potential to overcome heat transfer issues, making the technology a possible choice for the small appliances market. Some reviewers felt collaborations are a project highlight, while others thought industry should have been brought on board earlier.



Project # ET-50: Highly Insulating Residential Windows Using Smart Automated Shading

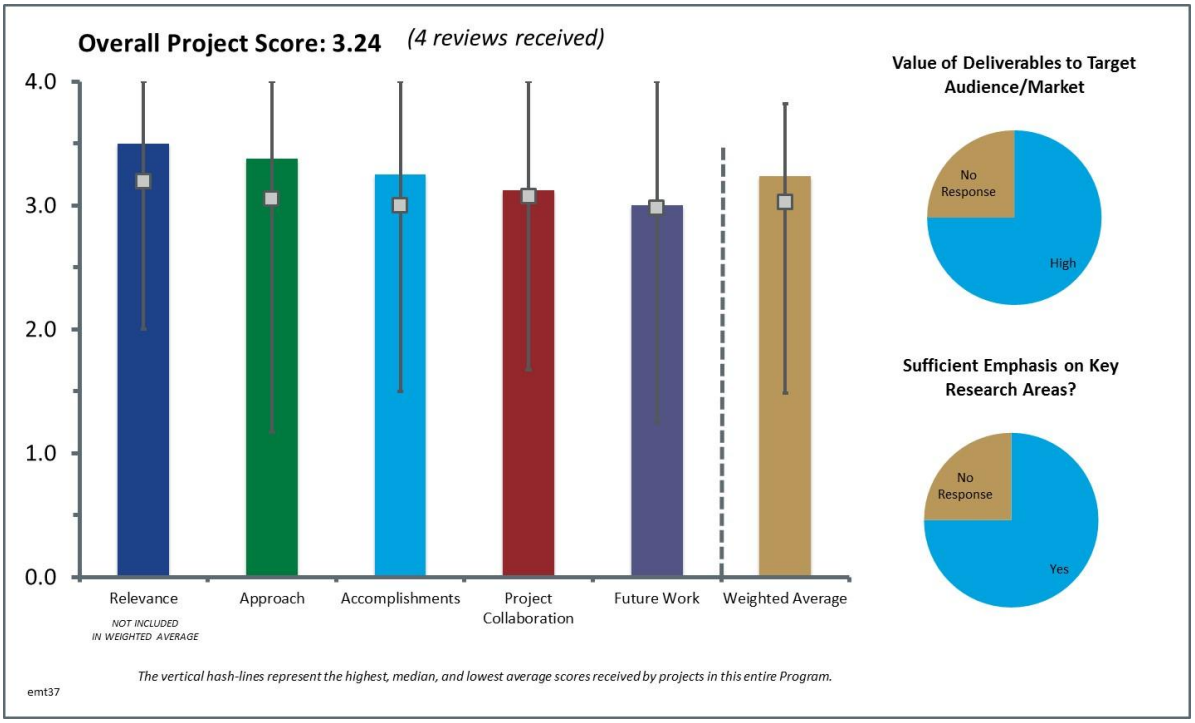
Presenter: Christian Kohler, Lawrence Berkeley National Laboratory, cjkohler@lbl.gov
DOE Manager: Bahman Habibzadeh, 202-287-1657, bahman.habibzadeh@ee.doe.gov

Project Description

This project creates a platform for cost-effective, high-performance residential windows that maximizes net useful solar gain in heating mode and minimizes solar gain in cooling mode. Fully automated operation that optimizes energy savings is provided by an intelligent, networkable sensor/microprocessor package that is easily installed and calibrated. Several window designs will be completed. At least one design will directly meet the project requirements in terms of U-factor and solar heat gain coefficient. Other designs will meet or exceed the project requirements on an annual energy equivalence basis in a cold and mixed climate. One design will be used to fabricate 25 windows, which will be demonstrated in a cold climate house. The windows will function autonomously and in a networked configuration.

Summary of Review Comments

Reviewers agreed that pursuing smart shading addresses a gap in the window market—i.e., algorithms to support dynamic windows—and has great potential for energy savings. They stated that the project has made excellent progress toward the stated goals, including achievement of a demonstrated prototype. However, one reviewer expressed concern that the solution seems expensive and suggested that low-cost options—such as replacing sensors with internet data sources—should be explored. Other recommendations include involving more than one manufacturer, integrating natural ventilation into the design, and exploring algorithms for mini-blinds that add blade angle as a variable.



Project # ET-51: Dynamic Windows

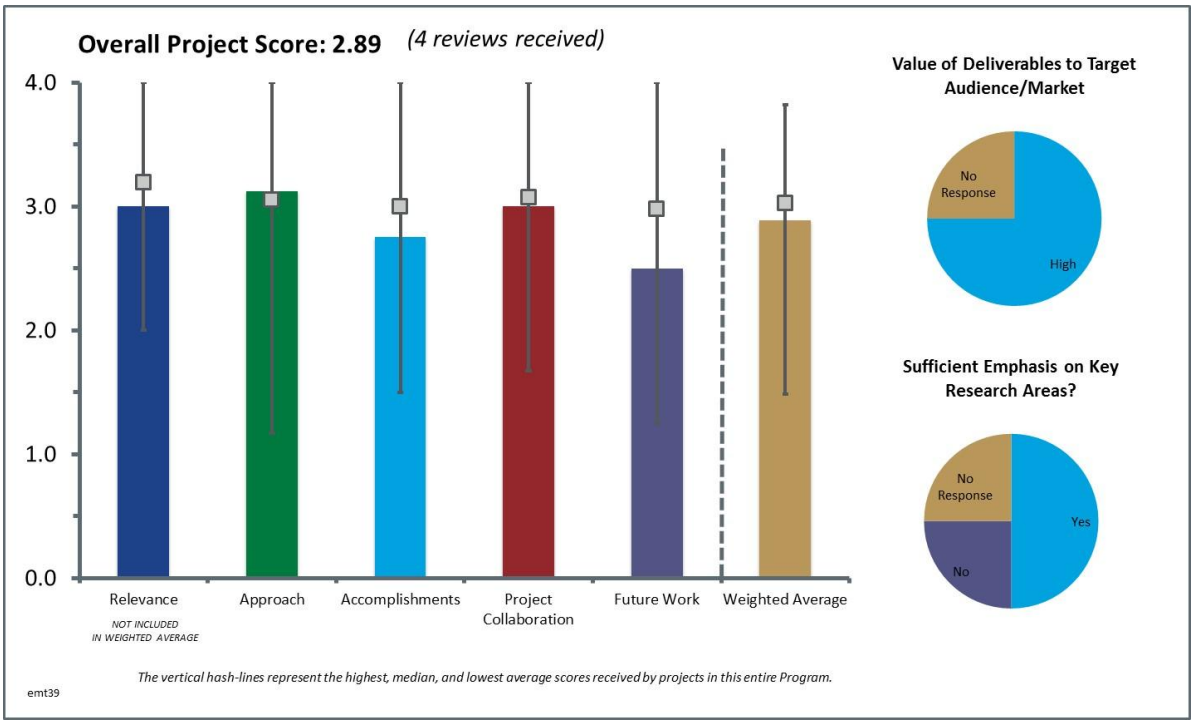
Presenter: Robert Tenent, National Renewable Energy Laboratory, robert.tenent@nrel.gov
DOE Manager: Karma Sawyer, 202-287-1713, karma.sawyer@hq.doe.gov

Project Description

This project is developing and demonstrating a dynamic window film prototype that switches between transparent and diffusely reflective states. The key element in this prototype is reversible reflectance switching, which has been previously demonstrated in a partial device format and on rigid glass substrates. This project will integrate this early result into a flexible prototype structure that will be used to demonstrate a reversibly switchable reflective electrochromic device on a flexible substrate. The result will be a 3-inch-by-3-inch laminated, flexible, dynamic window film prototype that switches between transparent and diffusely reflective states and includes full characterization of the specular and diffuse optical performance in the visible and near-infrared spectra.

Summary of Review Comments

Reviewers agreed that addressing key barriers to the adoption of dynamic windows aligns well with Building Technologies Office objectives, noting that the project has multiple approaches to enhancing dynamic glazing technologies for different applications. However, one reviewer felt the project focuses on cost reduction to the exclusion of other important barriers—specifically, aesthetic concerns and associated end-user (architect and building occupant) assessments. Nonetheless, reviewers agreed that the technologies have great potential for energy savings, with one stating that industry has shown a willingness to license and incorporate the delivered technologies into products and processes, affirming the project's value.



Project # ET-52: CERC: Advanced Window and Shading Technologies

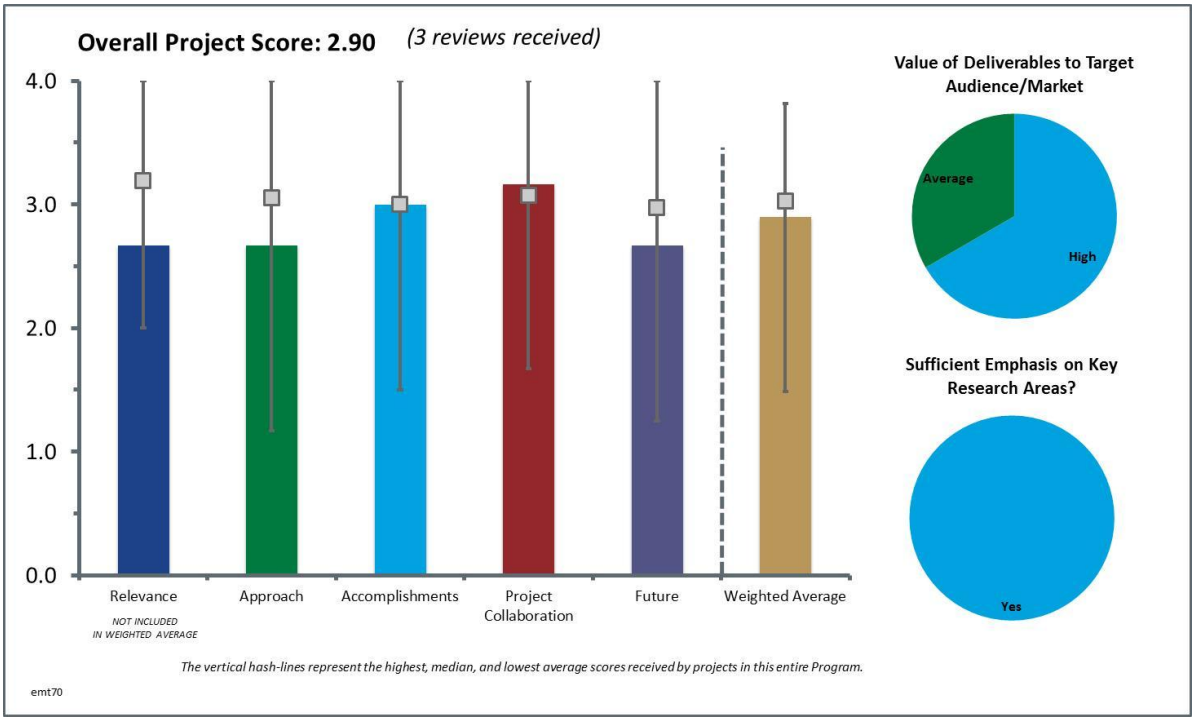
Presenter: Eleanor Lee, Lawrence Berkeley National Laboratory, eslee@lbl.gov
DOE Manager: Karma Sawyer, 202-287-1713, karma.sawyer@hq.doe.gov

Project Description

The U.S.-China Clean Energy Research Center (CERC) is a pioneering research and development (R&D) consortium bringing together governments, key policymakers, researchers, and industry to develop a long-term platform for sustainable U.S.-China joint R&D. This CERC project aims to identify, develop, and promote the use of energy-efficient window and shading technologies in Chinese and U.S. buildings. Specifically, this project focuses on pragmatic, cost-effective solar control and daylighting technologies that can provide 40%–50% perimeter zone total energy savings compared to current systems. In the near term, the project team is benchmarking the technical potential of these technologies in typical Chinese commercial buildings using advanced International Organization for Standardization (ISO)-compliant modeling tools. These third-party-monitored evaluations promote market adoption. Assuming a 50% market adoption rate, these technologies could save 995 trillion Btu per year by 2025.

Summary of Review Comments

Reviewers agreed that the project aligns well with Building Technologies Office goals and would provide useful tools, design strategies, and algorithms that will ultimately benefit both U.S. and Chinese building communities. They stated that the approach is well articulated and involves benchmarking technologies, verifying energy savings in real-world conditions, promoting market awareness, and encouraging broader adoption through demonstrated use of modeling tools compliant with the ISO. Reviewers agreed that the U.S.-China collaboration works well and noted that the project has multiple industry partners. Consensus was that the project is making excellent progress toward established goals; of particular importance, in one reviewer's opinion, was the successful transfer of ISO 15099 and WINDOW 6 to China.



Project # ET-53: Next-Generation Building Envelope Materials

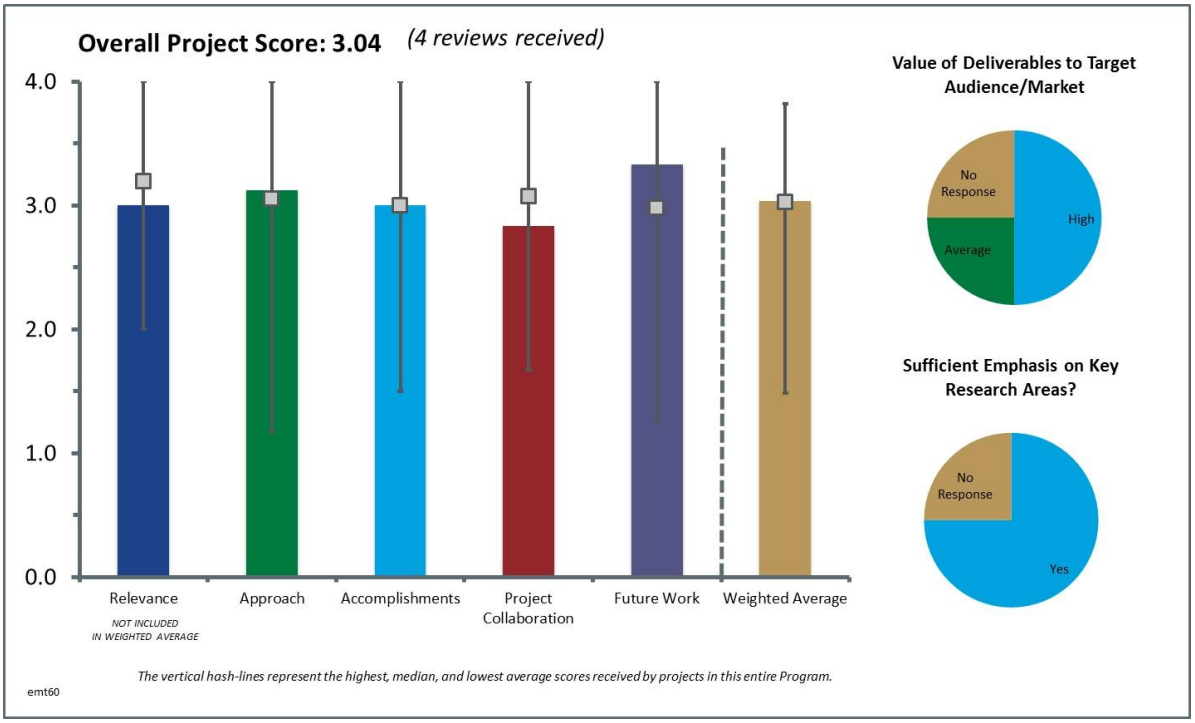
Presenter: Kaushik Biswas, Oak Ridge National Laboratory, biswask@ornl.gov
DOE Manager: Bahman Habibzadeh, 202-287-1657, bahman.habibzadeh@ee.doe.gov

Project Description

Vacuum insulation panels (VIPs) are the only insulation technology promising a step change in performance (R40 per inch) for both retrofit and new buildings. However, VIP manufacturing methods have not changed since the 1970s, and the production cost is more than \$0.25 per square foot (ft^2) per R. A new product, modified atmosphere insulation (MAI), eliminates most VIP production steps. MAI performs much like a VIP but is processed at ambient pressure at a cost of \$0.10–\$0.15 per ft^2 per R. MAI is already being produced for insulating packaging used for a transport medium; however, building insulation requires longer life, lower cost, higher performance, and robust design. This project is an initial scoping study that will demonstrate energy savings opportunities for MAI in building applications.

Summary of Review Comments

Most reviewers stated that the project addresses an important need—developing higher-insulating material at lower cost. However, one reviewer felt strongly that the risk-averse nature of users (architects and builders) limits the final product's market potential in the absence of evidence that the product would perform well in the long term and in actual buildings. Reviewers also noted that the project strategy does not address the need to fabricate irregular shapes. The project was commended for verifying thermal performance under variable temperature and panel pressure conditions. Reviewers felt that next steps, which involve various tests, are well defined and appropriate, and they stressed the importance of testing in new or retrofit construction. One reviewer wrote that durability assessments should be added to the work plan.



Project # ET-54: Dynamically Responsive Infrared Window Coatings

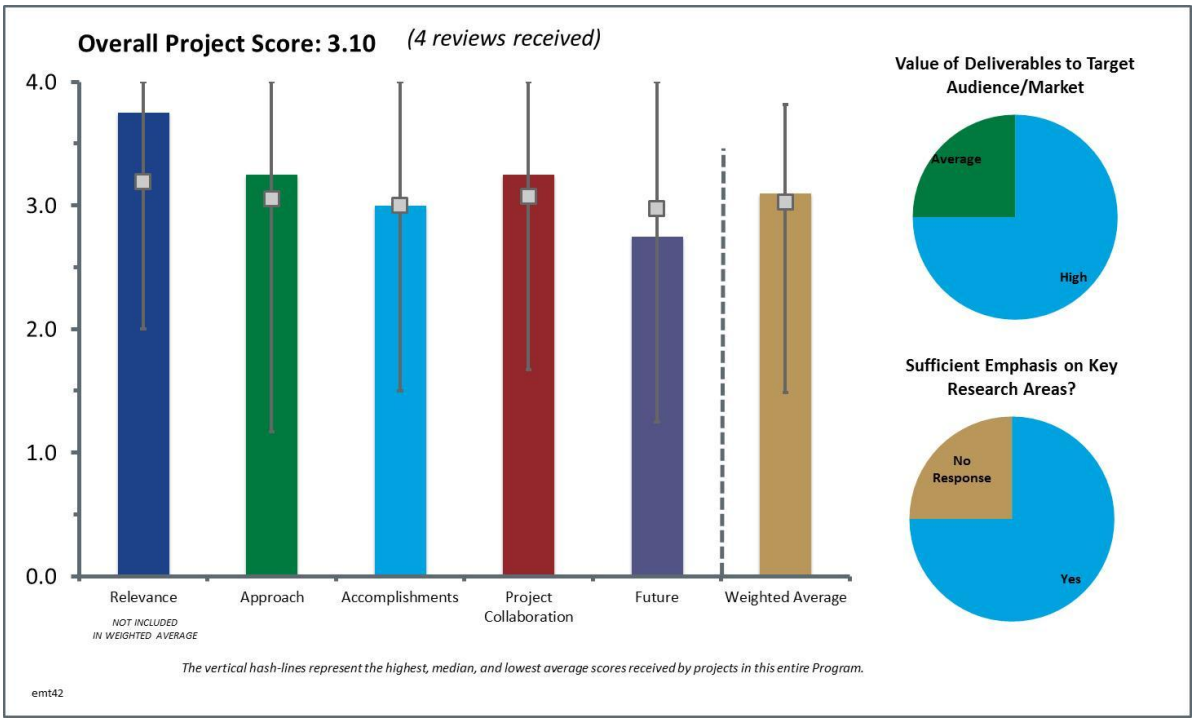
Presenter: Kyle Alvine, Pacific Northwest National Laboratory, kyle.alvine@pnnl.gov
DOE Manager: Bahman Habibzadeh, 202-287-1657, bahman.habibzadeh@ee.doe.gov

Project Description

This project is developing a low-cost, passively switchable dynamic infrared (IR) coating that integrates IR-reflective sub-wavelength nanostructures in a buckling layer. The reversible buckling effect switches from transmitting to reflecting in the IR only as the window coating temperature increases. Two prototype films will be created: (1) a laboratory-scale (1-inch) dynamic IR-responsive coating with a near-infrared (NIR) transmission delta of 20% and a visible transmission of greater than 50%, as well as a temperature-switching window in the 30°–90°C range; and (2) a bench-scale (6-inch) integrated buckling and sub-wavelength film with an average NIR transmission delta of 10%–15% (over 750–900 nanometers), an average visible transmission of at least 50%, and a temperature-switching window in the 30°–90°C range.

Summary of Review Comments

Overall, the reviewers commended the project's innovative approach to developing a novel, low-cost passive switching glazing. According to the reviewers, the project has made commendable progress despite being in the early stages and demonstrates significant potential for energy efficiency improvements. Reviewers also praised the project's collaborations and future plans. However, the reviewers expressed concern about the aesthetics of the film on the windows. They suggested conducting cost, aesthetic, and durability assessments of the end product.



Project # ET-55: Transactional Network

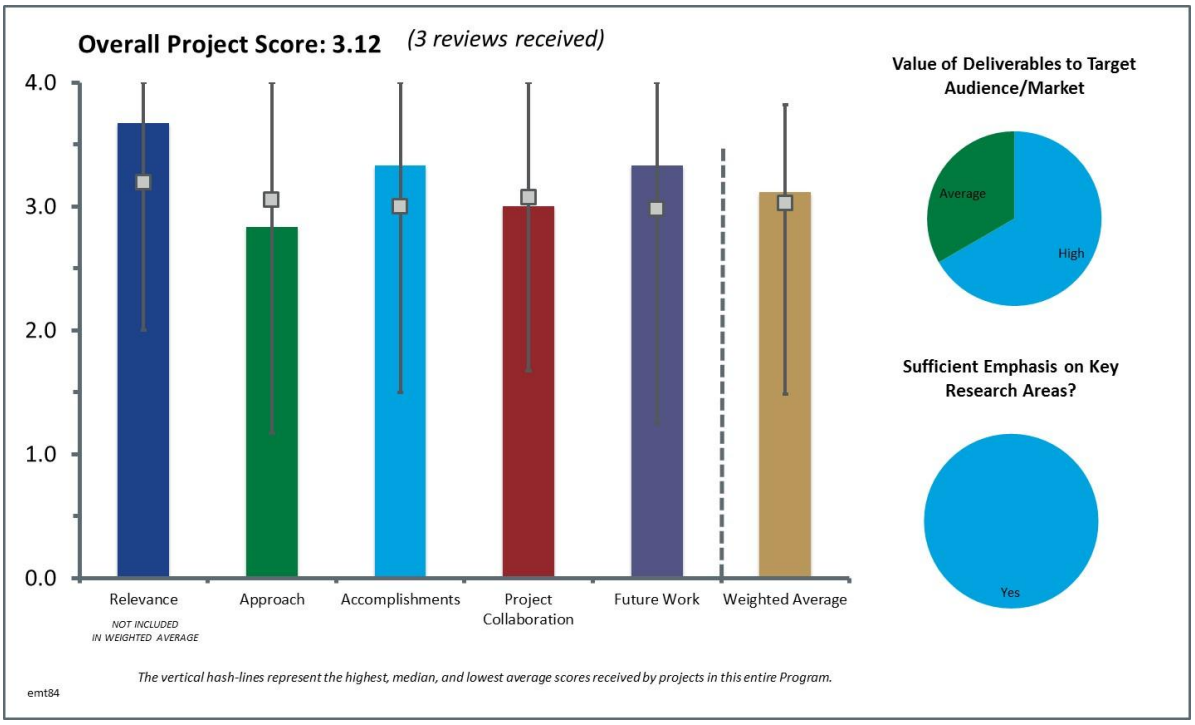
Presenter: Srinivas Katipamula, Pacific Northwest National Laboratory, Srinivas.Katipamula@pnnl.gov
DOE Manager: Joseph Hagerman, 202-586-4549, joseph.hagerman@ee.doe.gov

Project Description

This project is developing, demonstrating, and deploying an open-source, open-architecture transactional network platform. The transactional network enables interactions among networked systems, such as rooftop air conditioners, and the electric grid. These transactions occur either through automated diagnostics and advanced controls, which are embedded in the transactional platform, or through an application run in the cloud. In both cases, the software connects the building system to the grid while also providing continuous monitoring and energy management. This open-source platform enables building managers to make cost-effective energy-saving decisions for their building and the systems within it. The team first demonstrated the transactional concept with networked rooftop air conditioners and heat pumps, and it is now extending the concept to lighting and refrigeration systems.

Summary of Review Comments

Reviewers applauded the open-source, open-architecture transactional network platform as a software platform that will greatly improve energy utilization efficiency, but they also noted many opportunities for improvement. They observed that the project addresses real technological barriers and has achieved impressive results. The reviewers observed that the project has many early adopters and good collaboration; however, they also said that increased engagement with stakeholders and partners would greatly benefit the project. They felt that the project scope is too big and that the project goal needs greater clarity. One reviewer recommended that plans for future development be more explicit.



Project # ET-56: Low-Cost Wireless Sensors for Building Monitoring Applications

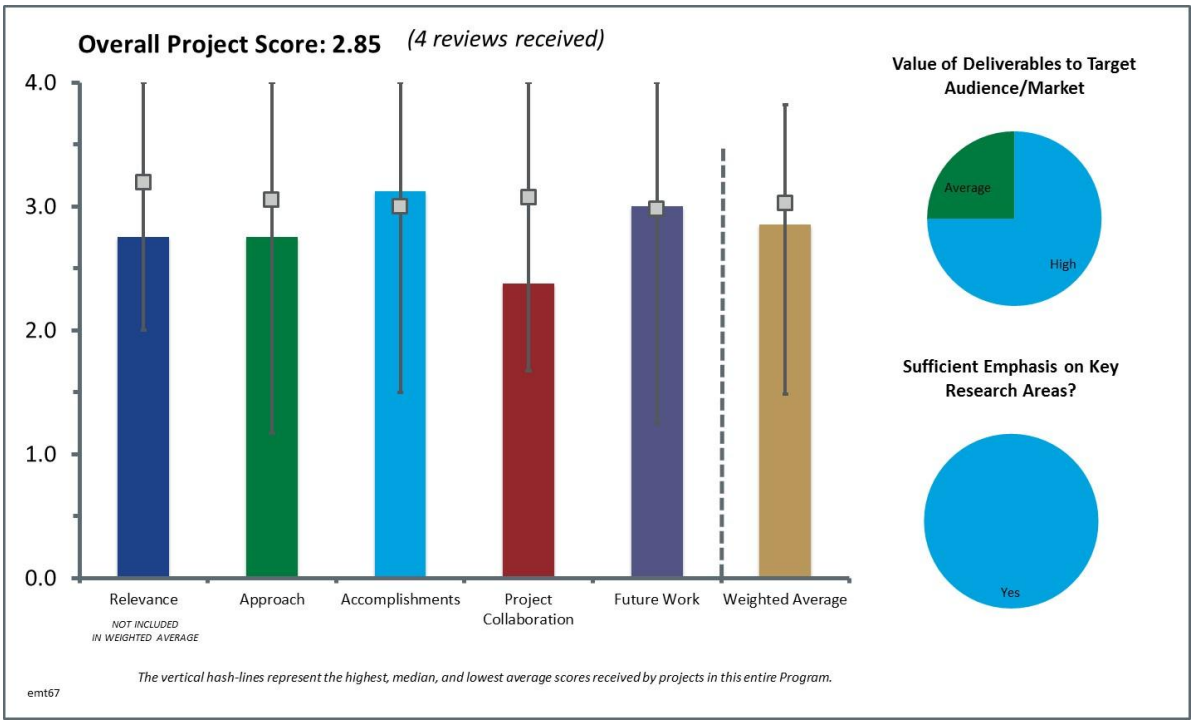
Presenter: Teja Kuruganti, Oak Ridge National Laboratory, kurugantipv@ornl.gov
DOE Manager: Joseph Hagerman, 202-586-4549, joseph.hagerman@ee.doe.gov

Project Description

Sensors and controls have the demonstrated potential to reduce building energy consumption by 20%–30%. However, these savings can be realized only when the retrofit solutions have a payback of 1–2 years. Current commercially available wireless sensors, which can cost $150–$300 per node, do not reach that target, which is critical to market adoption. This project aims to drive down the cost of sensors by improving the technology—specifically, through the use of advanced manufacturing techniques, including printable electronics and additive roll-to-roll manufacturing techniques. These techniques have the potential to generate fully printable wireless sensors with costs around $1–$3 per node. Oak Ridge National Laboratory is talking with potential industrial partners about how to incorporate low-cost sensors into their business strategy.

Summary of Review Comments

The project generally received high marks, but the reviewers were unsure whether development of low-cost sensors will lead to real energy savings in buildings. The reviewers were impressed with the employment of advanced techniques and the progress made. However, the reviewers felt that this is not a novel idea and that similar technologies exist that perform the same function. The reviewers recommended focusing more on laboratory and field testing, and they suggested increasing the collaborations with industry stakeholders.



Project # ET-57: OpenEIS

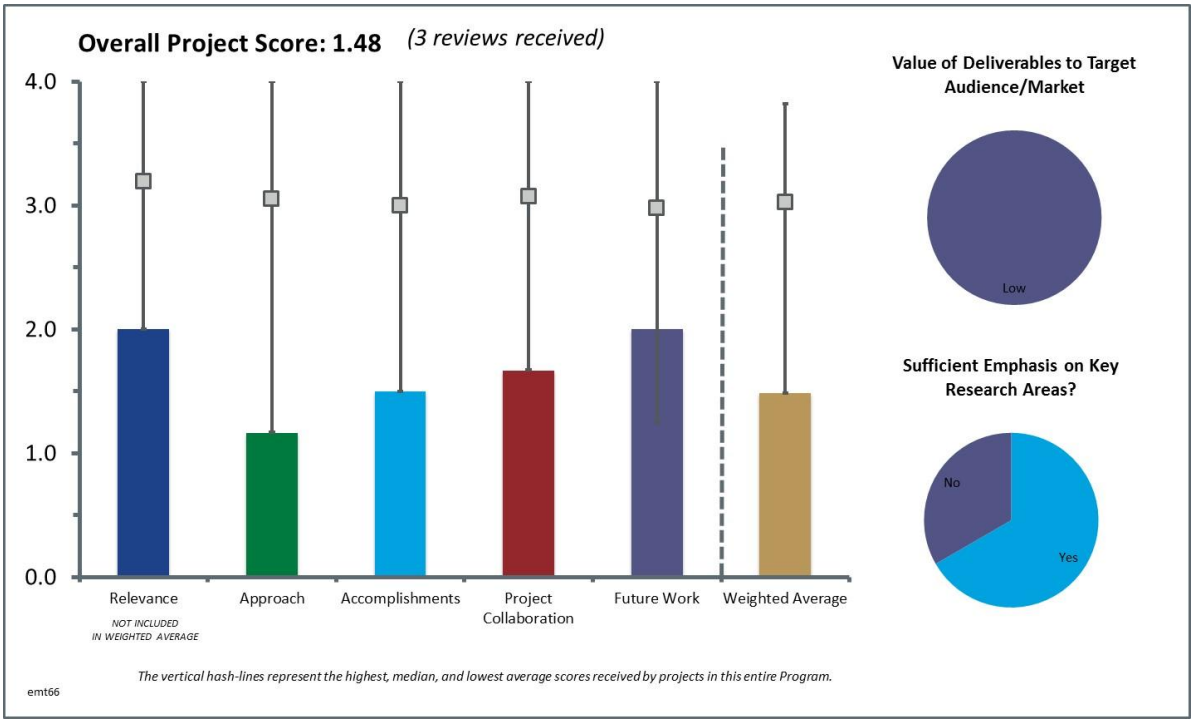
Presenter: Jessica Granderson, Lawrence Berkeley National Laboratory, JGranderson@lbl.gov
DOE Manager: Joseph Hagerman, 202-586-4549, joseph.hagerman@ee.doe.gov

Project Description

Building managers can increase whole-building energy efficiency by up to 20% through continuous monitoring and analysis. However, most building managers do not have cost-effective access to commercial tools, algorithms, or diagnostic methods. In response, the U.S. Department of Energy is developing an open-source data analysis and diagnostics platform that provides standard methods for authoring, sharing, testing, using, and improving algorithms for operational building energy efficiency. The open energy information system (OpenEIS) strategy is aimed at getting the market to validate and implement state-of-the-art analytical and diagnostic algorithms, thereby creating market demand for control system manufacturers and integrators serving small- and medium-sized commercial customers. Industry will not take on such an effort; it is investing in proprietary solutions.

Summary of Review Comments

Reviewers did not believe the project supports Building Technologies Office goals and objectives, stating there is no evidence the project solution would save energy or increase the adoption of building analytics. One reviewer stated that the project is well executed (if not well conceived) and had made good progress within its stated scope, while others stated that work and budget to date indicate poor progress and that critical barriers are not clearly identified. One reviewer felt the algorithms provided by the system are far too basic, providing only data rather than analytics. Also noted was a lack of input from or collaboration with the target audience: building managers. One reviewer suggested that the software base under development could be quite valuable if the project team would reconsider its purpose.



Project # ET-58: Building Energy Management Open Source Software Development (BEMOSS)

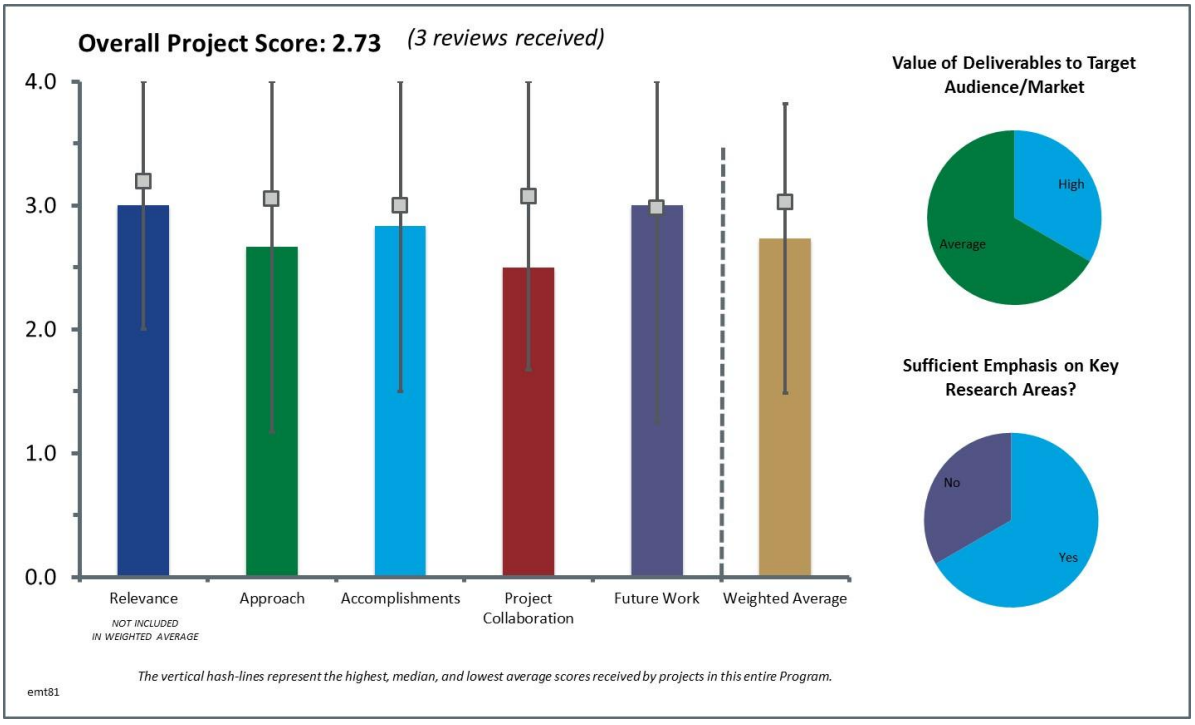
Presenter: Saifur Rahman, Virginia Tech Advanced Research Institute, srahman@vt.edu
DOE Manager: Joseph Hagerman, 202-586-4549, joseph.hagerman@ee.doe.gov

Project Description

Virginia Tech's Advanced Research Institute is developing a Web-based Building Energy Management Open Source Software (BEMOSS) platform for optimizing electricity usage in small- and medium-sized buildings. BEMOSS allows building owners to monitor in real time (and from a remote location) their buildings' energy consumption and the status of their devices. The software's real-time cost-saving calculation algorithms perform system tracking and provide possible performance enhancements, with different grades of comfort and savings. The BEMOSS platform improves building energy efficiency and also helps implement demand response. This opens up demand-side ancillary service markets and creates opportunities for building owners, which in turn can help accelerate development of market-ready products such as embedded building energy management systems and communication device controllers for heating, ventilation, and air conditioning; lighting; and plug loads.

Summary of Review Comments

Reviewers generally agreed that the project has interesting features and the potential to affect a significant market (small commercial buildings). They noted that, although in its early stages, the project has made good progress, having already produced a laboratory demonstration. Reviewers stated that the project team has identified several barriers but not any solutions. One reviewer felt that solving the scalability issue is critical; another noted that the path forward is not yet clear because there is no plan for marketing or deployment.



Project # ET-59: An Extensible Sensing and Control Platform for Building Energy Management

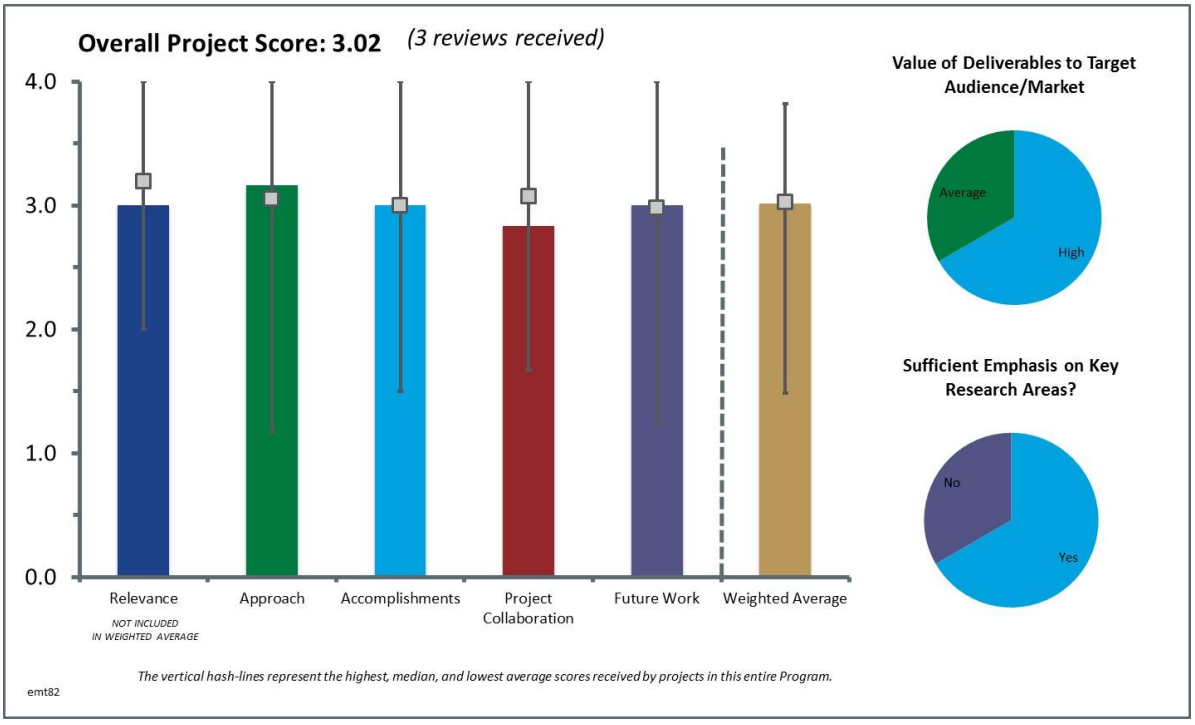
Presenter: Anthony Rowe, Carnegie Mellon University, agr@ece.cmu.edu
DOE Manager: Joseph Hagerman, 202-586-4549, joseph.hagerman@ee.doe.gov

Project Description

This software platform's comprehensive real-time command and control of indoor environments has the potential to revolutionize the way buildings are managed. The software addresses the needs of a building's most important stakeholders: (1) professional facility managers, who ensure the building performs as required, and (2) the occupants, who rely on the building for safety, security, and comfort. The objective of the project is to develop, deploy, test, and refine an open-source and open-architecture software platform for scalable, secure building management applications. By enabling easier access to existing building automation systems (BASs) and introducing controls where there are none, the software creates more opportunities for energy efficiency. The platform will be specifically tailored toward small- and medium-sized buildings.

Summary of Review Comments

Reviewers agreed that the project goal of addressing energy efficiency in small commercial buildings is important and relevant to the Building Technologies Office mission. One reviewer specified that the software product would more likely seed new products in the building energy management market than become the product of choice, suggesting that future plans be modified to accommodate this expectation (e.g., identify and address key barriers for relevant stakeholders to take similar products to market). The project is in its early stages but, according to reviewers, already showing good achievements, such as a lightweight meta-data model for BASs.



Project # ET-60: Software-Defined Solutions for Managing Energy Use in Small Commercial Buildings

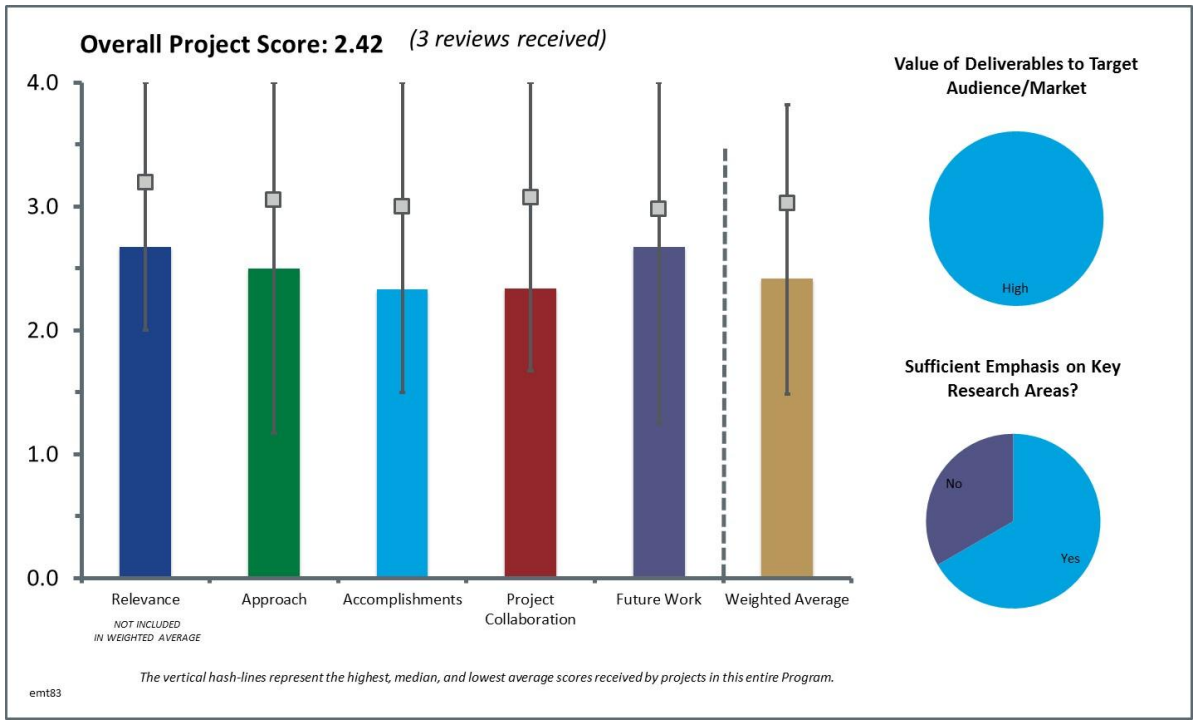
Presenter: Therese Peffer, California Institute for Energy & Environment, UC Berkeley, therese.peffer@uc-ciee.org
DOE Manager: Joseph Hagerman, 202-586-4549, joseph.hagerman@ee.doe.gov

Project Description

This project is developing an open-architecture, open-source building automation system (BAS) for small commercial buildings. The software uses the Building Operating System Services (BOSS) platform, which allows it to adapt to the size of the network (i.e., it adapts to the number of sensors or other nodes within the building). The prototype includes a plug-and-play thermostat, lighting and general controllers, a user interface with display, system setup, and auto-mapping. Third parties can easily create new applications, such as control algorithms, diagnostics, and visualization, or add new devices, such as occupancy sensors and actuators/monitors for specific loads. Small commercial buildings account for 42% of the floor area of U.S. commercial buildings, yet most do not currently benefit from BASs.

Summary of Review Comments

Reviewers liked this project's efforts to increase the automation and control of buildings but noted that its potential impact is unclear. They observed that the potential market for this technology is substantial and applauded the use of existing software (sMAP). Some reviewers questioned whether the platform will be accepted in the market, noting that vendors have been reluctant to adopt new platforms. Reviewers also stated that the proposed concept is not novel. They recommended that the future plans include more concrete steps to involve vendors and perform more demonstrations in real buildings.



Project # ET-61: CBERD: Controls and Communications Integration

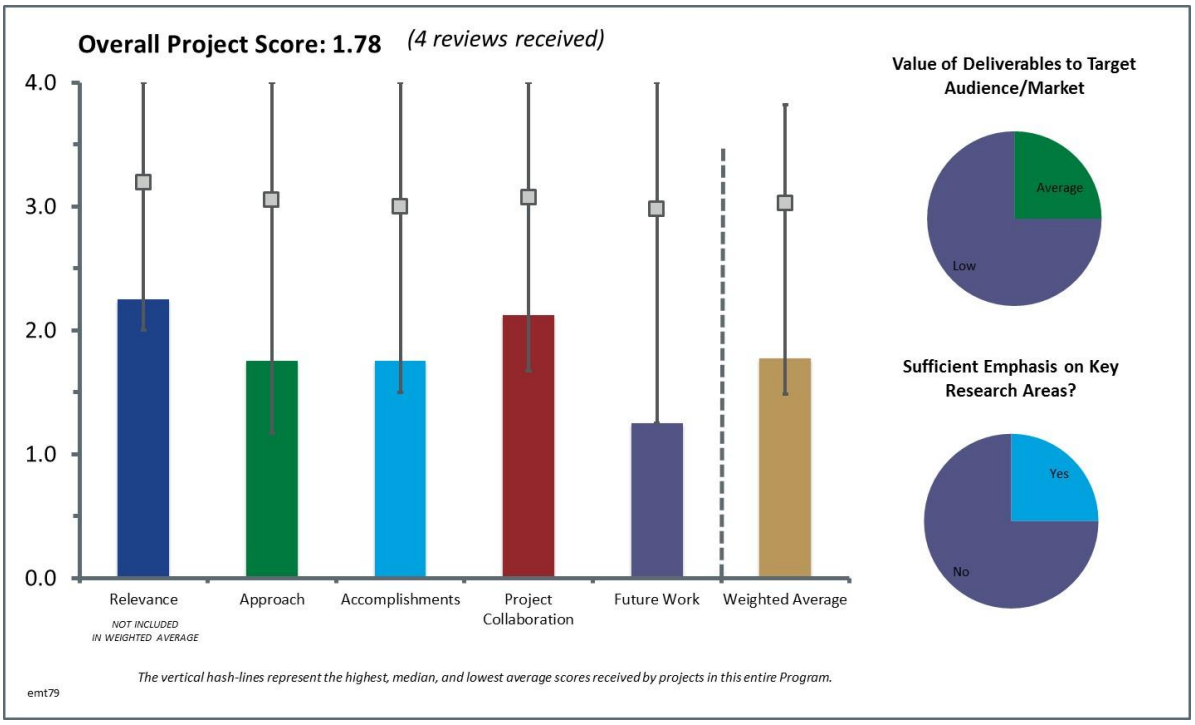
Presenter: Rich Brown, Lawrence Berkeley National Laboratory, rebrown@lbl.gov
DOE Manager: Karma Sawyer, 202-287-1713, karma.sawyer@hq.doe.gov

Project Description

The U.S.-India Joint Center for Building Energy Research and Development (CBERD) conducts energy efficiency research and development with a focus on integrating information technology with building controls and physical systems for commercial/high-rise residential units. This CBERD project aims to tackle the issue of building systems not interacting with each other. When the systems within a building do not interact, it is impossible to optimize the whole building's energy performance. Lawrence Berkeley National Laboratory is working directly with industry to solve this problem by integrating open-source tools with next-generation building systems. The project team will demonstrate proof of concept of a unified heating, ventilation, and air conditioning; lighting; and plug-load control interface. The platform, which is open-source and easy to use, will also integrate advanced plug-load management capabilities.

Summary of Review Comments

Reviewers found the progress to date to be unimpressive and short of the stated project goals and tasks. They characterized the project as a good international collaboration opportunity; however, they considered the laboratory demonstration and plug-load identification techniques to be less advanced than other ongoing research. They noted that the project has not presented major progress toward a demonstration of whole-building optimization, toward plug-and-play integration of different systems, or toward new plug-load management techniques. Reviewers observed that it is unclear how much India and the United States can leverage the technology together, noting that the two nations are quite different in terms of building system and climate types. Reviewers recommended that the project team consider engaging building design and facilities management professionals in the development and testing work in real buildings. One reviewer recommended that the Building Technologies Office require the contractors to define more rigid milestones to which they can be held accountable.



Project # ET-62: CBERD: Grid-Responsive Buildings

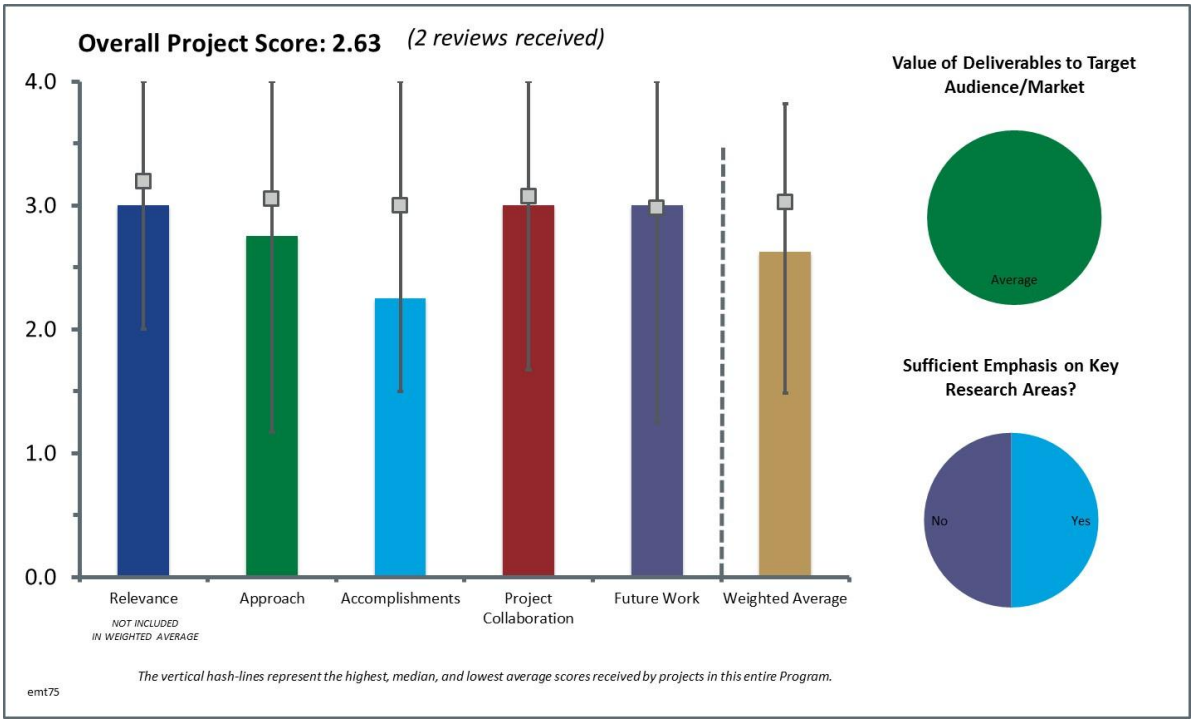
Presenter: Girish Ghatikar, Lawrence Berkeley National Laboratory, GGhatikar@lbl.gov
DOE Manager: Karma Sawyer, 202-287-1713, karma.sawyer@hq.doe.gov

Project Description

The U.S.-India Joint Center for Building Energy Research and Development (CBERD) conducts energy efficiency research and development with a focus on integrating information technology with building controls and physical systems for commercial/high-rise residential units. This CBERD project is developing a framework to integrate building technologies with the smart grid through collaborative knowledge and industry partnerships. The near-term goal is to identify the appropriate building sectors and end uses for technology intervention through a survey of Indian buildings. Following that, the project team, consisting of public and private entities from both countries, will create a roadmap to accelerate grid-responsive buildings through pilot studies in India. The long-term goal is to evaluate prototypes and scale up grid responsive/transactive technologies.

Summary of Review Comments

Reviewers praised the project's main goal of developing a framework to easily integrate building technologies into smart grid environments. They also noted its potential to develop more cost-effective technology. Reviewers observed that the project is in its beginning stages and therefore has limited accomplishments, but they acknowledged its progress in terms of publications and presentations. They also commended the project for including a good mix of partners from the United States and India; however, one reviewer suggested clarifying and highlighting how the project benefits the United States. Reviewers stated that the project cannot meet its proposed goals at current funding levels. Reviewers recommended that the project team focus on fewer activities, define specific measurable results, conduct additional analysis of the surveyed data, and be prepared to conduct a demonstration project should funding become available.



Project # ET-63: CERC: Microgrid Equipment Selection and Control

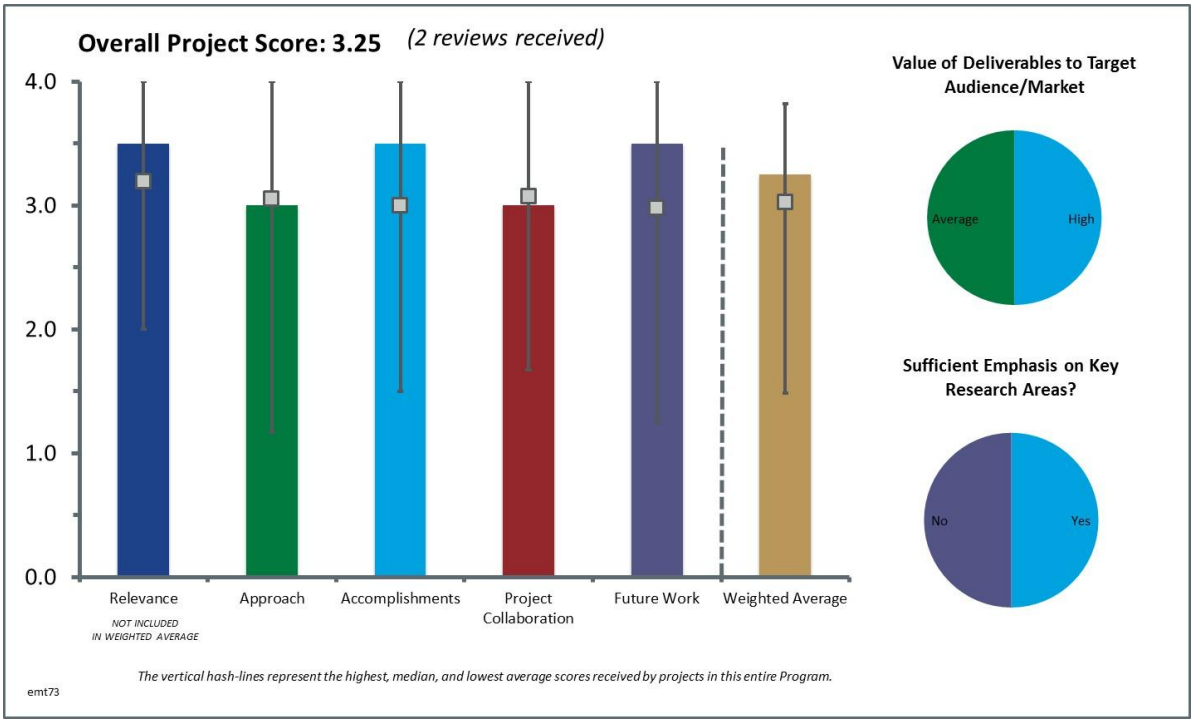
Presenter: Wei Feng, Lawrence Berkeley National Laboratory, weifeng@lbl.gov
DOE Manager: Karma Sawyer, 202-287-1713, karma.sawyer@hq.doe.gov

Project Description

The U.S.-China Clean Energy Research Center (CERC) is a pioneering research and development (R&D) consortium bringing together governments, key policymakers, researchers, and industry to develop a long-term platform for sustainable U.S.-China joint R&D. Ultra-efficient buildings and microgrids require complex optimization both for operations and when choosing equipment. This CERC project is developing software that optimizes distributed energy resource (DER) technology selection and operation. The three tools each have a separate purpose: the first finds optimal on-site generation, storage, and control equipment combinations that minimize cost and carbon footprint; the second is a 1–7 day ahead optimal control strategy generator; and the third analyzes multiple buildings to build bottom-up estimates of market trends. DER technologies could reduce carbon in Chinese commercial buildings by 40%.

Summary of Review Comments

Reviewers applauded this project's development of the Distributed Energy Resources Customer Adoption Model software and the case studies in China and the United States. Reviewers also liked that the project includes a good mix of partners in the United States and China. Identified weaknesses include the lack of detailed data about the case studies and their specifications, and that the project outcomes so far have been limited to one demonstration project. Reviewers recommended placing more emphasis on collaborating with industry, providing more explanation of the tool's value and how it is applied in the case studies, reporting specific and complete information and results, and integrating the optimization tool with a whole-building simulation analysis tool such as EnergyPlus.



Project # ET-64: FLEXLAB

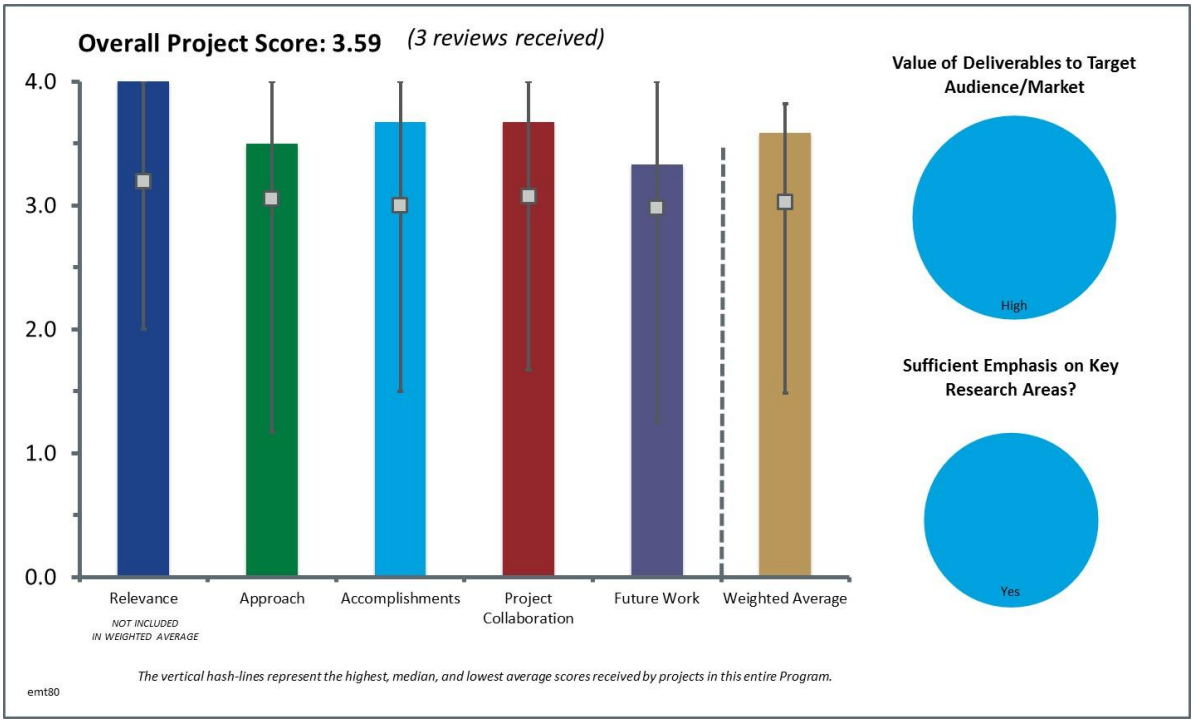
Presenter: Cindy Regnier, Lawrence Berkeley National Laboratory, CMRegnier@lbl.gov
DOE Manager: Robert Aasen, 202-586-9192, robert.aasen@ee.doe.gov

Project Description

FLEXLAB, the Facility for Low Energy Experiment in Buildings, represents a game-changing opportunity to support the development and validation of aggressive, low-energy-saving, integrated technologies and systems. The FLEXLAB test facility offers a fully reconfigurable "plug-and-play" space for both government and industry to develop and test these integrated solutions, focusing on technologies that achieve 50% whole-building energy savings cost effectively. The central goal is to develop or demonstrate 25 technologies, systems, or control strategies within 5 years. Many of these technologies will come from FLEXLAB's industry partnership program, which, besides offering a testing facility for industry stakeholders, also allows them to voice research and development (R&D) needs, identify barriers to market uptake, and inform R&D projects.

Summary of Review Comments

Reviewers viewed the project as very valuable to the building industry because it creates a major test bed for evaluating energy technologies in a real-world environment, and they rated its relevance to Building Technologies Office goals very highly. They lauded the project's accomplishments, especially the construction of laboratory test beds and involving collaborators in laboratory design. Reviewers were divided on whether the laboratory is unique or similar to existing facilities. They noted that the level of interest from building stakeholders is unclear. According to reviewers, the project's weaknesses include the lack of a business plan and a vision for how the laboratory can sustain itself, and the fact that the laboratory cannot be transported and used to test whole-building performance in other U.S. climate zones.



Project # ET-65: Miniaturized Air-to-Refrigerant Heat Exchangers

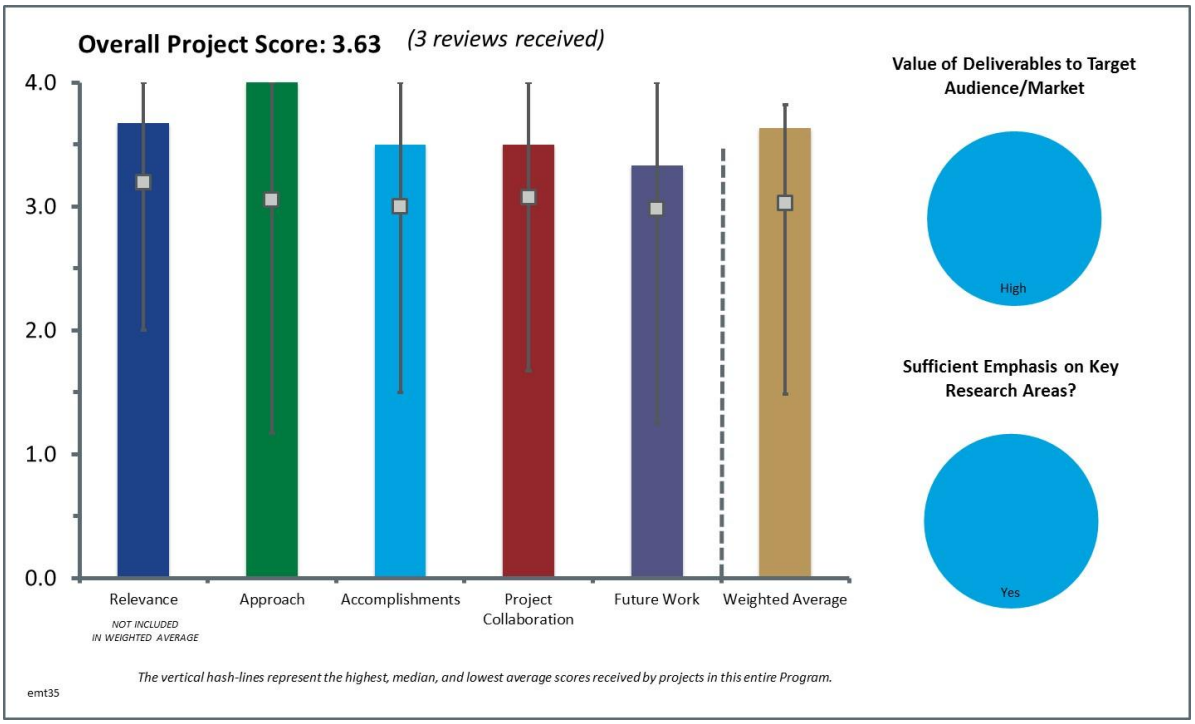
Presenter: Reinhard Radermacher, University of Maryland, raderm@umd.edu
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

This project is developing a miniaturized air-to-refrigerant heat exchanger (HX) that is more compact and more energy efficient than current market designs. This HX design will feature at least 20% less volume, material volume, and approach temperature compared to current multiport flat tube designs, and with the poential to be in production within 5 years. Heat exchangers, can act as evaporators or condensers in commercial and residential air conditioning or heat pump systems with various capacity scales. Prototype 1-kilowatt (kW) and 10 kW designs will be tested and then improved as necessary for final tests and demonstration in a 3-ton heat pump.

Summary of Review Comments

Reviewers lauded the project's efforts to make HXs smaller and more energy efficient, noting that the project is very relevant to U.S. Department of Energy energy efficiency goals. They commented that nearly all energy technologies have HXs, including heating and cooling equipment, and that improving HXs can result in energy efficiency gains in these technologies. Reviewers commended the project's progress on HX modeling, use of HX modeling to evaluate improvements that result from HX miniaturization, efforts in designing and fabricating the test bed, and high-quality collaborations. According to reviewers, the researcher's expertise on HXs is an important strength of this project. One reviewer noted that the research appears to be driven by the hypothesis that HXs will be made more energy efficient by designing smaller and lighter packages, and that while this is plausible, it would be useful for the project team to identify more specific objectives for applications.



Project # ET-66: Low-Cost Gas Heat Pump For Building Space Heating

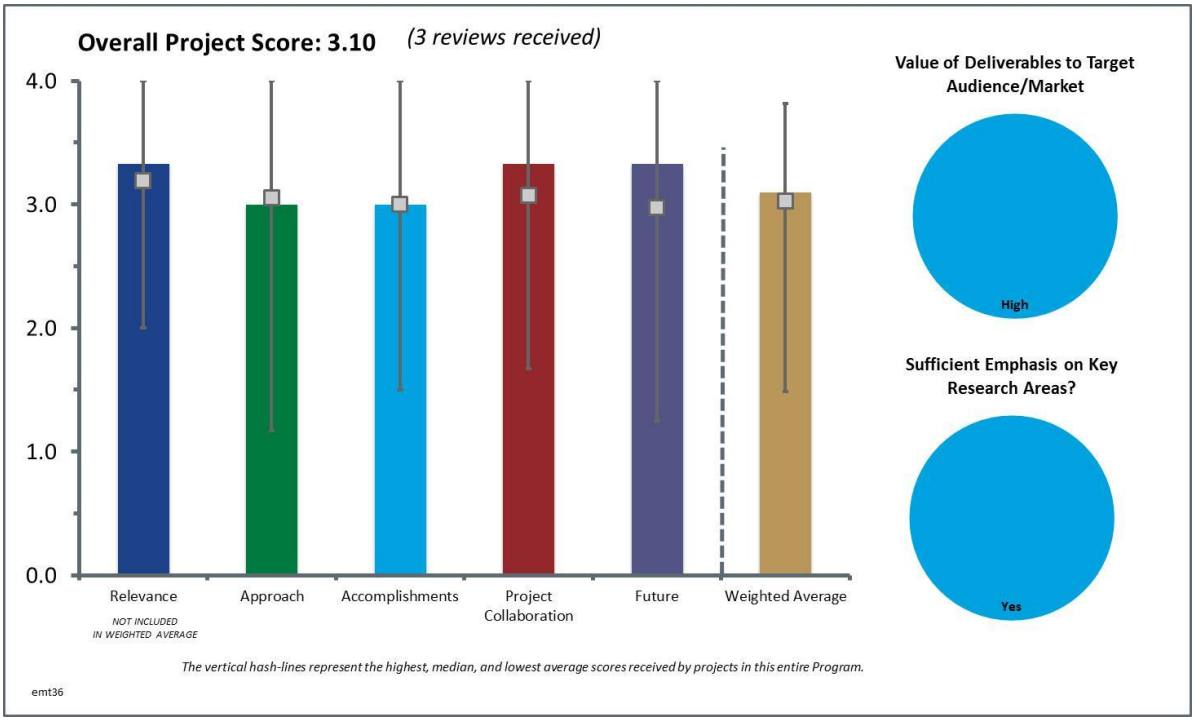
Presenter: Michael Garrabrant, Stone Mountain Technologies, mgarrabrant@stonemtntechnologies.com
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

Stone Mountain Technologies is building and testing a packaged heat pump prototype with a nominal capacity of 80,000 Btu/hour for cold climate applications. Ideal for northern, heating-dominated climates, the heat pump will offer a simple payback, without incentives, of 3–5 years. This technology reduces heating costs by 30%–45% compared to conventional gas furnaces and boilers. The heat pump reaches a coefficient of performance (COP) of 1.4 at 47°F and 1.2 at -13°F using a simple, single-effect ammonia-water absorption cycle. The prototype will be tested over a range of ambient temperatures to verify its efficiency and manufacturing cost.

Summary of Review Comments

Reviewers noted that the project could be quite valuable if it achieves its goals, but they had mixed views on whether it will do so. Reviewers commended the project's focus on critical barriers, strong relationships with industry partners, and energy savings and carbon dioxide reduction potential. Some reviewers noted that it is not a given that a smaller-sized, heat-driven system can be economical, stating that most real-world applications utilize much larger systems. One reviewer commented that researchers should focus on the economics of the final system relative to its efficiency, noting that this will determine whether the market accepts this technology.



Project # ET-67: Building Integrated Heat and Moisture Exchange

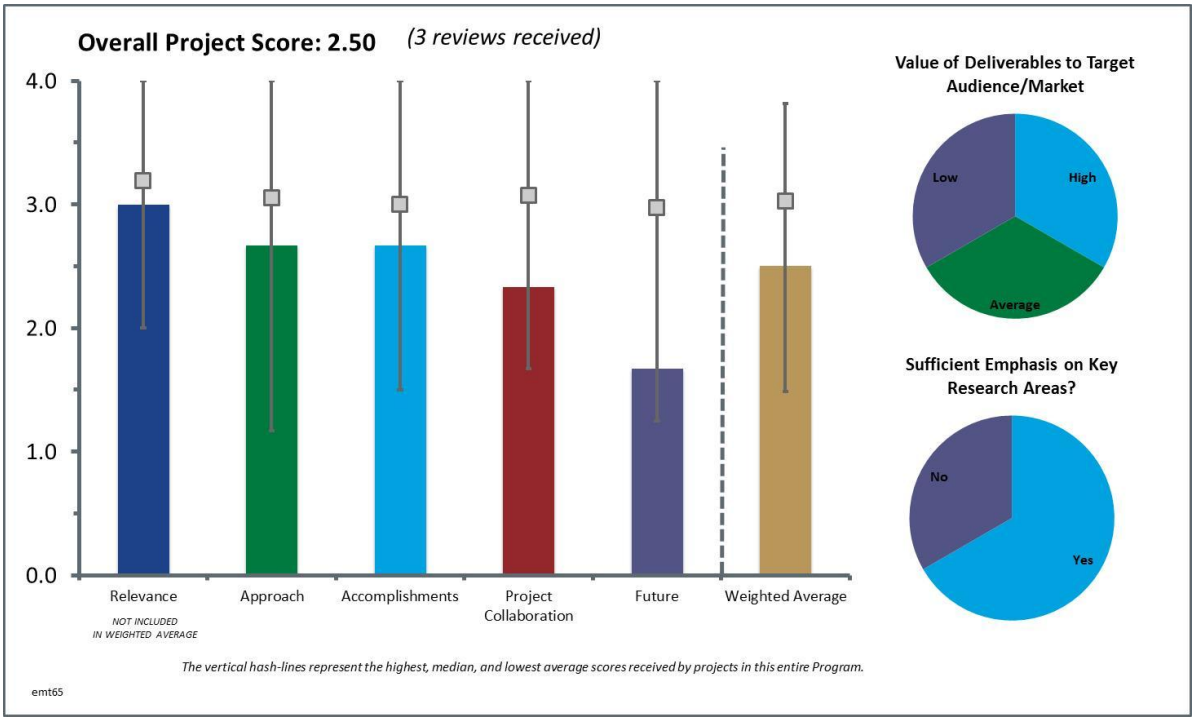
Presenter: John Breshears, Architectural Applications, Inc., jebreshears@comcast.net
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

This project combines two building system functions—ventilation and insulation—into a unified technology. The goal is to achieve lower energy use at better cost and at increasing scale. Current energy recovery ventilators offer low humidity exchange with high attendant pressure, resulting in low market penetration and limited impact. By integrating the two components—heat and moisture exchange—this technology could produce a better return on investment and reap nearly 3 quads of U.S. energy savings annually. The project team is conducting pilot installations and validated testing at various scales. The target market for AirFlow™ panels includes developers, owners, and operators of commercial and multifamily residential buildings.

Summary of Review Comments

Reviewers praised the project for exploring a more passive ventilation technology; however, the project's accomplishments received mixed reviews. Some reviewers noted that the milestones are 2–5 months behind schedule and that work has not been done to address practical applications. Reviewers noted that risks related to the environment have not been addressed, and that the project's future plans are not clearly articulated. Reviewers recommended that the project team perform real-world tests and evaluate the potential for market acceptance.



Project # ET-68: CO_2 Heat Pump Water Heater

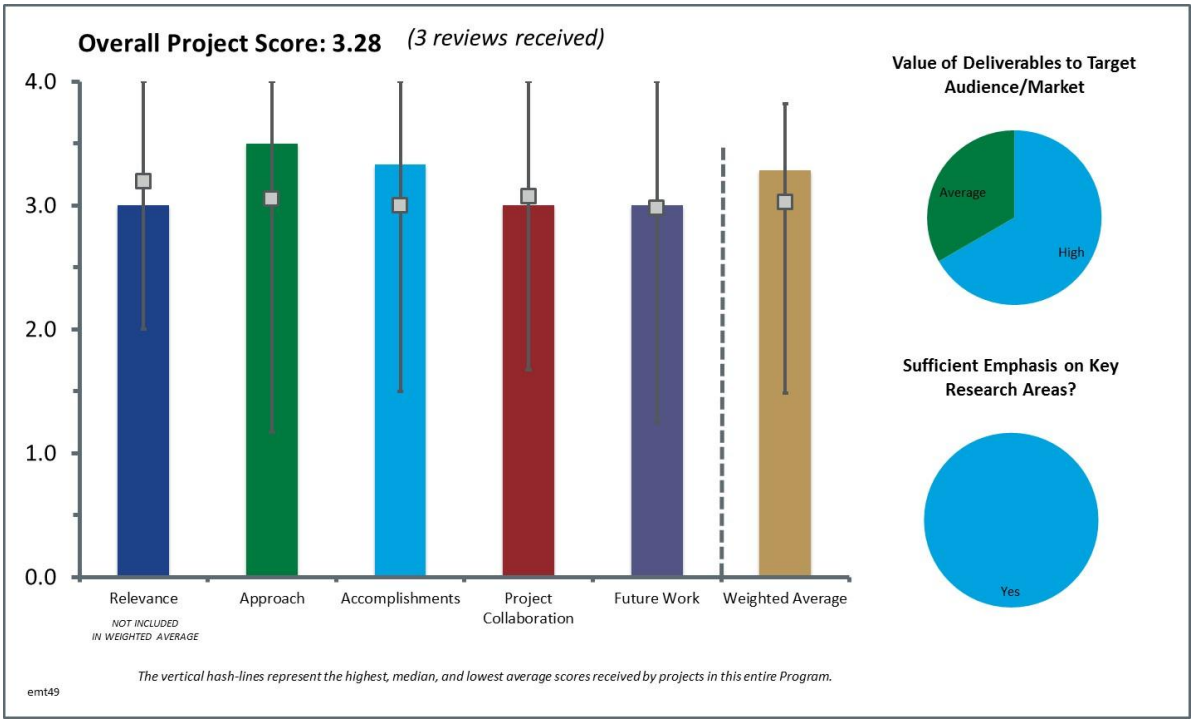
Presenter: Kyle Gluesenkamp, Oak Ridge National Laboratory, gluesenkampk@ornl.gov
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

This project is developing a carbon dioxide (CO_2) heat pump water heater (HPWH) that meets ENERGY STAR® standards for HPWHs at an installed cost that will enable widespread acceptance in the U.S. residential market. CO_2 has low global warming potential when compared to other refrigerants, has zero ozone depletion potential, is very inexpensive, and is not flammable. With full deployment, cost-effective CO_2 HPWHs could reduce energy use by 0.8 quads a year; currently, electric water heaters use 1.38 quads annually. Because of the higher temperatures in the transcritical CO_2 cycle (compared to subcritical cycles of other refrigerants), CO_2 also has greater potential for use in residential/commercial demand response units, as well as for high-temperature commercial water heating applications.

Summary of Review Comments

Reviewers commended the project for its efforts to reduce the cost of HPWH technologies and noted that it could have a significant impact if technical and economic goals are met. Most reviewers felt that the project is relevant to Building Technologies Office (BTO) objectives. One reviewer questioned why BTO is supporting research to build an HPWH that is less efficient than what is already on the market in other countries; however, that reviewer and others noted the high cost of those products. Reviewers praised the project's progress toward developing the tank-heat pump design tool and the design and fabrication of a wrap-around gas cooler based on computational fluid design, but one reviewer questioned whether a disproportionate amount of effort has gone toward work on the wrap-around heating coil. One reviewer recommended pursuing dissemination activities that account for all stakeholders to potentially increase market impact.



Project # ET-69: Thermodynamic Evaluation of Low Global Warming Potential Refrigerants

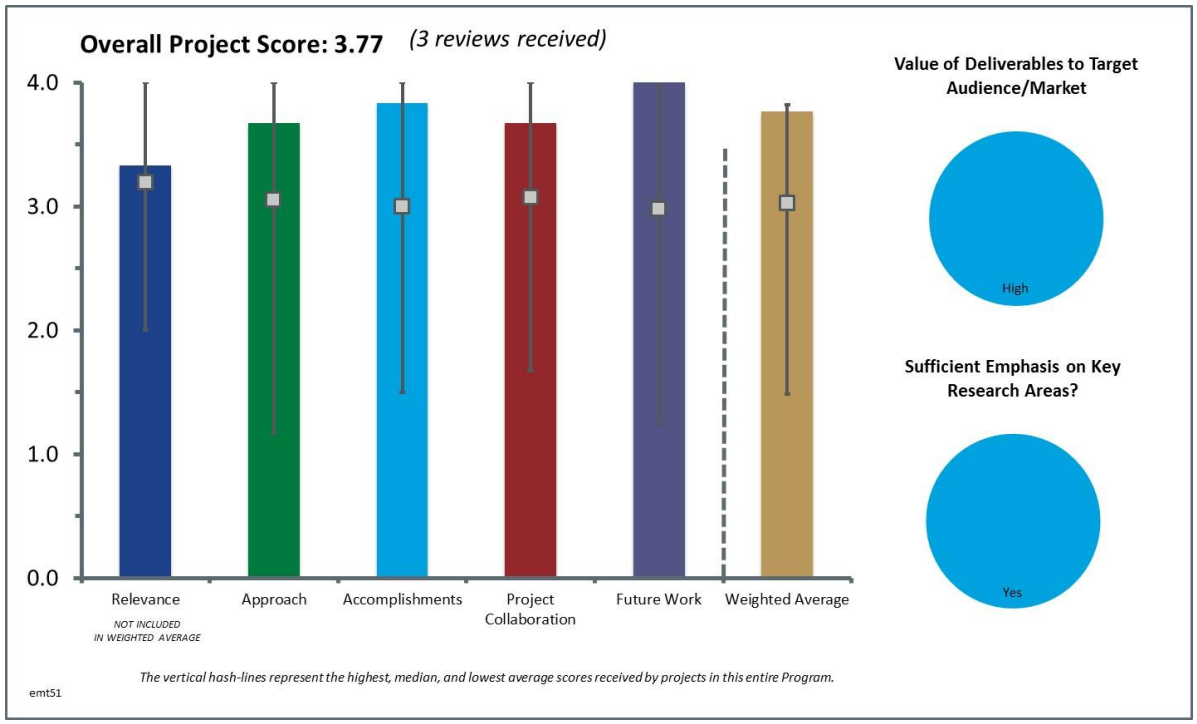
Presenter: Piotr Domanski, National Institute of Standards and Technology, piotr.domanski@nist.gov
DOE Manager: Tony Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

This project evaluates alternative refrigerants with low global warming potential (GWP) to identify the best candidate fluids and the trade-offs among them. This will provide the heating, ventilation, air conditioning, and refrigeration industries and policymakers with definitive information regarding the available refrigerant options and trade-offs. The project will attempt to identify and characterize one or more new refrigerants that have a low GWP along with thermophysical properties that yield high energy efficiency in refrigeration equipment. However, even if such a refrigerant is not identified, the industries' options will be defined conclusively. These options will impact the goal of achieving high energy efficiency in buildings.

Summary of Review Comments

Reviewers applauded the project for developing a thorough screening methodology that is flexible enough to be used with an updated input database, as well as for its goal to contribute to the phase-out of low GWP refrigerants. Reviewers commended the project for its relevance to Building Technologies Office objectives, developing a systematic screening method and evaluation tools to screen the large number of candidate molecules, its choice of collaborators, and its future work. Reviewers' recommendations include emphasizing the screening methodology in the final report instead of the top 20 candidate molecules it identified (because input data may change over time), and considering statistical parameter identification methods in screening tool development.



Project # ET-70: CERC: Advanced Ground Source Heat Pump Technology for Very-Low-Energy Buildings

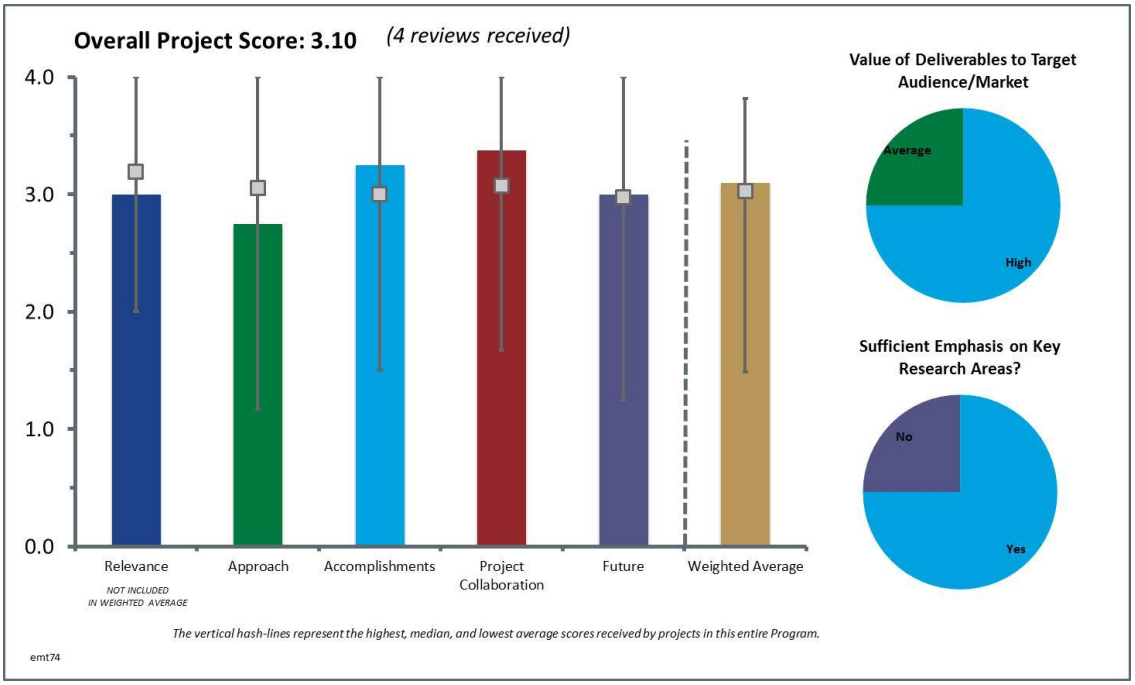
Presenter: Xiaobing Liu, Oak Ridge National Laboratory, liux2@ornl.gov
DOE Manager: Karma Sawyer, 202-287-1713, karma.sawyer@hq.doe.gov

Project Description

The U.S.-China Clean Energy Research Center (CERC) is a pioneering research and development (R&D) consortium bringing together governments, key policymakers, researchers, and industry to develop a long-term platform for sustainable U.S.-China joint R&D. This ongoing CERC project accelerates ground source heat pump (GSHP) deployment by developing and identifying new technologies that reduce cost and/or improve performance. A central goal of this project is the exchange of best practices between the two countries, which can lead to improved controls and lower costs for GSHP equipment. The project team is developing a smart control for the hot water tank that optimizes the tank's water temperature schedule after learning the user's pattern of hot water usage. These controls can increase water heating efficiency by 10%.

Summary of Review Comments

Reviewers praised the project for promoting collaboration and technology transfer between China and the United States on the topic of GSHPs. They also noted that the data obtained for GSHP systems installed in both countries will promote more widespread application of the systems. Reviewers also stated that the project goals are clearly identified, and that good progress has been made to achieve the goals. Specific weaknesses cited include the project's broad scope, the lack of creativity in terms of making the water side of the systems more cost effective, and a lack of detail in the presentation. Reviewers' recommendations include stronger oversight to ensure the project is meeting Building Technologies Office goals, a focus on specific measures to advance GSHP technology, and a consideration of cost factors in the comparative analysis.



Project # ET-71: CBERD: Advanced Heating, Ventilation, and Air Conditioning

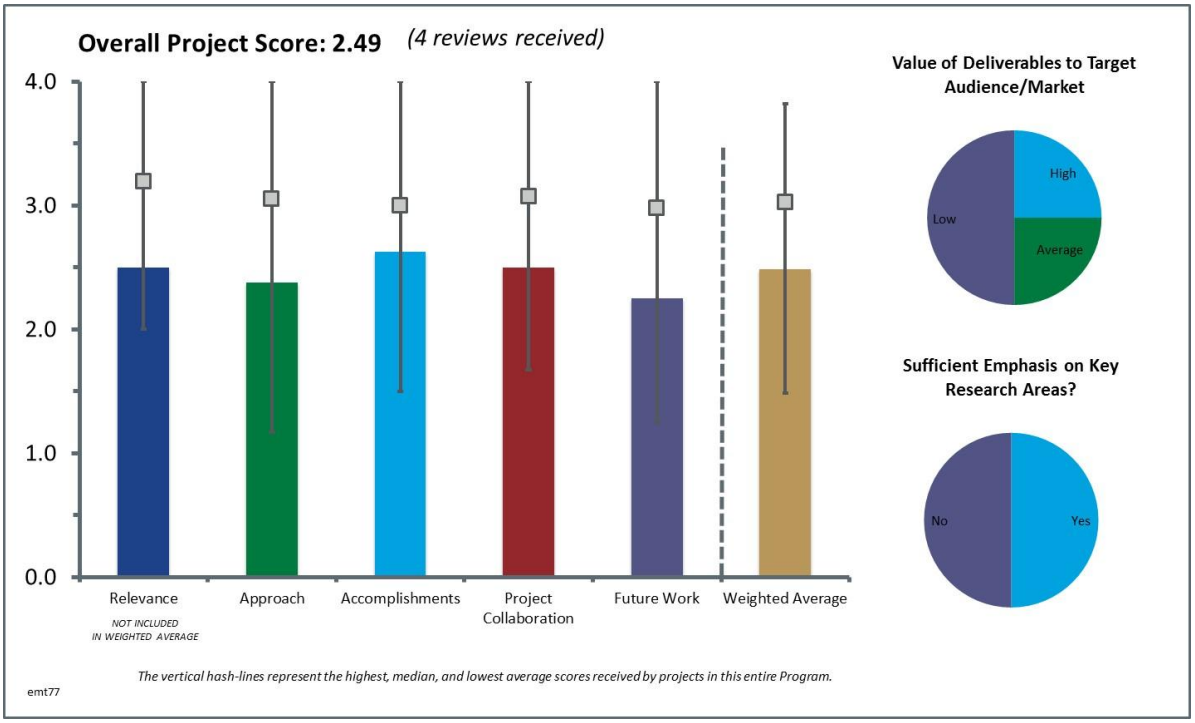
Presenter: Mahabir Bhandari, Oak Ridge National Laboratory, bhandarims@ornl.gov
DOE Manager: Karma Sawyer, 202-287-1713, karma.sawyer@hq.doe.gov

Project Description

The U.S.-India Joint Center for Building Energy Research and Development (CBERD) conducts energy efficiency research and development with a focus on integrating information technology with building controls and physical systems for commercial/high-rise residential units. This CBERD project is (1) optimizing the operation of existing cooling and dehumidification systems, and (2) developing improved heating, ventilation, and air conditioning (HVAC) physical systems. These improved systems need to handle fresh air more efficiently, which improves air quality, and must also have a cost-effective design. The long-term goal is to integrate an energy-efficient non-compressor dedicated outdoor air system into HVAC systems, which could improve performance by up to 30%. The project team is directly collaborating with HVAC manufacturers, users, and consultants to meet this goal.

Summary of Review Comments

Reviewers expressed concern about the project's limited scope and had mixed views on the project's potential impact on the relevant technologies. The project's ability to facilitate collaboration and relationship-building between India and the United States were noted as areas of strength. Reviewers had mixed views on whether the project will have a notable impact in the United States, with reviewers commenting that the collaboration seems to be limited to two institutes in India and that the main deliverable is a report on best practices based on field tests in India. They also had differing opinions about the project's accomplishments. Reviewers' recommendations include expanding the best practices guide to be much broader than just chilled water systems, expanding the scope of the project, and increasing the focus on deployment in the U.S. market.



Project # ET-72: Vacuum Insulation for Windows

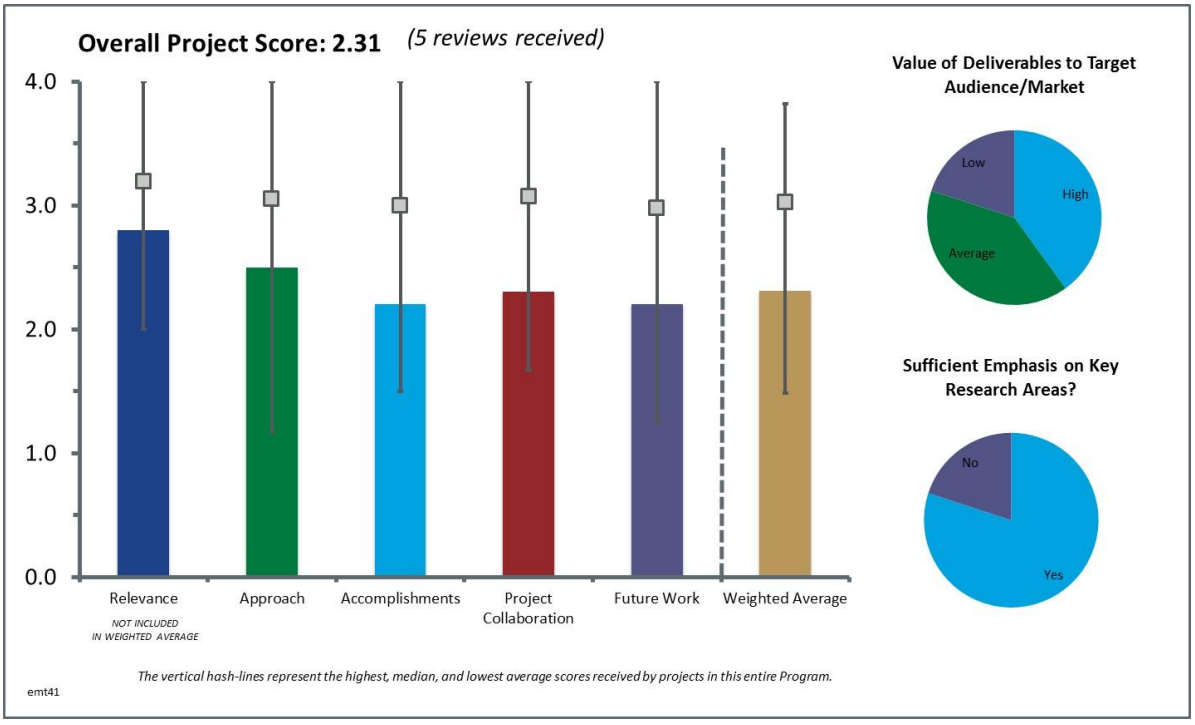
Presenter: Lin Simpson, National Renewable Energy Laboratory, lin.simpson@nrel.gov
DOE Manager: Bahman Habibzadeh, 202-287-1657, bahman.habibzadeh@ee.doe.gov

Project Description

This project is developing vacuum insulation for window applications using novel evacuated materials—so small that they are invisible—integrated with low-e-coated plastic films. The materials will have better insulation values than vacuum-insulated glass and have the correct form factor for easy integration with installed windows. The life expectancy of installed windows is greater than 30 years; decades and tens of trillions of dollars would be required before they are replaced with highly insulating windows. Thus, there is a substantial need for ways to retrofit windows to make them more insulating.

Summary of Review Comments

Reviewers praised the project's relevance to Building Technologies Office goals and its potential to make a substantial impact on the energy performance of existing residential buildings. However, one reviewer questioned whether the project team will be able to translate the properties of the core material as tested in the laboratory apparatus to a coated thin film on a window with the material embedded in a polymer matrix. Reviewers noted that the application may be an attractive alternative to window retrofit for old commercial building fenestration. Identified weaknesses include that (1) the concept for translating the commercially available vacuum capsules to a useful (and highly insulating) sheet material is poorly supported by measured data, and (2) the team needs to resolve issues with the measurement system, as well as regarding the integration of the vacuum cells with the plastic film and low-e coated surface(s). Reviewers recommended collaborating with other national laboratories on some of the issues concerning low-e and heat transfer through the matrix, as well as on proving the technical feasibility of the concept.



Project # ET-73: CERC: Cool Roofs and Urban Heat Islands

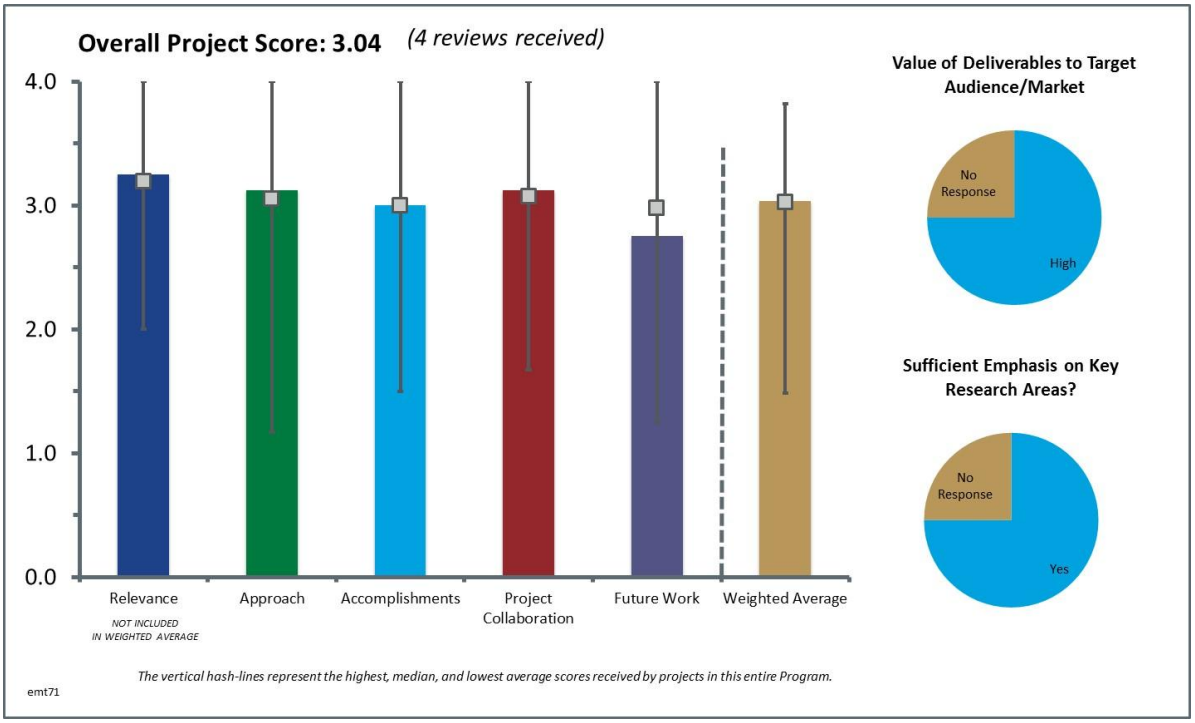
Presenter: Ronnen Levinson, Lawrence Berkeley National Laboratory, RMLevinson@lbl.gov
DOE Manager: Karma Sawyer, 202-287-1713, karma.sawyer@hq.doe.gov

Project Description

The U.S.-China Clean Energy Research Center (CERC) is a pioneering research and development (R&D) consortium bringing together governments, key policymakers, researchers, and industry to develop a long-term platform for sustainable U.S.-China joint R&D. CERC has two projects that are advancing cool roofs. The first is developing the infrastructure—including credits, policies, and rating systems—needed to promote the climate-appropriate use of energy- and carbon-saving cool surfaces in China. The second project aims to decrease roof soiling on white cool roof coatings, which causes a loss of optical reflectivity. The project is demonstrating that superhydrophobic powders can be added as anti-soiling agents to the roof coatings. In hot summer climates, choosing cool roofs for new construction and end-of-service-life replacement could save 120 trillion Btu per year of source energy and 10 million tons per year of carbon dioxide by 2025.

Summary of Review Comments

According to reviewers, the project has a high value because it directly influences decision making at the national codes/standards level and provides valuable results for the Chinese construction industry. Identified strengths include (1) adapting an approach and methods established in the United States to Chinese climates; (2) collaboration between U.S. laboratories, industry, and Chinese partners; (3) and outlining the remaining research needed to demonstrate proof of performance. Reviewers noted the benefits seem weighted more toward the Chinese building community but are still relevant to Building Technologies Office goals. One reviewer expressed concern that the coating durability is not established. Reviewers recommended that the project team pursue deeper engagement with the U.S. audience and collaborations with emerging Chinese cool roof manufacturers, as well as improve the product development cycle.



Project # ET-74: Stay-Clean and Durable White Elastomeric Roof Coatings with Dow Chemical

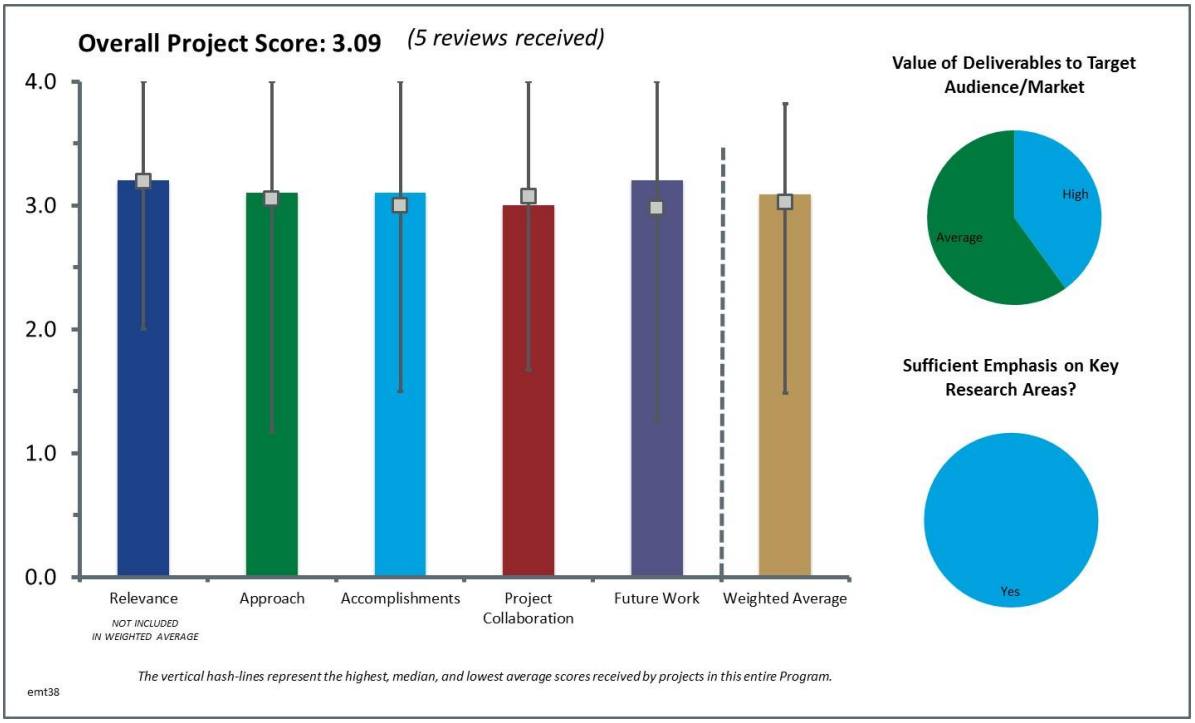
Presenter: Hugo Destaillats, Lawrence Berkeley National Laboratory, HDestaillats@lbl.gov
DOE Manager: Karma Sawyer, 202-287-1713, karma.sawyer@hq.doe.gov

Project Description

This project is developing stay-clean white elastomeric roof coatings (ERCs) with a 3-year aged solar reflectance (SR) of at least 0.75 and a service life of 15 years or more. A 50% increase in U.S. cool roof energy cost savings can be achieved if performance standards for white roofs are raised from the current aged SR of 0.55 to 0.75. ERCs that are more mechanically durable would increase service life from about 10 years to at least 15 years. The higher ERC SR and durability could double lifetime energy savings.

Summary of Review Comments

Reviewers commended the project's technical accomplishments, potential impact, and relevance to the building envelope focus area. Identified strengths include the project's (1) focus on an important area of performance loss for white roofs, (2) inclusion of laboratory testing, (3) results showing an improvement over baseline coatings, and (4) use of accelerated age testing to explore various coating formulations. Most reviewers were very complimentary of Dow Chemical's role, but one reviewer commented that Dow should use in-house resources for this research and development because the coating will be proprietary, while another noted that the project's benefit goes to a single manufacturer. Reviewers identified a few areas of uncertainty, including (1) the path forward for the transition of fundamental findings and (2) whether Dow has plans to commercialize any of the test samples. One reviewer recommended that if coating D is a success, the government should exercise its rights to widen the use by other manufacturers as well.



Project # ET-75: Fluorescent Pigments for High-Performance Cool Roofing and Facades

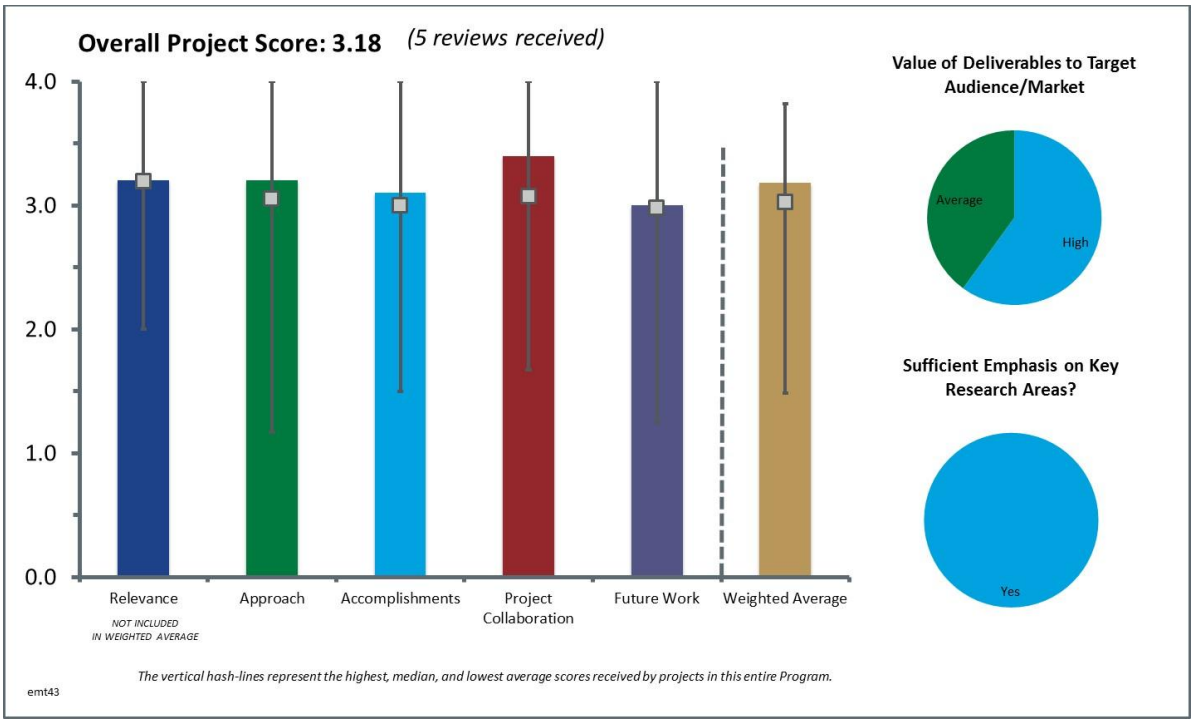
Presenter: Michael Zalich, PPG Industries, Inc., mzalich@ppg.com
DOE Manager: Bahman Habibzadeh, 202-287-1657, bahman.habibzadeh@ee.doe.gov

Project Description

This project is developing dark-colored cool pigments that combine near-infrared (NIR) fluorescence with NIR reflectance. These pigments will obtain unprecedented effective solar reflectance (ESR) values for dark-colored coatings used in the building envelope. Metal coatings will be formulated and characterized in dark red and near-black colors with ESR values of 0.50–0.70, a significant improvement over standard dark coatings, which have ESRs of only about 0.10–0.30. Such coatings would satisfy consumer demand for dark colors on building surfaces and also save 0.17 quads annually.

Summary of Review Comments

Reviewers generally recognized the project as having a novel approach to increasing cool roof adoption and praised the project's early progress. Specific strengths noted by reviewers include (1) reflecting additional solar irradiation, specifically from the NIR spectrum, to enhance roof cooling; (2) the innovative fluorescent coatings; and (3) the researchers' awareness of the relevant barriers. Reviewers expressed concern that the pigments have potential toxicity and stability issues, and that potential performance gains and color options should be explored more at a theoretical level to determine what is possible in conjunction with establishing proof-of-concept paints. Two reviewers also stated that PPG Industries should commit more of its own research funding to the project. Recommendations from reviewers include (1) increasing involvement from the roofing industry, (2) identifying specific quantitative approaches to measure pigment dispersion effectiveness, and (3) considering spray pyrolysis for volume production.



Project # ET-76: Low-Cost, Highly Transparent, Flexible, Low-Emission Coating Film to Enable Electrochromic Windows with Increased Energy Savings

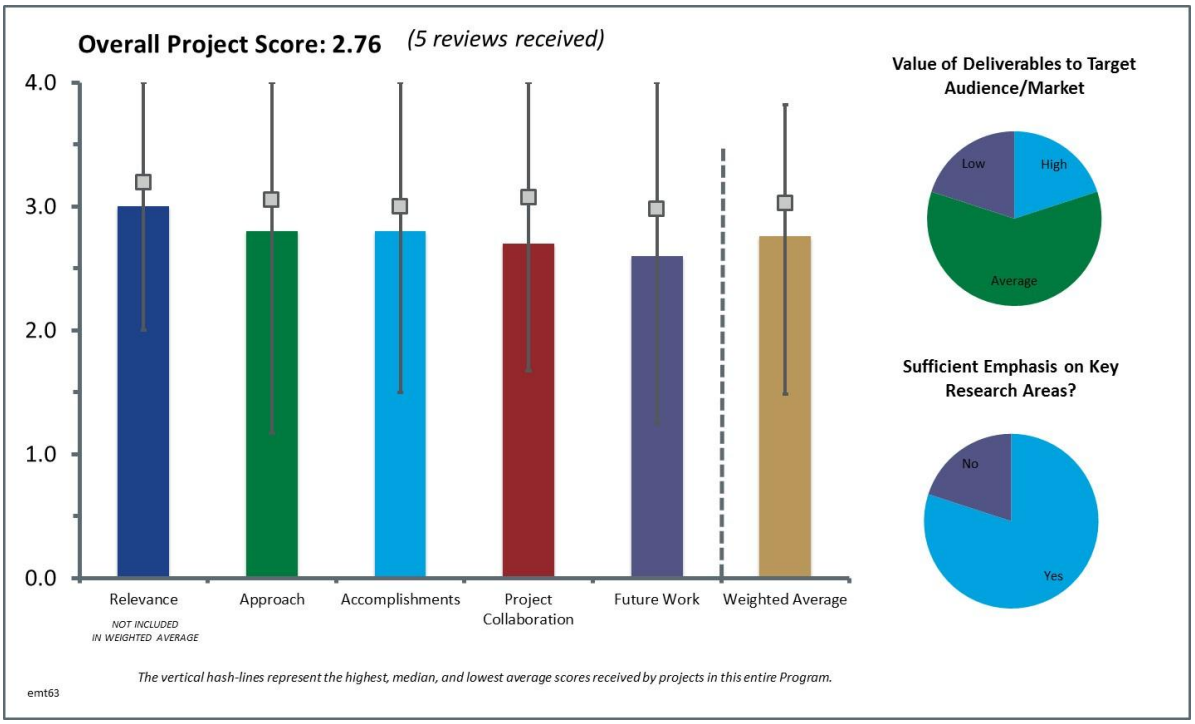
Presenter: Brian Berland, ITN Energy Systems, bberland@itnes.com
DOE Manager: Bahman Habibzadeh, 202-287-1657, bahman.habibzadeh@ee.doe.gov

Project Description

ITN Energy Systems is developing a retrofit, integrated low-e/electrochromic (EC) window film. While field testing of state-of-the-art EC windows shows that energy savings are maximized if a low-e coating is used in conjunction with the EC, available low-e films have a low visible transmission (~70% or less) that limits the achievable clear state and, therefore, the appearance and energy savings potential. This project will develop a novel low-e film that is optimized for compatibility with EC windows but that can also be used independently. Successful completion of the effort will produce a prototype integrated low-e, dynamic window film with high energy savings potential.

Summary of Review Comments

According to reviewers, this project is relevant to Building Technologies Office goals, particularly because of its possible application in retrofits. Reviewers commended the project's innovative film processing and its energy savings potential for windows. Reviewers had mixed views on the project's accomplishments. Specific weaknesses cited are (1) challenges associated with deposition film quality, interfaces, and compatibility with EC film; (2) the lack of commercial partners; and (3) processing methods that need significant improvement. One reviewer noted that market acceptance still needs to be addressed, and another noted that cost, lifetime, and aesthetics may be major hurdles. Reviewers recommended that the researchers collaborate with Lawrence Berkeley National Laboratory.



Project # ET-77: A New Generation of Building Insulation by Foaming Polymer Blend Materials with CO_2

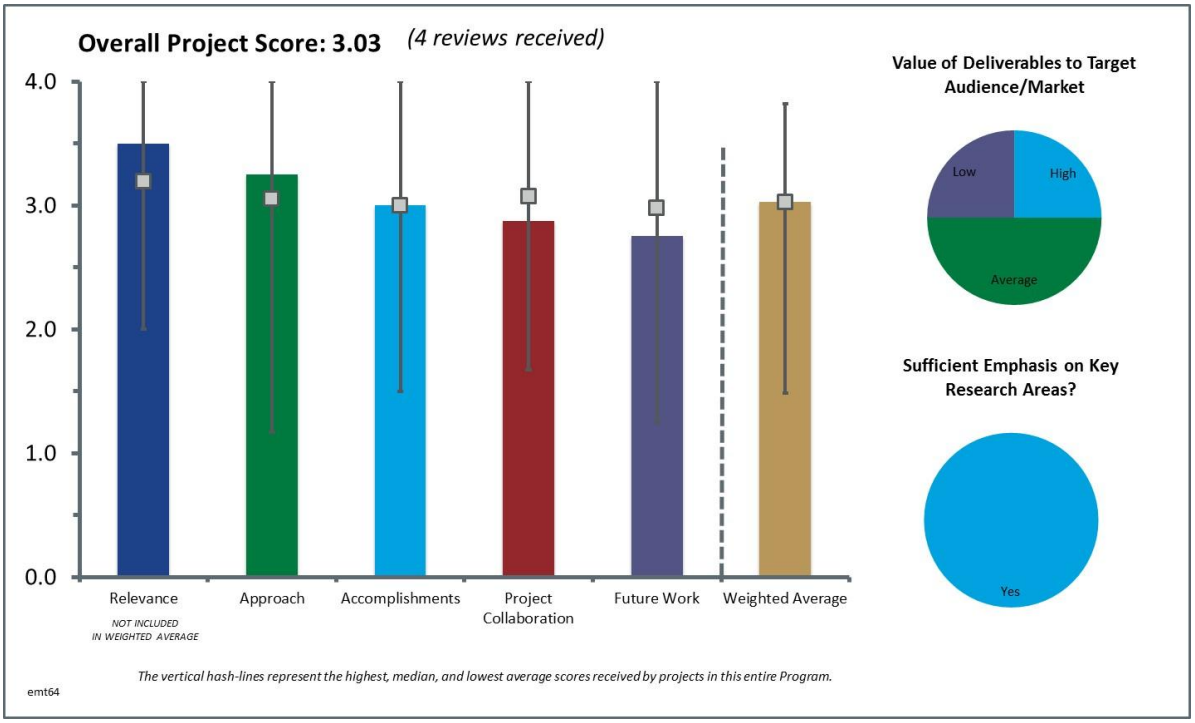
Presenter: Arthur Yang, Industrial Science & Technology Network, ajyang@istninc.com
DOE Manager: Bahman Habibzadeh, 202-287-1657, bahman.habibzadeh@ee.doe.gov

Project Description

This project aims to develop a new, environmentally clean building insulation with superior performance (R-9 to R-10 per inch) to existing insulation, as well as competitive costs on a per R-value basis. Instead of hydroflurocarbon, carbon dioxide (CO_2) is used as the blowing agent. This technology represents a highly valuable market opportunity given its ability to achieve maximum energy savings (at equal or lower cost) across a variety of thermal insulating applications, such as building foundations and walls, and refrigeration and heating, ventilation, and air conditioning applications. The Industrial Science & Technology Network estimates that the commercialization of this technology would reduce U.S. energy consumption related to building envelope components by 7%, which equates to an annual U.S. energy savings of 0.361 quads, or $8 billion in annual economic savings.

Summary of Review Comments

According to reviewers, the project is still in its early stages; however, the reviewers noted that some technical challenges must be addressed. Noted project strengths are the (1) use of carbon dioxide to increase panel insulation value at an acceptable cost, (2) technical expertise of the project team, (3) innovative approach for producing high-R-value foams, and (4) potential high impact on building insulation. Reviewers pointed to the following project weaknesses: (1) the limitations in exceeding R-6 per inch, (2) a lack of clarity on the technical approach to creating secondary nanostructure in pores, (3) the risk of not achieving high performance values, (4) the lack of a track record in commercialization, and (5) a lack of detail in the goals. Reviewers recommended that the project explore other gases, rather than using only CO_2.



Project # ET-78: Acoustic Building Infiltration Measurement System (ABIMS)

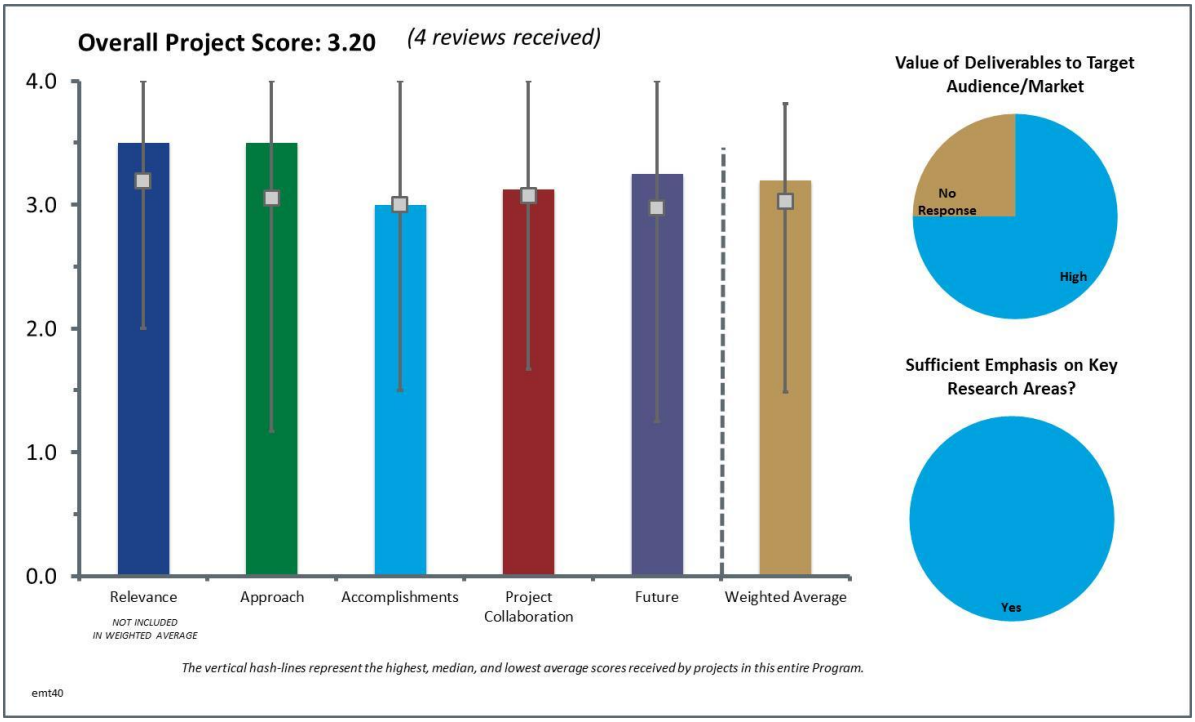
Presenter: Ralph Muehleisen, Argonne National Laboratory, rmuehleisen@anl.gov
DOE Manager: Bahman Habibzadeh, 202-287-1657, bahman.habibzadeh@ee.doe.gov

Project Description

This project is developing an acoustic method of measuring the infiltration of a building envelope. The Acoustic Building Infiltration Measurement System (ABIMS) overcomes many of the limitations of existing pressurization and tracer gas methods, including the need for completed building envelopes and the inherent size limitations of the pressurization test method. Current infiltration methodologies require a completed building enclosure for testing and are limited to small buildings because pressurization tests cannot be conducted on large buildings. ABIMS will enable infiltration measurement of all buildings. Testing for infiltration compliance could be added to building codes, increasing codes compliance rates and decreasing building energy use.

Summary of Review Comments

Reviewers noted that although the project is still in its early stages, it will have high value across the building industry if successful. The following project strengths were cited: (1) the creation of a new building infiltration measurement method, replacing trace gas techniques; (2) the development of analytics that relate acoustic flow to airflow; (3) the collaborations with commercialization partners; (4) the development of a new, less intrusive way to measure infiltration using acoustics simulation; (5) the novel, high-value approach to characterizing infiltration; and (6) the on-schedule development. Reviewers pointed to the following project weaknesses: (1) the approach requires calibration of specific structures and correlating measurements to real structures, (2) the project currently lacks proof of concept, (3) there is a risk the approach will not work in a field setting, (4) the project fails to measure the infiltration of the whole building in one step, and (5) the project goals are overly ambitious. One reviewer recommended that there should be a focus on measuring infiltration at laboratory scale prior to field demonstrations.



Project # ET-79: WUFI Basement Module

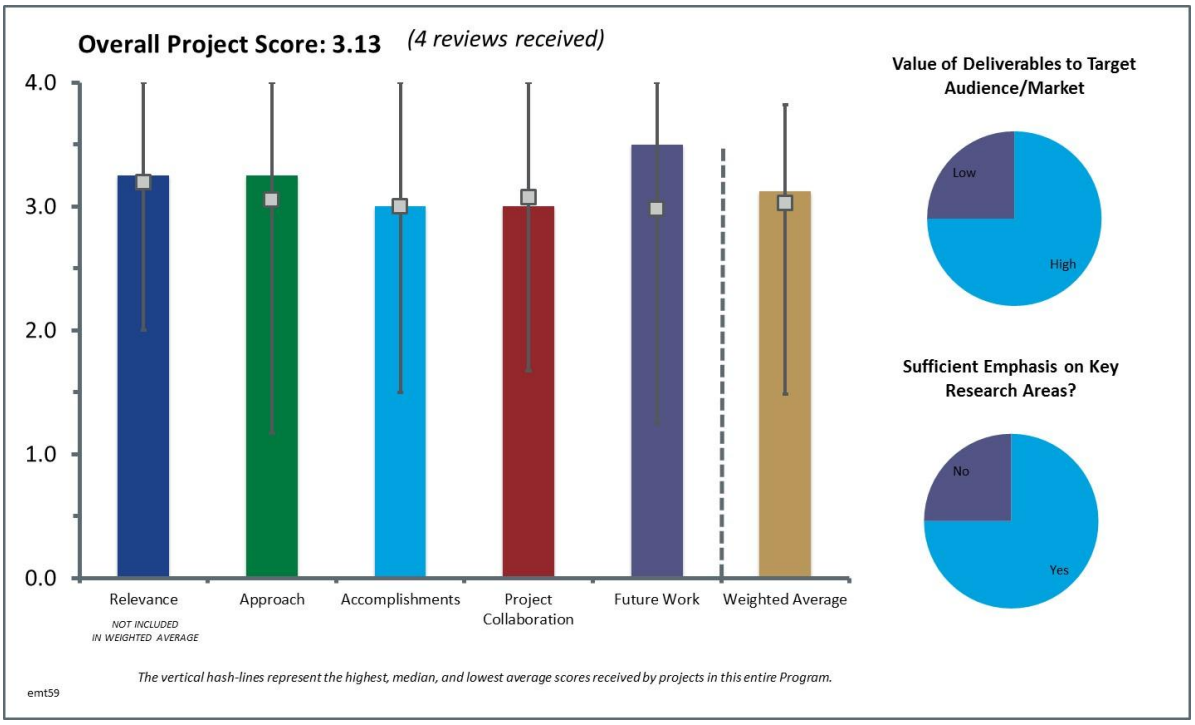
Presenter: Manfred Kehrer, Oak Ridge National Laboratory, kehrerm@ornl.gov
DOE Manager: Amir Roth, 202-287-1694, amir.roth@ee.doe.gov

Project Description

Approximately 41% of U.S. households are in the Northeast and Midwest regions, where deep foundations are the dominant below-grade construction style. This ongoing project at Oak Ridge National Laboratory (ORNL) aims to identify durable foundation insulation systems—customized to climate zone, soil type, and insulation system—that do not accumulate moisture and consequently can save 0.1 quads annually, depending on market penetration. WUFI has been deployed and validated for decades worldwide as a tool to predict heat and moisture transfer in building envelopes, and it has been successfully adopted for use in the United States by ORNL. The fiscal year 2014 goal of the project is to assess the viability of WUFI 2D as a tool that can be employed for below-grade construction, and to initiate fixes as required, in collaboration with Fraunhofer IBP.

Summary of Review Comments

Reviewers commented that good progress has been made in modeling and validation for the WUFI simulation tool; however, they noted that the project would benefit from increased consultant feedback and manufacturer involvement. Cited project strengths include the (1) creation of a software tool to simulate heat and moisture transfer on below-grade building components and the surrounding ground, (2) technical expertise of the project team, (3) potential to improve below-grade energy savings, and (4) promising results that could assist builders and manufacturers with proper below-grade materials to improve insulation in wet conditions. Reviewers noted the following project weaknesses: (1) the unclear market need for software; (2) the inaccuracy of governing equations, properties, and boundary conditions; (3) a lack of communication regarding commercial partners; (4) the lack of clarity regarding the need for validation in locations with different soils and conditions; (5) a lack of detail on budget; and (6) weak collaborations. Reviewers recommended that the principal investigator further clarify the physics of the problem and the solution, identify commercialization partners that will eventually use the software, and consider addressing the difficulty with validation in the Minnesota field trial by supplementing it with mock-up testing in a controlled laboratory setting.



Project # ET-80: Fenestration Software Tools

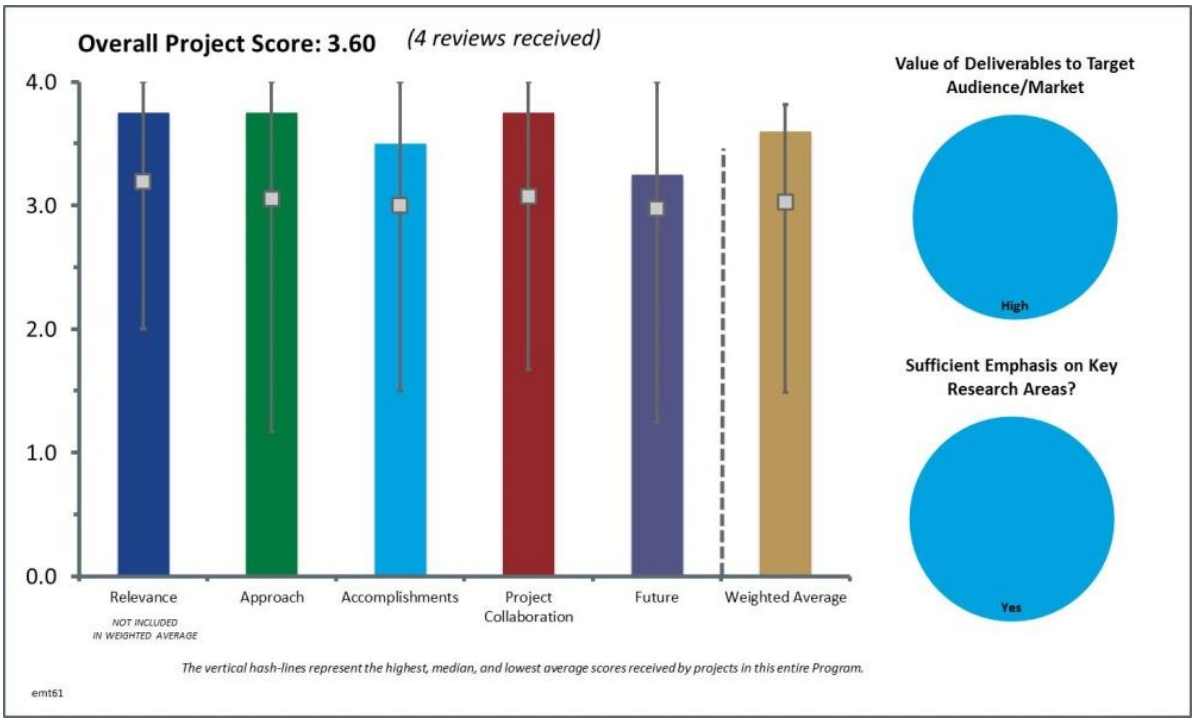
Presenter: Charlie Curcija, Lawrence Berkeley National Laboratory, dccurcija@lbl.gov
DOE Manager: Amir Roth, 202-287-1694, amir.roth@ee.doe.gov

Project Description

Manufacturers have been using Lawrence Berkeley National Laboratory's fenestration software tools for decades to design energy-efficient window technologies. These advanced, independently verified tools are moving the window industry toward virtual, rapid product design and product development, which accelerates design-to-market delivery. In fiscal year 2014, the primary effort is to maintain and support software tool use through bug fixes, user support, and user manual updates. The goal for the end of fiscal year 2014 is to release a new version of software tools (v7.3) with improved reliability and robustness, updated knowledge base articles, frequently asked questions, and additional tutorials addressing issues that are most frequently raised by users.

Summary of Review Comments

According to reviewers, the project is relevant to overall Building Technologies Office goals and has had a large impact on window energy efficiency. Reviewers commented favorably on the project's approach and industry collaboration. Reviewers praised the project for (1) providing a critical design tool for improving the energy performance of windows; (2) having a strong research team, methodology, and objectives; (3) improving an advanced fenestration software tool; and (4) coordinating closely with manufacturers and certifiers. Reviewers noted the lack of collaboration with software users as a project weakness and commented that it would be beneficial if the software supported the Mac platform as well. Reviewers recommended that an explanation be provided regarding why this project is now a separate project instead of receiving support from individual technology projects.



Project # ET-81: CERC: Hybrid Ventilation Optimization and Control Research and Development

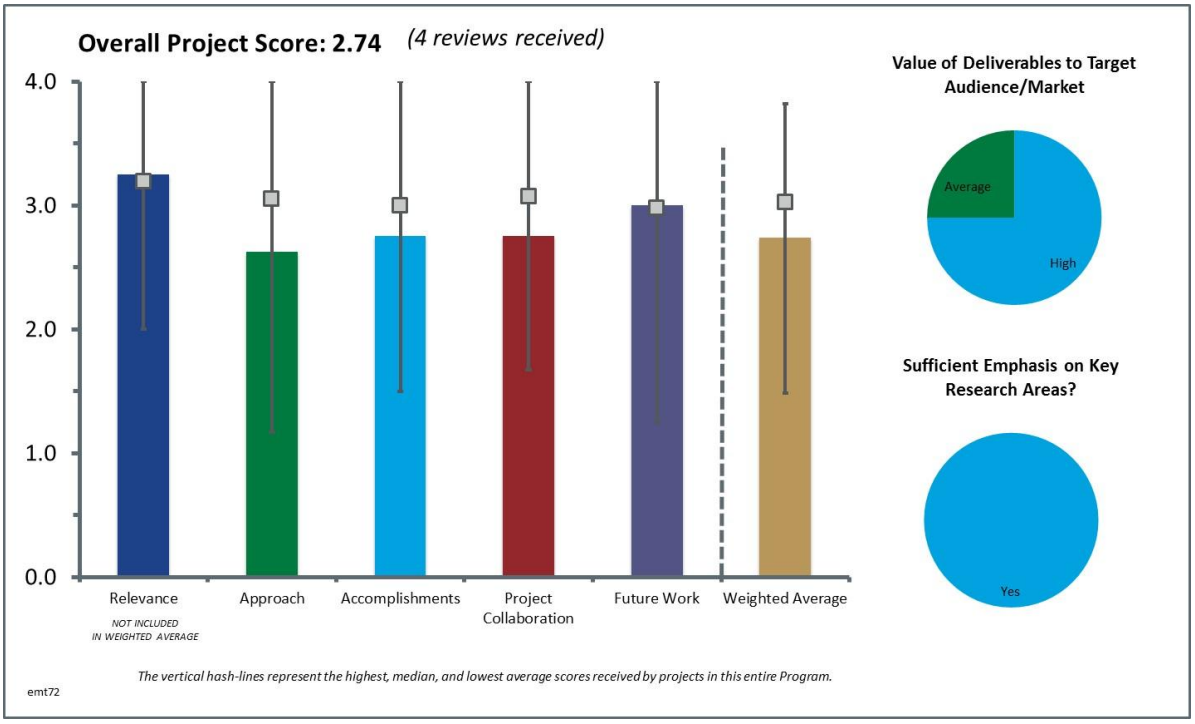
Presenter: Leon Glicksman, Massachusetts Institute of Technology, glicks@mit.edu
DOE Manager: Karma Sawyer, 202-287-1713, karma.sawyer@hq.doe.gov

Project Description

The U.S.-China Clean Energy Research Center (CERC) is a pioneering research and development (R&D) consortium bringing together governments, key policymakers, researchers, and industry to develop a long-term platform for sustainable U.S.-China joint R&D. A building's natural ventilation depends on the building's shape, orientation, and operation. Currently, there is a lack of simple and accurate models that test different shapes, orientations, and ventilation strategies at the early design stage. This CERC project is filling that hole in the market. By developing quick, easy-to-use tools that optimize ventilation control, this project will promote the widespread application of natural ventilation in commercial buildings—and the substantial savings that come with it. The long-term goal is to reach the $1.6 billion market that includes design and architecture firms, hybrid ventilation equipment companies, and building operators and managers.

Summary of Review Comments

Reviewers noted that the project has made good progress, but they also stated that there are still barriers to address and were uncertain that the tool would be useful in the future. Identified project strengths include the (1) collaboration between China and the United States, (2) international use of the tool, (3) improvements in control algorithms, (4) expansion and improvements of CoolVent, (5) focused approach in software development, and (6) potential impact on greenhouse gas emissions. Identified project weaknesses are the (1) lack of a survey of software tools available for naturally ventilated building analysis; (2) weak objectives and approach; (3) possibility that natural ventilation will only be considered during the early design phase without real adoption in buildings; (4) barriers, such as air pollution, air quality, and acoustics; and (5) issues with energy savings and comfort. Reviewers recommended determining the number of software users, identifying commercial partners (particularly from the architectural sector), and exploring the integration of CoolVent with EnergyPlus.



Project # ET-82: High-Efficiency, Low-Emission Refrigeration System

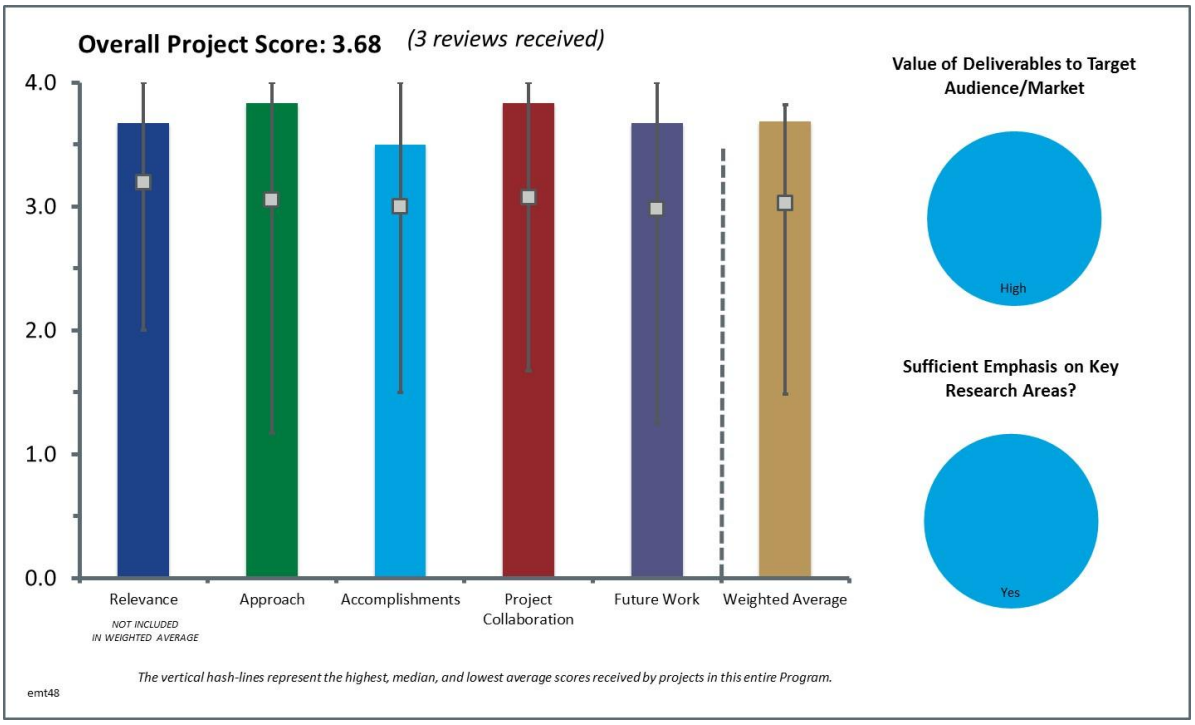
Presenter: Brian Fricke, Oak Ridge National Laboratory, frickeba@ornl.gov
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

This project is developing a supermarket refrigeration system that reduces greenhouse gas emissions and uses 25%–30% less energy than existing systems. The primary market segment is large national food retailers; the secondary segment is small food retailers. Project results will be used to encourage large food retailers to purchase the system in volume, which will reduce the system's cost and increase penetration of the smaller food retailer market. Adoption of advanced refrigeration equipment is required to achieve the Building Technologies Office's goal of reducing the energy and carbon emissions of service equipment by 50%. A system that used 25% less energy and achieved a 10% adoption rate could achieve annual primary energy savings of 17 terawatt hours a year; current annual consumption is 688 terawatt hours a year.

Summary of Review Comments

Reviewers commented favorably on the project's approach and progress to date, noting effective collaboration with key stakeholders and industry partners. Reviewers praised the project for (1) its low risk and significant potential for impact, (2) its strong project goals, (3) leveraging the expertise of Oak Ridge National Laboratory, and (4) its high value to the target market. The fact that implementation of project results would require significant rethinking of existing systems was noted as a project weakness. Reviewers recommended continuing the field evaluation steps and significantly increasing the industry cost-share.



Project # ET-83: Magnetocaloric Refrigeration

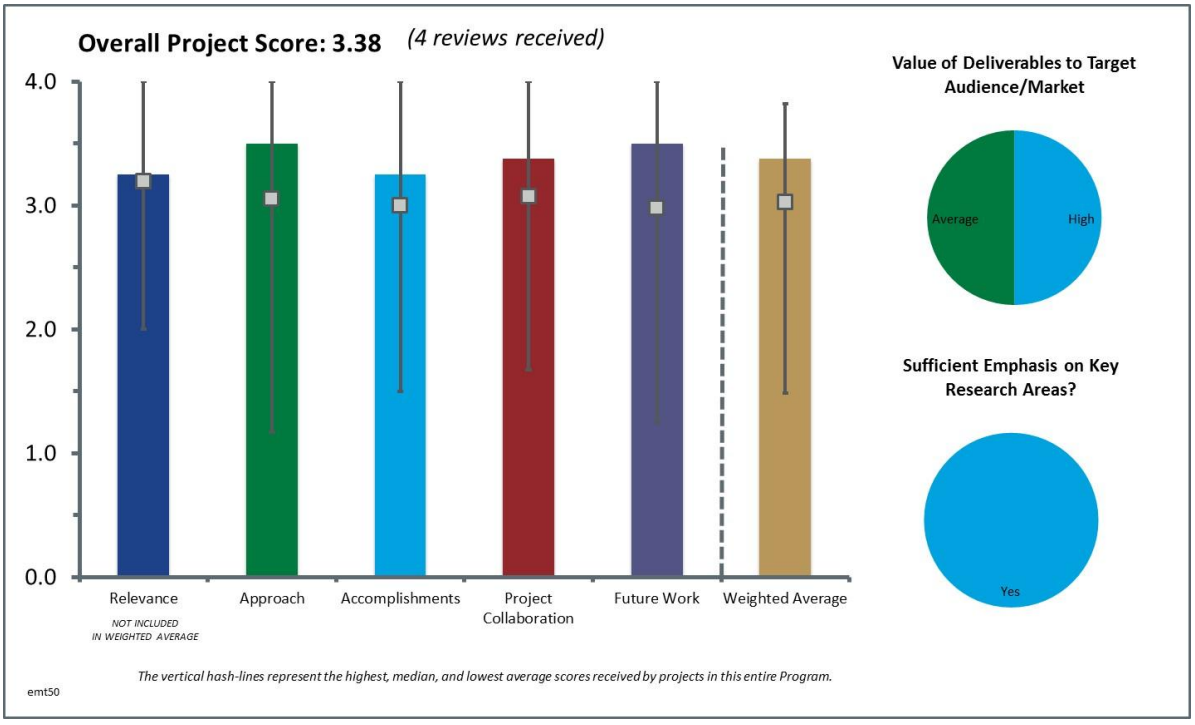
Presenter: Ayyoub Momen, Oak Ridge National Laboratory, momena@ornl.gov
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

This project is developing a residential refrigerator/freezer with 25% lower energy consumption relative to current U.S. Department of Energy minimum efficiency standards. The refrigerator will be designed to use the magnetocaloric effect (MCE) rather than a conventional vapor compression cycle and thus reduce greenhouse gas emissions by eliminating the use of refrigerants with high global warming potential. Refrigeration technologies based on MCE are fluorocarbon-free and offer potential energy savings of 20%–30% over conventional vapor compression systems. The potential savings would be 0.28–0.42 quads annually, assuming full market penetration. This project addresses the Building Technologies Office's (BTO's) goal of developing highly energy-efficient appliance equipment that will significantly reduce overall energy needs in new and existing buildings.

Summary of Review Comments

Reviewers commented that the project is relevant to BTO goals and has the potential to reduce the energy consumption of residential refrigerators. Identified project strengths include the (1) 6-year commitment from General Electric (GE), (2) promising proposed solutions to technical challenges, (3) potential energy savings of 25%, and (4) excellent progress made on issues relating to hydraulics and materials. One reviewer also praised the future plans to build a working device that incorporates all of the research and development explored in this project and then evaluate the performance of the device. Identified project weaknesses include the (1) unclear roles of Oak Ridge National Laboratory and GE, (2) lack of details about inventions, (3) project risk and uncertainty, and (4) lack of detail regarding expected performance. Because the potential future government funding for this project is substantial, one reviewer suggested special care in developing the criteria for go/no-go decisions.



Project # ET-84: Max Tech and Beyond

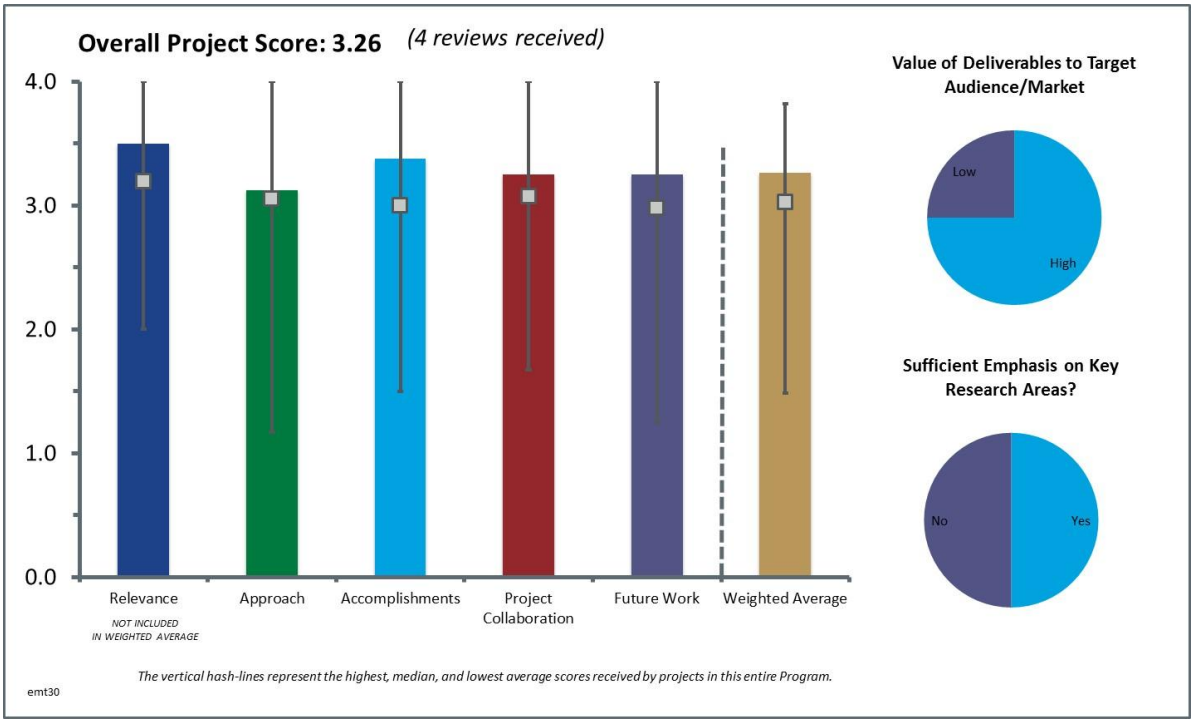
Presenter: Robert Van Buskirk, Oak Ridge National Laboratory, RDVanBuskirk@lbl.gov
DOE Manager: Antonio Bouza, 202-586-4563, antonio.bouza@ee.doe.gov

Project Description

The annual Max Tech and Beyond Design Competition challenges students to design ultra-energy-efficient appliances. Each year, the U.S. Department of Energy (DOE) and the Lawrence Berkeley National Laboratory select 8–12 collegiate teams to design and test ultra-energy-efficient appliances that use less energy than the most efficient products currently on the market. The team that creates the product that demonstrates the most energy-and/or cost-savings potential wins the competition. The competition supports DOE's broader efforts to train and educate a new generation of engineers and entrepreneurs who will help solve our national energy challenges and bring cutting-edge energy technologies to the global market.

Summary of Review Comments

Reviewers noted that the project engages college students and promotes energy-efficient appliances; however, they also noted that there are several barriers to the project's overall success. Identified project strengths include the project's effective leadership, education of future appliance engineers, emphasis on efficiency and innovation, and good collaboration between government and academic entities. Reviewers observed that although the project is, in theory, in line with Building Technologies Office goals, the actual approach might not yield significant results because of barriers to market implementation and commercialization. Identified project weaknesses include the low number of participating universities, the possibility that no significant contributions will come to pass, and the need for a metric measuring future employment of participating students. Reviewers recommended the project be more heavily promoted to university partners, as well as throughout the industry. Additional reviewer recommendations include adding a patent search as part of the evaluation process and exploring ways to sustain and expand the program without federal funds in the future.



3. Commercial Buildings Integration

3.1 Program Overview

The Commercial Buildings Integration (CBI) Program accelerates energy performance improvements in existing and new commercial buildings by developing, demonstrating, and deploying a suite of cost-effective technologies, specifications, tools, and solutions. The Program also works with industry to promote voluntary activities to motivate and support improved energy efficiency in the commercial building sector. These voluntary activities focus on increasing the use of underutilized technologies that have high potential to overcome performance and cost hurdles preventing investment in efficiency measures.

The Program's *mission* is to accelerate voluntary uptake of significant energy performance improvements in existing and new commercial buildings. The Program's *vision* is a commercial buildings market where energy performance is a key consideration during construction, operation, renovation, and transactions, and where Zero Energy Ready (ZER) commercial buildings are common and cost effective.

The Program pursues goals for both new and existing buildings. For new buildings, the Program's 2020 goal is to demonstrate at convincing scale (in all climate zones and major building types) that it is cost effective to reduce the energy required to operate new commercial buildings by 50% relative to American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standard 90.1 (2004). The Program's 2030 goal is to demonstrate at convincing scale that it is cost effective to construct new ZER commercial buildings. For existing buildings, the goal is to demonstrate at convincing scale commercial building upgrades with 20% cost-effective savings by 2020 and 25% cost-effective savings by 2025, relative to the prior operations for those buildings.[3]

The Program achieves these goals through the following: (1) technology-to-market activities, (2) demonstration and deployment activities, (3) developing tools and resources needed to build the market infrastructure for greater investment in efficiency, and (4) partnering with market leaders to accelerate adoption of these technologies and solutions by the commercial buildings market. The Program tracks its progress toward goals by analyzing the impacts of Program-funded activities on building energy codes and standards, examining energy trends, and tracking the cost of energy efficiency measures in the commercial buildings market.

Figure 5. The role of the Commercial Buildings Integration Program in the BTO Ecosystem

[3] BTO goals were updated after this report was generated. The updated goals will appear in the 2015 BTO Peer Review Report and in BTO's Multi-Year Program Plan, which will be published in the Fall of 2015.

3.2 Summary of Peer Review Feedback

Project # CBI-04: Technology Performance Exchange

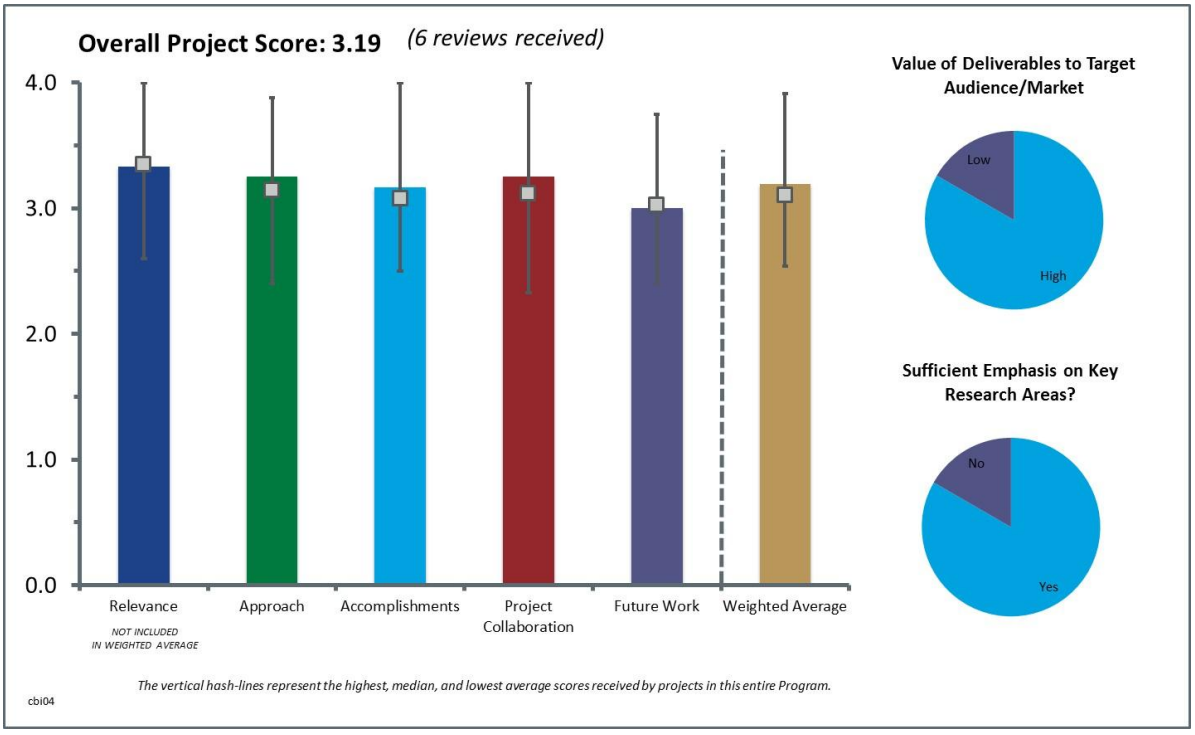
Presenter: Bill Livingood, National Renewable Energy Laboratory, william.livingood@nrel.gov
DOE Manager: Amy Jiron, 720-339-7475, amy.jiron@ee.doe.gov

Project Description

This project's overall goal is to ensure that necessary energy performance data are easily accessible for a broad array of technologies to reduce investment risk and drive uptake of cost-effective efficiency measures. The objectives of this project include defining the characteristics necessary to credibly predict energy performance, and creating the infrastructure necessary for stakeholders to find, share, and leverage submitted data. By reducing the risk associated with the adoption of energy efficiency solutions, the Technology Performance Exchange (TPEx) accelerates and broadens the uptake of energy efficiency solutions in the commercial building space.

Summary of Review Comments

Reviewers commented that the TPex includes a robust platform with a good user interface and provides an accessible two-way flow of data that could benefit a wide array of stakeholders. Reviewers also noted several weaknesses: (1) a lack of clarity around project targets and measuring progress toward them, (2) a disconnect from the realities of commercial building decisions, (3) uncertainty regarding the credibility of the data, and (4) the team's poor understanding of the market. Reviewers suggested making a distinction between different types of products and developing a better method for finding out what users need.



Project # CBI-07: Lighting and Electrical Team Leadership and Project Delivery

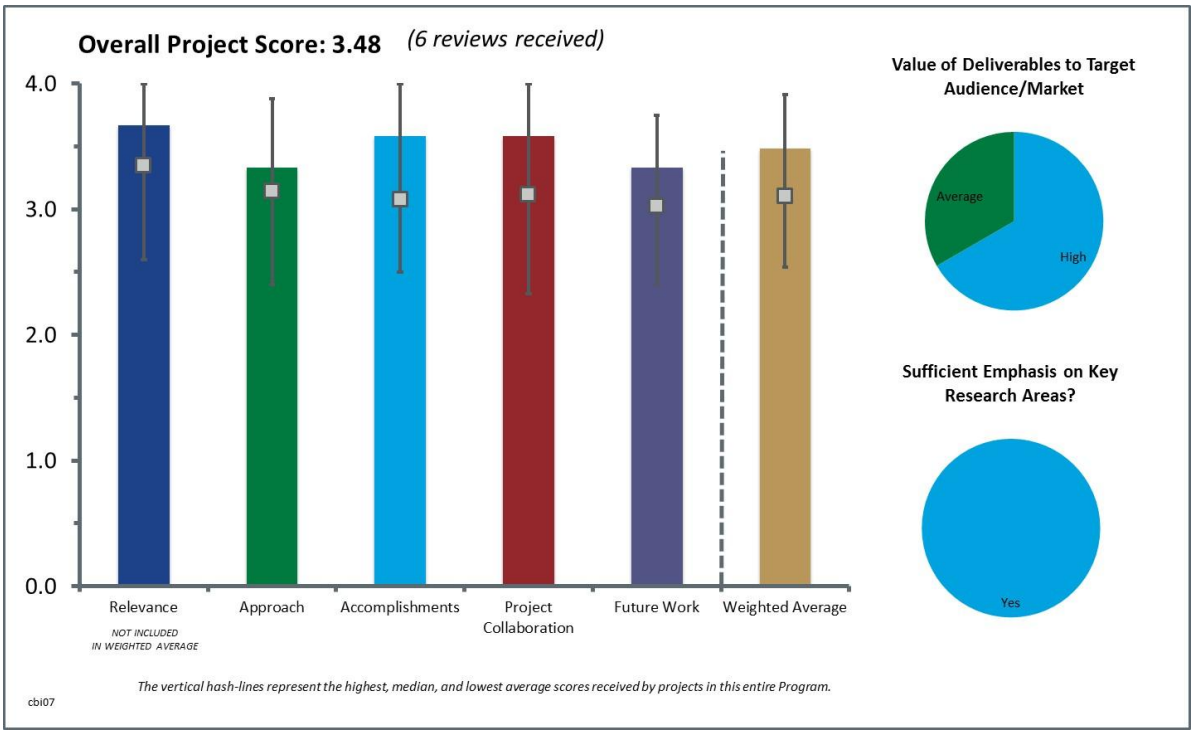
Presenter: Linda Sandahl, Pacific Northwest National Laboratory, linda.sandahl@pnnl.gov
DOE Manager: Kristen Taddonio, 720-356-1779, kristen.taddonio@ee.doe.gov

Project Description

The partners involved in the Lighting Energy Efficiency in Parking (LEEP) campaign, along with private and public entities, advocate for and install energy-efficient lighting in public parking lots to foster significant reductions in participants' energy consumption. The project's primary goal for exterior lighting is to drive LEEP participation well beyond the 2013 achievement of installing energy-efficient lighting for 100 million square feet of parking space. For interior lighting, the primary goal is to lay the foundation and establish the partnerships required to launch an interior high-efficiency lighting campaign.

Summary of Review Comments

Reviewers commented that the project has made great progress, having exceeded its target and spurred the installation of energy-efficient lighting for 270 million square feet of parking space. One reviewer stated that, of the nine projects the reviewer assessed, this one has the best-defined approach. However, another reviewer was less impressed, stating that the project should include behavioral research (people's needs for certain lighting conditions in dark parking lots at night), that interior lighting should be prioritized over parking, and that no information about planned and actual installations is provided, making the overall value uncertain. Reviewers suggested obtaining more feedback from participants and identifying how the energy savings metrics are measured.



Project # CBI-09: Buildings Performance Database

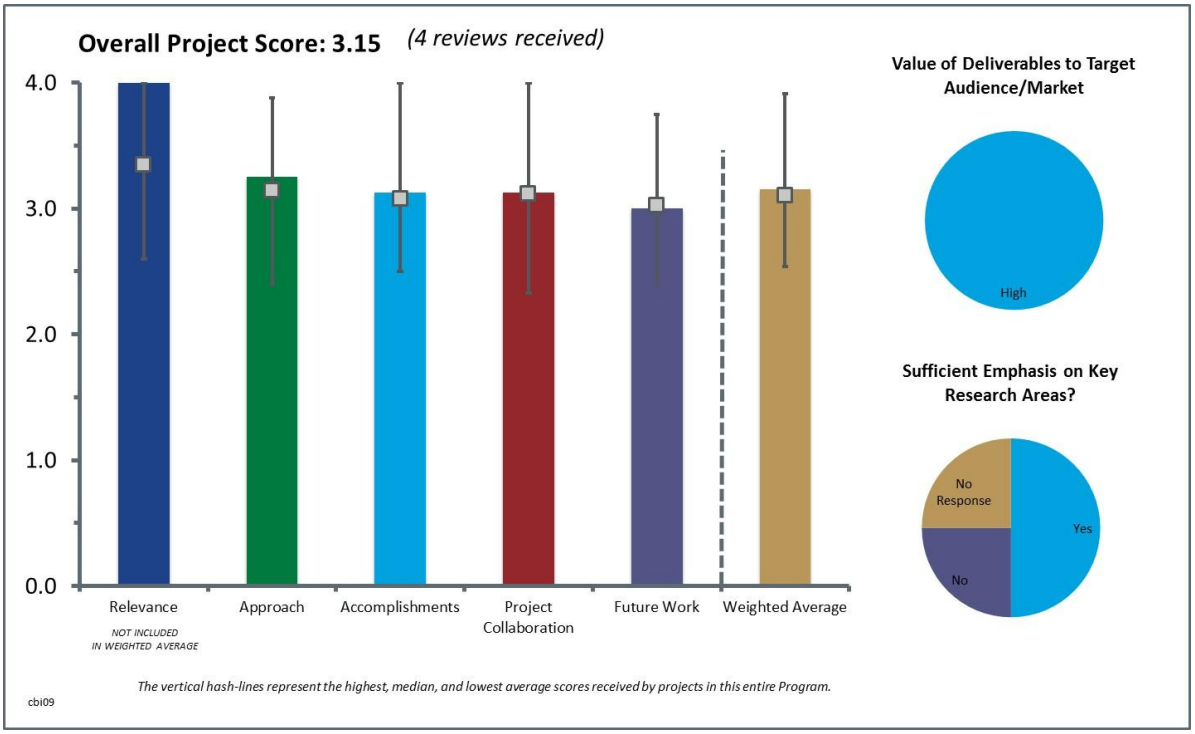
Presenter: Rich Brown, Lawrence Berkeley National Laboratory, rebrown@lbl.gov
DOE Manager: Elena Alschuler, 202-287-1561, elena.alschuler@ee.doe.gov

Project Description

The overall goal of the Buildings Performance Database (BPD) is to provide public access to high-quality building characteristics and energy consumption data to incentivize, analyze, and validate energy efficiency investments. The project's objectives for this year are to (1) significantly increase data acquisition, mapping, and cleansing, including an enhanced process for automated data updates from data contributors and exploring low-cost approaches to get new asset data; (2) publish, license, promote, and support an Application Programming Interface to permit third-party software developers to use the core functionality of the BPD; (3) develop a strategic plan for the BPD, including quantifiable impact metrics and targets; (4) implement software updates, including enhanced analytical methods and improved usability; and (5) conduct data analysis and publish results for three specific "real-world" use cases.

Summary of Review Comments

According to reviewers, the project has made progress toward its goals and has the potential to provide data that will support future Building Technologies Office projects. Reviewers commented that the project (1) provides a significant, user-friendly platform for credible energy-use data; (2) has the potential to change the valuation of buildings in the marketplace; (3) has identified a good strategy for obtaining more data; and (4) has good stakeholder engagement. Too much focus on the impact of data gaps, instead of exploring their causes, such as challenges in collecting clean data from principal holders, was cited as a project weakness. Reviewers recommended that more attention be given to the fit between the data sets being developed for specific use cases and the BPD's data collection capacity and needs. They also suggested that the project become a mandatory (versus voluntary), data-driven exercise.



Project # CBI-10: Standard Energy Efficiency Data (SEED) Platform

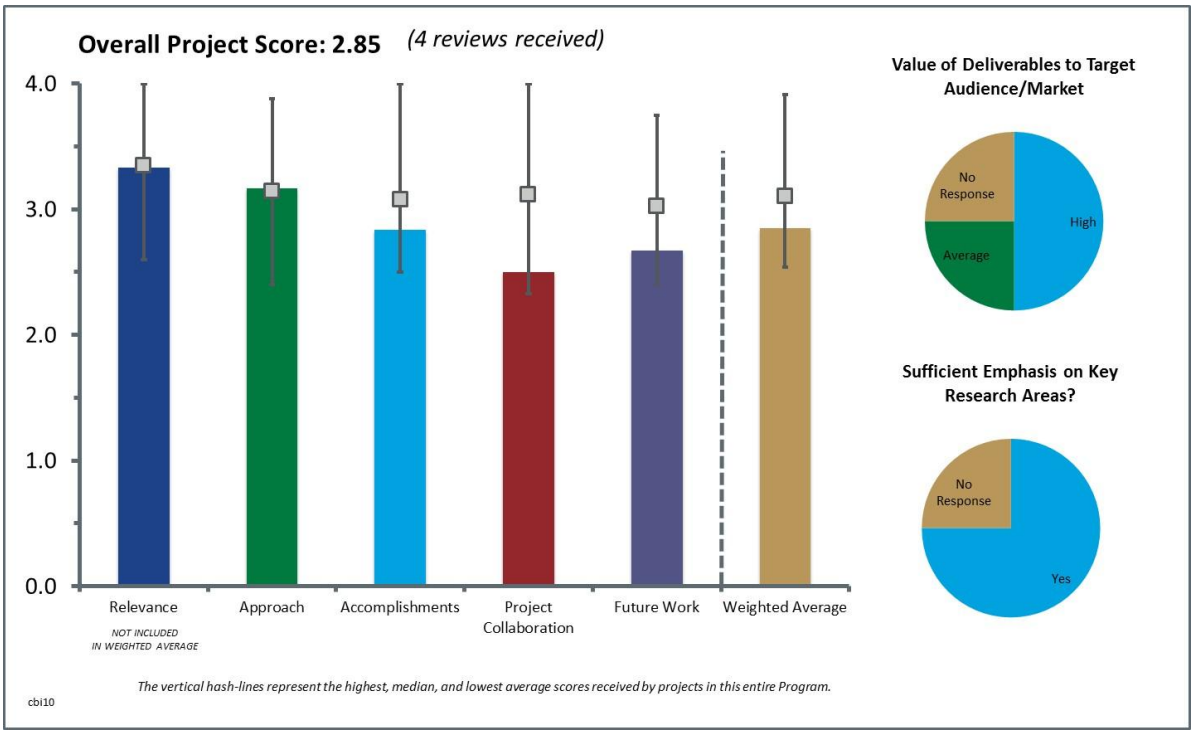
Presenter: Rich Brown, Lawrence Berkeley National Laboratory, rebrown@lbl.gov
DOE Manager: Elena Alschuler, 202-287-1561, elena.alschuler@ee.doe.gov

Project Description

The Standard Energy Efficiency Data (SEED) software application helps organizations easily manage data on the energy performance of large groups of buildings, thus also improving the consistency and interoperability of the data. The project's objectives this year are to (1) complete development of a production-grade, first version of SEED and release it to the market; (2) provide limited technical support for users and third-party developers, as well as support the U.S. Department of Energy through marketing and rollout to promote adoption; and (3) develop a long-term management strategy.

Summary of Review Comments

Reviewers praised the project for developing tools to standardize and aggregate efficiency-related data, but they noted that the level of interest from cities and other users is unclear. They had mixed views on the project's proposed future work and collaborations. Specific identified weaknesses include the apparent lack of local engagement and the lack of a defined pathway to engage stakeholders and promote adoption of the tools. Reviewers recommended (1) increasing the stakeholder pool; (2) conducting direct outreach to cities with data management needs; and (3) and engaging the information technology development community to ensure that the role of the public sector is balancing and supporting private-sector activity, rather than crowding it out.



Project # CBI-14: Transforming the Commercial Building Operations

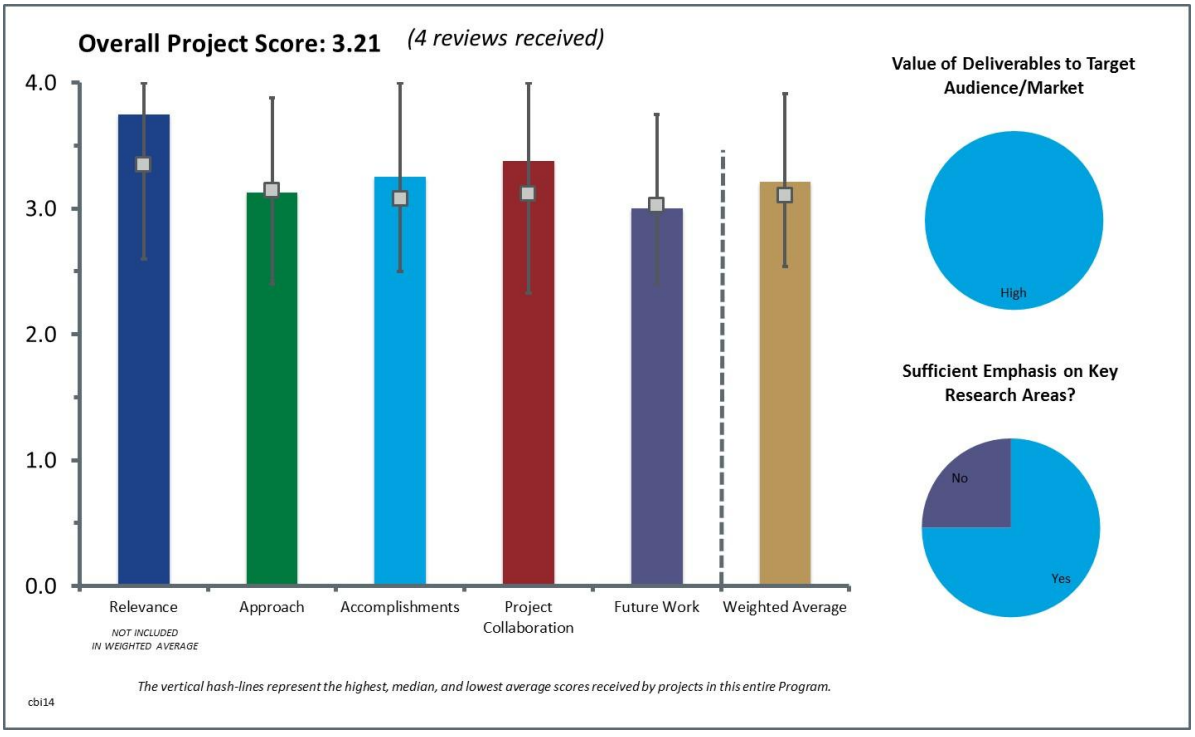
Presenter: Marta Milan, Waypoint Building Group, martamilan@waypointbuilding.com
DOE Manager: Cody Taylor, 202-287-5842, cody.taylor@ee.doe.gov

Project Description

The overall goal of this project is to train building operations staff and service providers in a systematic process for identifying and correcting no-cost building operational problems that lead to energy waste. Such a training program gives building operators the "how to" on operating buildings efficiently with retuning practices. The retuning training was piloted throughout 2013, and in 2014 the focus is on deploying the training to the wider market to encourage more buildings to take advantage of this tremendous energy savings opportunity. To this end, the project's specific objectives are to (1) establish regional training centers and transfer training tools and materials; (2) enhance/update training materials, including Web-based training; and (3) work with other stakeholders to expand the project's audience.

Summary of Review Comments

According to reviewers, this project is meeting the needs of an underserved market and tapping into a large set of potential energy efficiency opportunities; however, they expressed concern about the lack of plans for moving forward. Reviewers commended the project for conducting numerous training sessions and producing a number of valuable materials, and for targeting a good group of stakeholders. Identified weaknesses include (1) the lack of a systematic succession plan that allows the U.S. Department of Energy to transfer the program to industry, and (2) the lack of follow-up and long-term tracking of training attendees to gauge the impact of the training programs. Reviewers recommended (1) enhancing methods to track the effectiveness of the training programs; (2) marketing the project to a wider audience; and (3) connecting with other organizations, such as utilities and community colleges.



Project # CBI-21: OpenStudio Core Development and Deployment Support

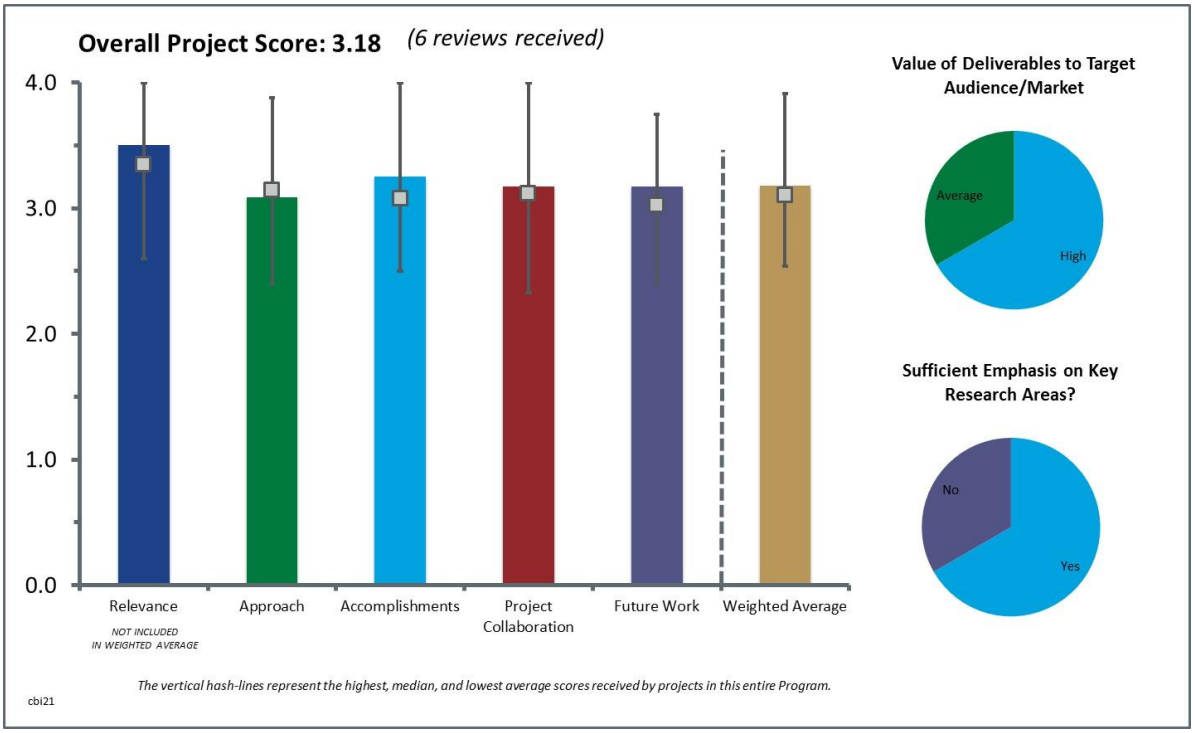
Presenter: Larry Brackney, National Renewable Energy Laboratory, larry.brackney@nrel.gov
DOE Manager: Amir Roth, 202-287-1694, amir.roth@ee.doe.gov

Project Description

The U.S. Department of Energy's energy analysis platform, OpenStudio, has made construction and analysis of building energy models easier and faster. The OpenStudio software development kit (SDK) also enables national laboratory and university researchers, along with private-sector tool developers, to effectively create new analysis tools and workflows. This project will develop the first version of DEnCity, a simulation database, and expand OpenStudio's value to design practitioners, researchers, and software developers. OpenStudio's year-out goals include achieving comprehensive coverage of all EnergyPlus objects; improved integration with Radiance, CONTAM, and Modelica; isolation of OpenStudio-based applications from changes in underlying engines; addition of measures and modeling components to the Building Component Library; expanded functionality for model articulation, calibration, and optimization; and support for national laboratory and private-sector application of the SDK to create new market-facing tools and services.

Summary of Review Comments

There was general consensus among reviewers that this project is relevant to Building Technologies Office goals, is making very good progress toward stated goals, and has the potential to impact energy savings through building optimization. However, one reviewer suggested tracking additional metrics for OpenStudio to better understand the number of people who are actually using the tool and the number of design projects that are affected. Views on the approach were varied. One reviewer felt rigorous "curated" crowd-sourcing to vet components contributed by non-core developers insulates the project from risk; another reviewer questioned whether enough skilled users would participate in the vetting process; and a third noted that this approach would help drive innovation, accessibility, and community adoption while keeping development costs low.



Project # CBI-22: Energy Design Assistance Project Tracker

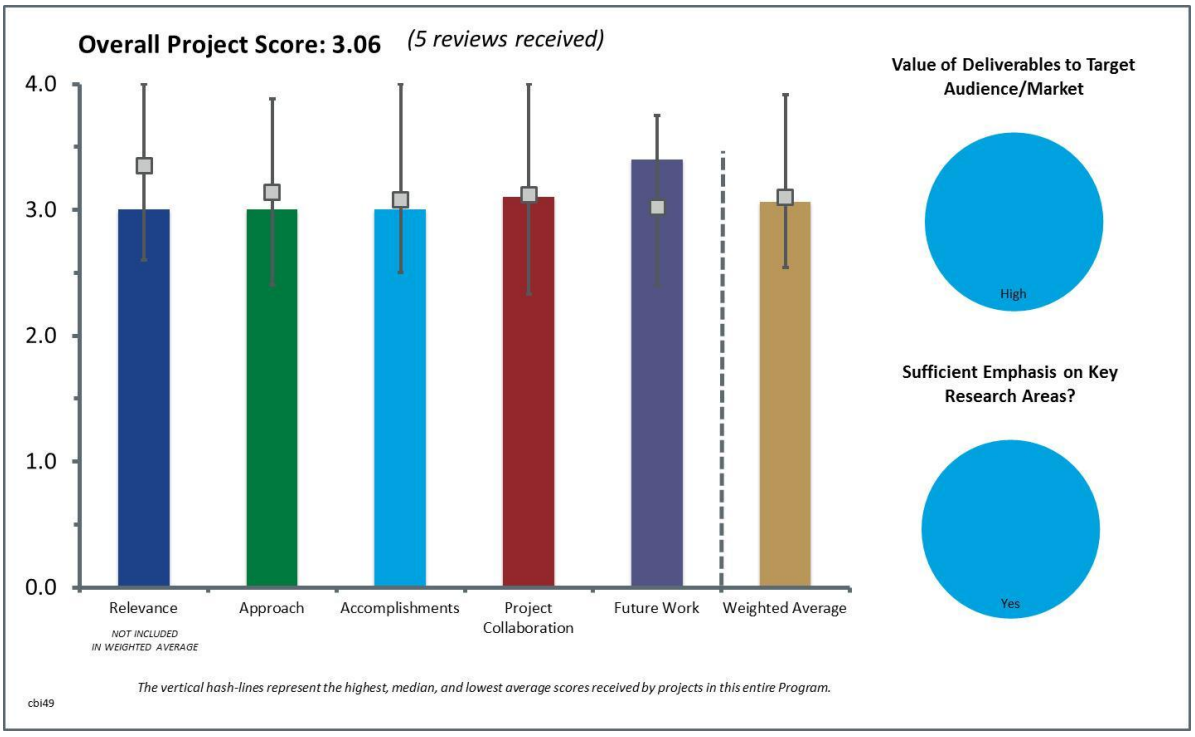
Presenter: Larry Brackney, National Renewable Energy Laboratory, larry.brackney@nrel.gov
DOE Manager: Amir Roth, 202-287-1694, amir.roth@ee.doe.gov

Project Description

The Energy Design Assistance Program Tracker (EDAPT) tracks and manages projects, performs automated quality checks of energy model designs, and generates project documentation and reports for commercial buildings. The ultimate goal of this project is to develop cost control best practice guidance that key industry users (building owners, architects, designers, energy champions, etc.) can incorporate into their everyday workflows. This project also includes compiling and disseminating data about the cost effectiveness of net zero energy (NZE) buildings that use innovative technologies and design approaches. By demonstrating how to combine NZE technologies and design approaches into an overall efficiency package that can be implemented at minimal incremental capital cost, this project will help expand the domain of NZE design and construction.

Summary of Review Comments

Although the project generally received high marks, the review team was divided on the project's progress. Some stated that the project has had and will have a significant impact, while others were confused about the project objective and said that the project has made no progress. One reviewer contended that the project is too early in development to assess its progress or value. The reviewers generally agreed that the project's stated deliverables target a market need; however, one reviewer said it is unclear how the project supports Building Technologies Office goals. Reviewers recommended increasing the number of utilities involved in the project.



Project # CBI-23: CBEI: OpenStudio Enhancements for Whole-Building Daylighting, Airflow, and Energy Modeling Leveraging Interoperable Building Information Modeling Data

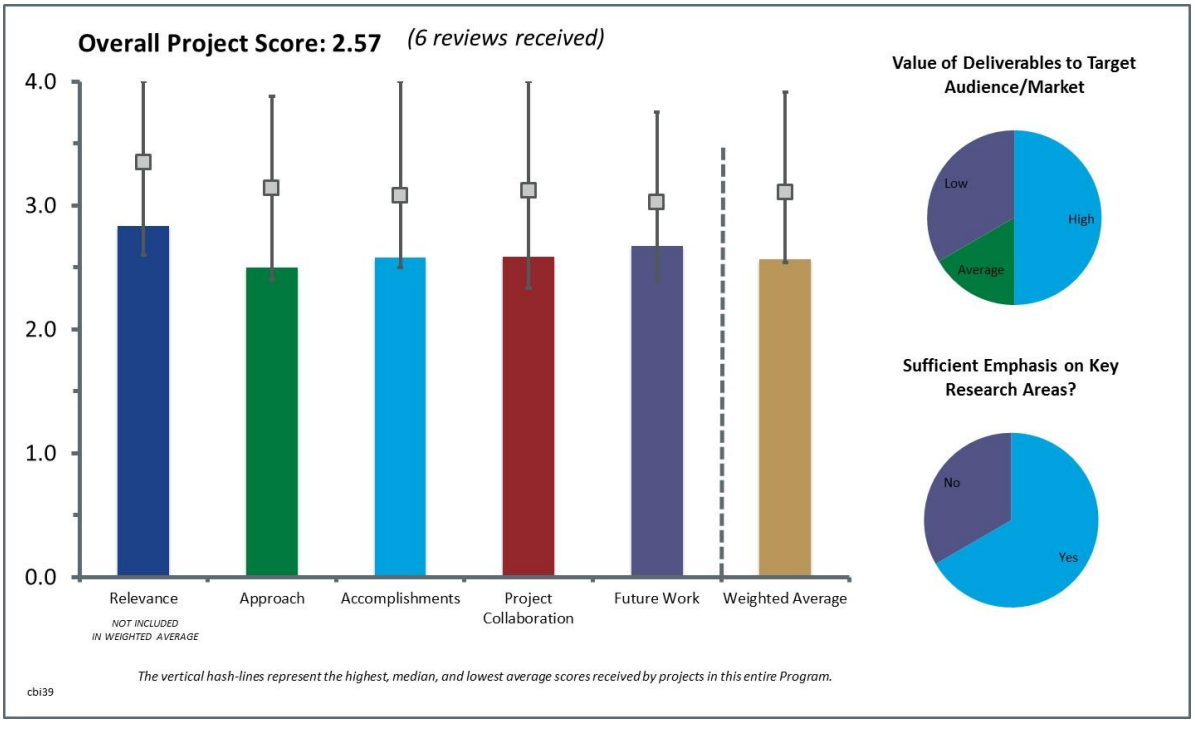
Presenter: John Messner, The Pennsylvania State University Consortium for Building Energy Innovation, jmessner@engr.psu.edu
DOE Manager: Cody Taylor, 202-287-5842, cody.taylor@ee.doe.gov

Project Description

Energy modeling is often inconsistently applied in the small- and medium-sized commercial building market, in part because existing models are either too complex relative to the project size or not interoperable with other retrofit design tools. To address that issue, the U.S. Department of Energy and The Pennsylvania State University are working to enhance the functionality of OpenStudio, which is a cross-platform (Windows, Mac, and Linux) collection of software tools that support whole-building energy modeling. To this end, the project aims to boost retrofit projects and enable project teams to easily integrate energy, daylight, and airflow modeling into their design workflows.

Summary of Review Comments

Reviewers noted that the project has made significant progress toward its stated goals; however, there was concern that the use of the enhanced software tools, no matter how good, will have little effect on energy conservation. Specific project strengths cited include the focus on reducing the cost of modeling and adding a number of capabilities to the OpenStudio platform. Some reviewers felt that the project includes good collaborations, while others wrote that there is a lack of collaboration with relevant industry, end users, and research and educational centers. Reviewers commented that the project does not address all the relevant barriers and that some elements of the approach are unclear. They recommended putting more emphasis on end-user testing and strengthening collaborations.



Project # CBI-24: Commercial Building Energy Asset Score

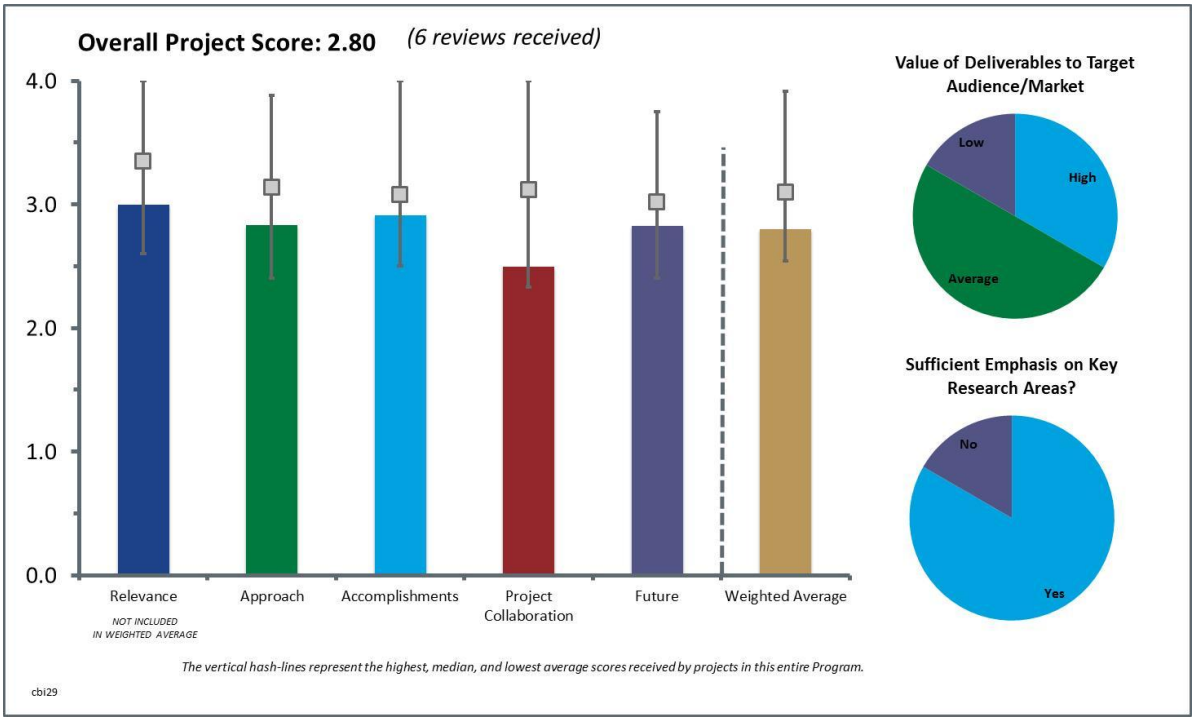
Presenter: Nora Wang, Pacific Northwest National Laboratory, nora.wang@pnnl.gov
DOE Manager: Joan Glickman, 202-586-5607, joan.glickman@ee.doe.gov

Project Description

One of the primary market barriers to enhancing energy efficiency in the commercial building sector is that building owners and investors lack a reliable and low-cost source to understand a building's as-built efficiency and identify opportunities for cost-effective improvements. While the ENERGY STAR Portfolio Manager can be used to assess operational building energy consumption, building stakeholders do not have a consistent basis for determining whether the differences in energy use between two similar buildings are associated primarily with installed building systems or with operational choices. The Commercial Building Energy Asset Score addresses this market barrier by providing a standardized approach for assessing the as-built energy efficiency of commercial buildings independent of occupancy and operational choices. This information is important for building owners and investors to make retrofit decisions and for appraisers and buyers to use as a tool to value energy efficiency during a real estate transaction. The Asset Score can also inform local governments and utilities about their building stock and help them to develop appropriate goals and incentive programs.

Summary of Review Comments

Reviewers praised the project's goal of developing a free and simple modeling tool to encourage lower energy use; however, many reviewers felt that this tool offers few benefits over other scoring systems. Some reviewers commented favorably on the project's potential and future plans; however, one reviewer expressed that the project has used its financial resources poorly and lacks a clearly defined method to validate its scores, offers no explanation on how future work is prioritized, and fails to address significant barriers. Reviewers recommended that the project work to gain additional market buy-in and engage more partners and stakeholders. Also, reviewers suggested further emphasizing quality assurance protocols and score validation.



Project # CBI-25: American Institute of Architects 2030 Commitment Enabled by Energy IQ

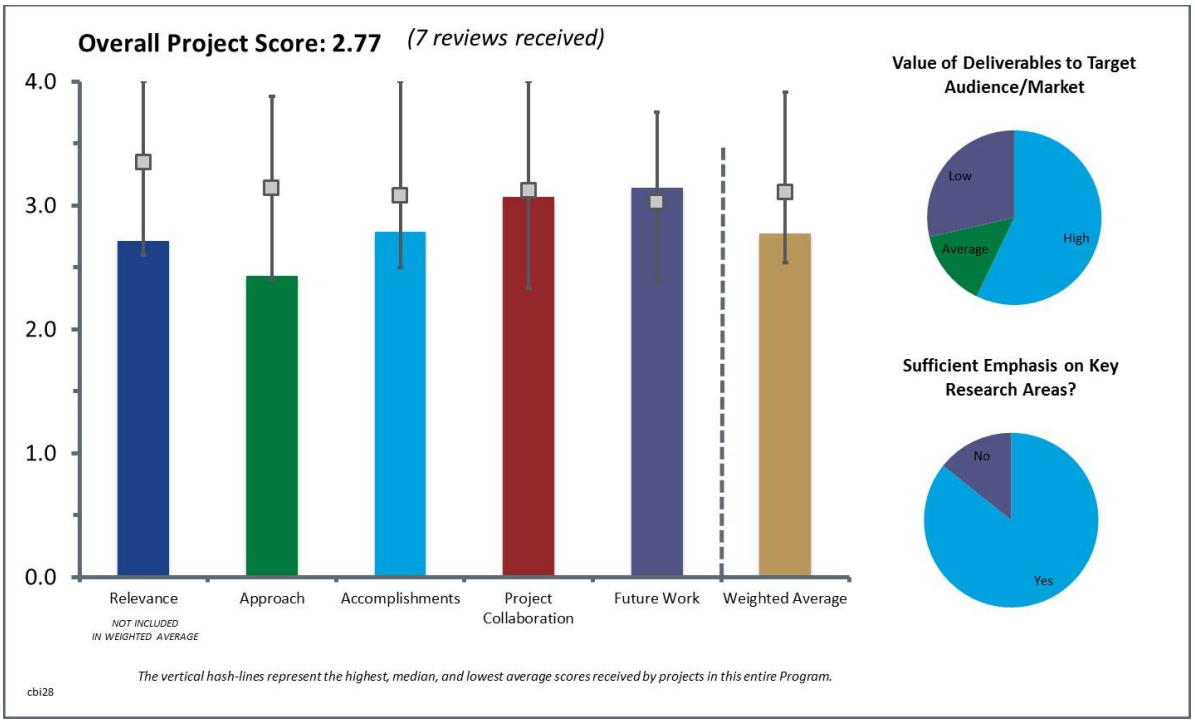
Presenter: Kevin Settlemyre, Lawrence Berkeley National Laboratory, kfs@sustainable-iq.com
DOE Manager: Cody Taylor, 202-287-5842, cody.taylor@ee.doe.gov

Project Description

This project aims to expand participation in the American Institute of Architects (AIA) 2030 Commitment, which asks organizations working in the built environment to make a pledge, develop action plans, and implement steps to construct carbon-neutral buildings by the year 2030. To increase participation, this project is developing a tool that makes documentation of this process easier. This effort will, in turn, develop a larger data sampling that the U.S. Department of Energy (DOE) can use to gain insight into a range of challenging questions, such as the role of performance simulation in energy savings for projects. In addition, this data set can help DOE create comparisons to building projects that have been uploaded to the Building Performance Database.

Summary of Review Comments

According to reviewers, the project will enable AIA firms to more easily track and record progress toward the 2030 energy efficiency objectives. Strengths cited include the project's focus on providing valuable data to the industry and striving to close the gap between design and actual energy performance. Also, reviewers commended the participation of large architectural companies and the support from AIA. However, reviewers were concerned that the focus on such a long-term goal (2030) might hinder the project, that the data might not capture actual energy performance because they are based on initial design results, and that the participation of architectural firms is too limited. Reviewers recommended incentivizing participation, building questions into the design of the data collection fields, placing greater emphasis on the usability feedback, and validating energy-savings levels for each building participant.



Project # CBI-26: Better Buildings Energy Data Accelerator Support

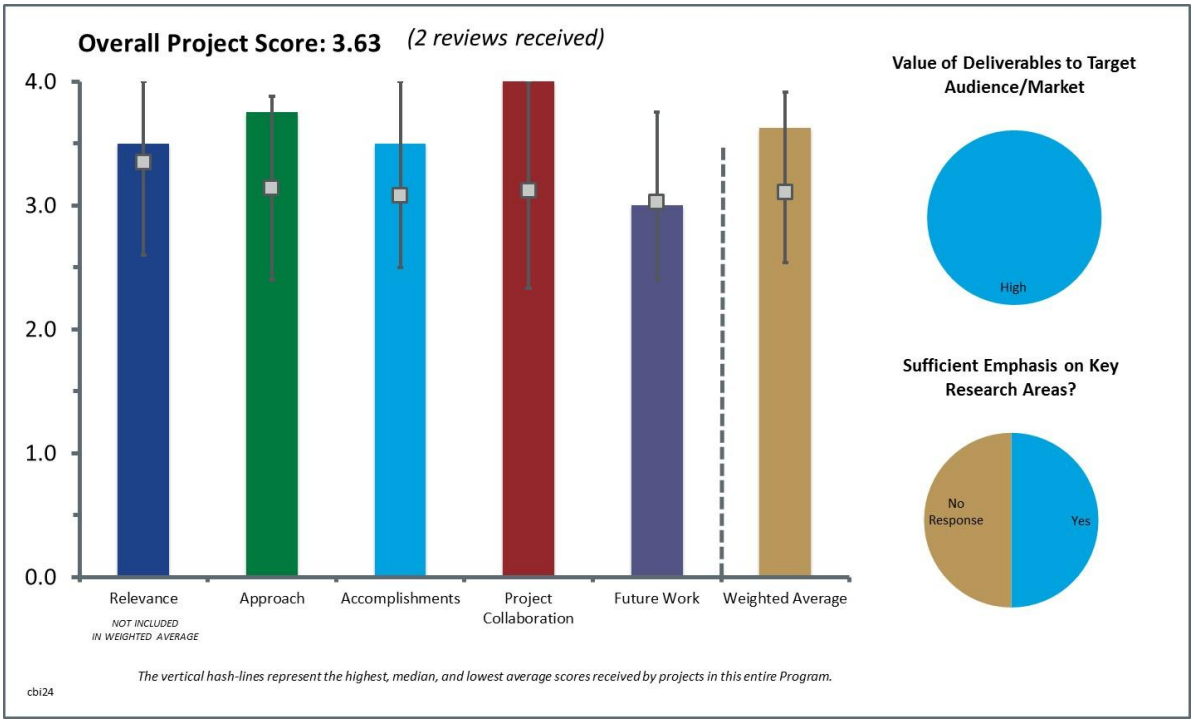
Presenter: Monisha Shah, National Renewable Energy Laboratory, monisha.shah@nrel.gov
DOE Manager: Cody Taylor, 202-287-5842, cody.taylor@ee.doe.gov

Project Description

Through the Better Buildings Energy Data Accelerator, local governments are joining forces with their utilities so that commercial and multifamily building owners can more easily access whole-building energy usage data. This effort helps building owners—especially those with multiple tenants—break through barriers to energy information, which is needed to manage energy and benchmark their buildings. In addition, this coordinated interaction with utilities is set to encourage utility uptake of Building Technologies Office (BTO) tools and technical resources.

Summary of Review Comments

Reviewers agreed that the project addresses BTO goals by developing solutions to the challenges of quantifying and benchmarking whole-building energy consumption and of accessing utility billing data while addressing privacy concerns. According to reviewers, the project has identified relevant barriers and has a good plan for stakeholder engagement. One reviewer noted significant geographic coverage but wondered whether the goal of 20% of relevant buildings could be "loftier." Reviewers suggested investigating any regulatory issues—including potential National Association of Regulatory Utility Commissioners involvement—and ensuring local customer buy-in.



Project # CBI-27: Architecture 2030 District Toolkit

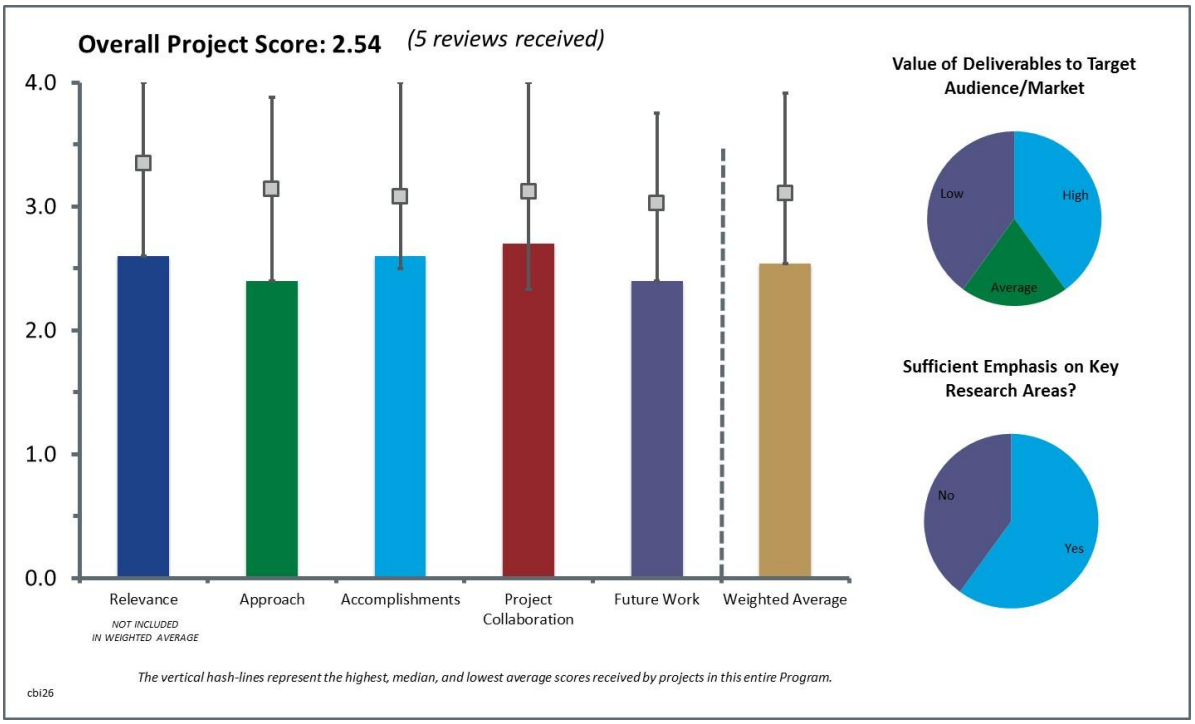
Presenter: Cindy Regnier, Lawrence Berkeley National Laboratory, CMRegnier@lbl.gov
DOE Manager: Priya Swamy, 202-287-1875, priya.swamy@ee.doe.gov

Project Description

This project aims to create programmatic guidance and a technical toolkit to support the promotion, development, and execution of 2030 District energy efficiency savings programs for small commercial office and retail buildings across the nation. The 2030 District program guides and technical toolkit—which can achieve savings of 20%–50% in commercial buildings—address the specific energy efficiency needs of the small commercial building sector, providing a suite of organizational, analysis, implementation, and verification methodologies, as well as tools and resources, to meet the 2030 Challenge for Planning targets for >20% energy reductions in small commercial buildings.

Summary of Review Comments

Reviewers had varied views on this project. Most reviewers agreed that targeting the 2030 Districts is a good idea, but most also felt that the project team's engagement with the 2030 Districts is insufficient for success. One reviewer was generally critical of the project's approach and suggested that local Building Owners and Managers Association or ASHRAE chapters should take on this work. Two reviewers stated that the project is a beneficial leverage of the District 2030 initiative and has a good engagement model. However, three reviewers saw the project as weak with a poorly developed toolkit; unclear direction for how the tools would be applied; and limited understanding of the cost-sensitive and fragmented market of small business owners, as well as their challenges in addressing energy efficiency. One reviewer said project collaboration is strong, while others said critical information about relationships with local entities was missing in the presentation. Overall, reviewers thought the project would benefit from continued development of best practices, and one noted that this early demonstration phase could be used to learn what tools and processes might work and determine how best to motivate the tools' application.



Project # CBI-28: Advanced Commercial Buildings Initiative

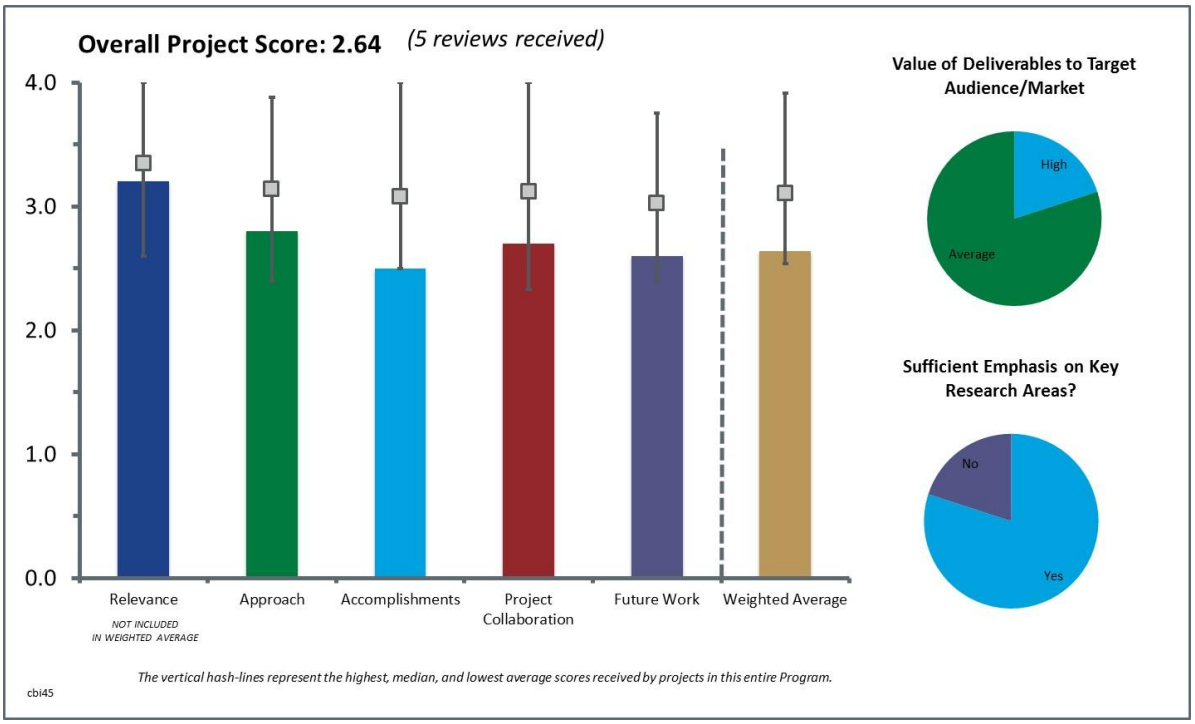
Presenter: Sydney Roberts, Southface Energy Institute, sroberts@southface.org
DOE Manager: Priya Swamy, 202-287-1875, priya.swamy@ee.doe.gov

Project Description

The Southface Advanced Commercial Buildings Initiative (ACBI) leverages existing local and regional commercial energy efficiency programs and U.S. Department of Energy resources to create research-driven solutions. Small commercial building decision makers do not generally have the information, time, or financing available to prioritize energy efficiency improvements. Traditional building professional services (e.g., energy modeling and building certification) are too expensive for small commercial project budgets. ACBI is working to overcome market barriers to broad adoption of deep energy packages for new and existing small commercial buildings under 50,000 square feet. ACBI is helping to develop simple, affordable energy efficiency evaluation and upgrade tools that meet or exceed the Architecture 2030 Challenge targets, including a 50% energy improvement in new construction and a 20% decrease for existing buildings via cost-effective engagement with third-party building performance experts.

Summary of Review Comments

There was general consensus that the project's concept is consistent with Building Technologies Office priorities and that the team understands the barriers to energy efficiency implementation for commercial buildings. However, some reviewers felt the approach to addressing those barriers is uncertain and diffuse. According to reviewers, the project comprises several sub-projects. One reviewer saw the diversity as a multiplicity of strategies that could prove out models for deployment, while others saw little integration, poor strategic direction, and dilute focus. All agreed that collaborations are critical to this project's success and that the team comprises a variety of stakeholders, but some felt the approach is too remote and unfocused for an arena requiring hands-on consultation. Most reviewers rated the project's value as average and were unclear about ultimate outcomes or their impacts. One reviewer expressed concerns about the EarthCraft ratings system, noting that there is already a nationally recognized system—Leadership in Energy & Environmental Design (LEED) certification. Reviewers suggested increasing stakeholder integration and developing clearer communication strategies.



Project # CBI-29: Pre-Packaged Commercial Property-Assessed Clean Energy (PACE) Financing Solutions

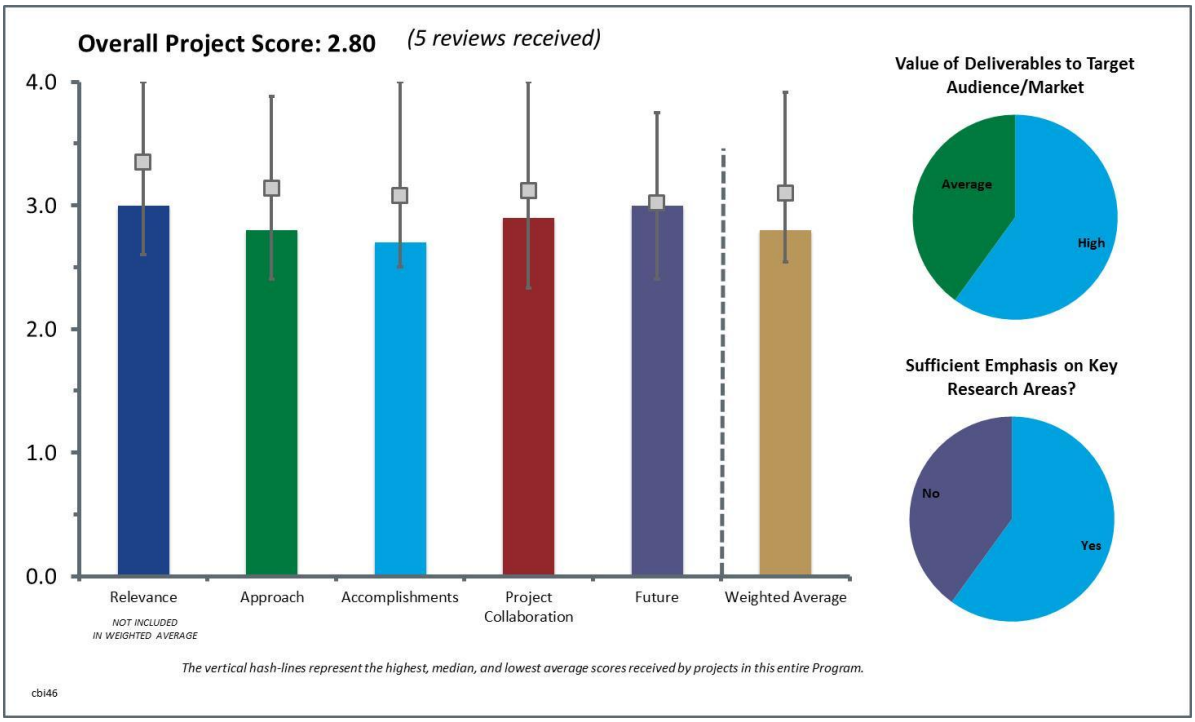
Presenter: Michael Wallander, EcoCity Partners, michael@ecocitypartners.com
DOE Manager: Priya Swamy, 202-287-1875, priya.swamy@ee.doe.gov

Project Description

The objective of the EcoCity Partners' project is to demonstrate a more streamlined method for facilitating commercial property assessed clean energy (PACE) retrofits. The project is seeking to prove that energy efficiency performance of simple, prepackaged technologies—such as lighting and heating, ventilation, and air conditioning—can be accurately estimated without the need for a detailed energy audit. The project is funding 25 small commercial building retrofits across five building types in Palm Beach County, Florida. A successful project will prove the accuracy of pre-project estimates for multi-technology, prepackaged retrofits, eliminating the need for a pre-project audit without compromising owner or investor confidence. EcoCity Partners will be measuring project results both quantitatively (i.e., number of projects) and qualitatively (i.e., accuracy of results). Intermediate and long-term success will be measured by evaluating replication within the PACE community.

Summary of Review Comments

Most reviewers agreed that the project addresses two critical barriers to energy efficiency implementation in the small commercial buildings sector: financing and ease of use. According to one reviewer, the concept is good, the approach is simple, and the project uses existing financing mechanisms. However, another reviewer expressed concerns that there is a lack of emphasis on achieving energy savings. Most reviewers felt the project is on its way to a strong collaboration model. Reviewers suggested focusing more on verification, developing a risk mitigation strategy, and reconsidering having a vendor rather than a neutral party lead building owner engagement.



Project # CBI-30: America Saves! Energizing Main Street's Small Businesses

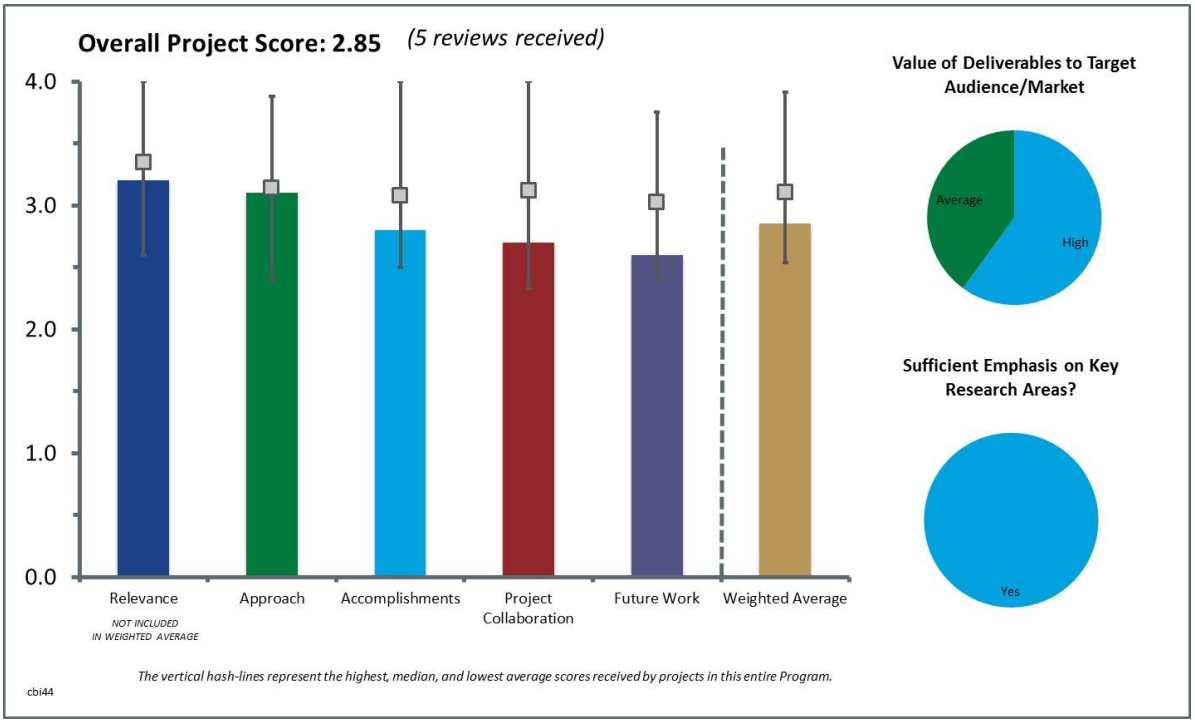
Presenter: Ric Cochrane, National Trust for Historic Preservation, ric_cochrane@nthp.org
DOE Manager: Priya Swamy, 202-287-1875, priya.swamy@ee.doe.gov

Project Description

America Saves! is intended to create a model for retrofit implementation in millions of small businesses nationwide by aligning small businesses and utilities through large-scale data acquisition, cost-effective building analytics, and community-based retrofit delivery. The National Trust for Historic Preservation has partnered with the National Renewable Energy Laboratory and others to deploy, test, and validate scalable, low-cost tools for partners participating in regional pilot projects. The National Trust for Historic Preservation is also verifying savings resulting from retrofit projects conducted by these local program partners. The goals of this project are to (1) demonstrate a community-based approach to business engagement that enhances small business participation in energy retrofit programs and (2) evaluate technology-based tools to reduce cost and technical barriers to retrofit delivery in small businesses. The project is first focusing on three geographic regions: the Pacific Northwest, Upper Midwest, and Northeast, and it will work in both urban and rural Main Street communities—a network of communities focused on preservation-based economic revitalization.

Summary of Review Comments

The review team praised the project's community-based approach, including its strong emphasis on people and relationships. Reviewers noted that the project has a logical and innovative strategy, has identified key barriers, and includes a strong focus on data acquisition. However, reviewers commented that it is unclear how the project plans to engage the community and that collecting utility data may be more difficult than anticipated. One reviewer was concerned that using utility incentive programs for financing will hinder the project's potential to achieve significant energy reduction. Reviewers recommended conducting research on different regional cultures and challenges, identifying more local partners, focusing on a simple model, and developing partnerships with utilities from different markets to aid in data collection.



Project # CBI-31: Crowdsourced Microfinance for Energy Efficiency in Underserved Communities

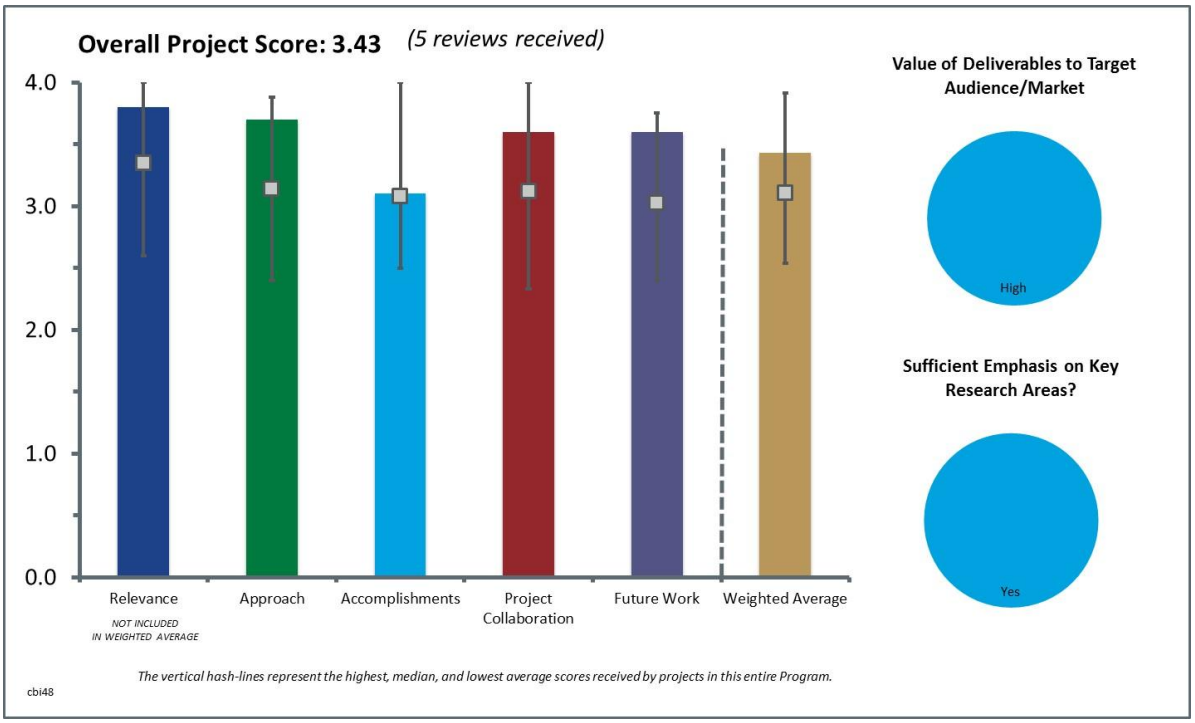
Presenter: Donnel Baird, BlocPower, Donnel@blocpower.org
DOE Manager: Priya Swamy, 202-287-1875, priya.swamy@ee.doe.gov

Project Description

BlocPower is developing a crowd-sourcing website to help market, finance, and install energy efficiency retrofits for 1,000 small buildings (under 50,000 square feet), including churches, schools, small businesses, and nonprofit organizations in low-income communities across the country. BlocPower's online platform connects individual and institutional investors who focus on social or environmental issues to energy efficiency project financing or investing opportunities. As part of an initial pilot program, the project is targeting retrofit projects in Boston, Massachusetts; Cleveland, Ohio; Raleigh-Durham, North Carolina; and Baltimore, Maryland. BlocPower is also partnering with companies in these areas to train local residents in small building retrofits.

Summary of Review Comments

The review team applauded the project's efforts to target underserved communities with an innovative financing structure. Reviewers noted that the project is working toward a viable solution with an excellent approach, has identified and addressed important barriers, and has leveraged important partners. Reviewers identified as project weaknesses the model's complexity, the limited consideration for engagement with potential clients, and the lack of focus on long-term energy performance verification. One reviewer suggested engaging in further collaboration efforts with others who are developing similar programs aimed at smaller buildings.



Project # CBI-32: Small Market Advanced Retrofit Transformation Program (SMART Scale)

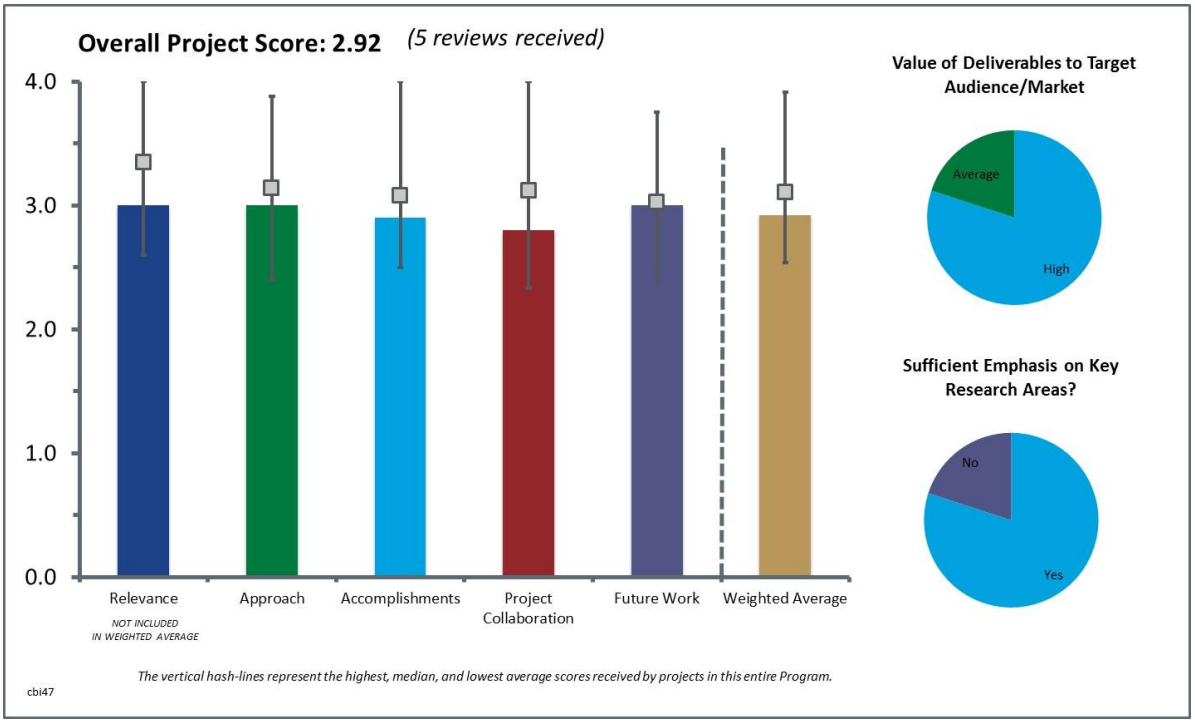
Presenter: Colin Clark, Ecology Action of Santa Cruz, CClark@ecoact.org
DOE Manager: Priya Swamy, 202-287-1875, priya.swamy@ee.doe.gov

Project Description

Ecology Action's Small Market Advanced Retrofit Transformation (SMART Scale) program is a new technical, business, and implementation model for delivering energy efficiency measures in small (50,000 square feet or smaller) commercial buildings. Nationally, this market segment includes 4.6 million businesses and represents 40% of annual commercial building energy consumption. The SMART Scale program offers a platform designed for utility and government administrators of energy efficiency programs for small- and medium-sized buildings. SMART Scale is looking to achieve an average of 20% energy savings per building by offering a comprehensive set of measures, integrated financing tools, and expedited project measurement and verification via a contractor-driven delivery model. Ecology Action is also seeking to transfer the ability to deliver deep retrofits to contractors nationwide and ensure that these contractors can reach an average of at least 20% savings at scale.

Summary of Review Comments

The reviewers were divided over the project's ability to meet Building Technologies Office objectives. Some reviewers noted that the project engages key stakeholders, has a strong analytical approach, and demonstrates substantial potential. However, some reviewers commented that the scope is too narrow and that the project is missing key stakeholders, such as contractors, owners, and tenants. One reviewer expressed concern that if the project focuses too heavily on "low-hanging fruit," it could make it harder to cost-effectively make all the improvements needed to meet 2030 goals. Also, one reviewer observed that the materials were not clear or comprehensive. Reviewers suggested testing the toolkit in a practical setting and integrating additional resources to achieve greater energy reductions.



Project # CBI-33: Small Buildings Small Portfolio Commercial Upstream Incentive Project: Regional Roll-Out

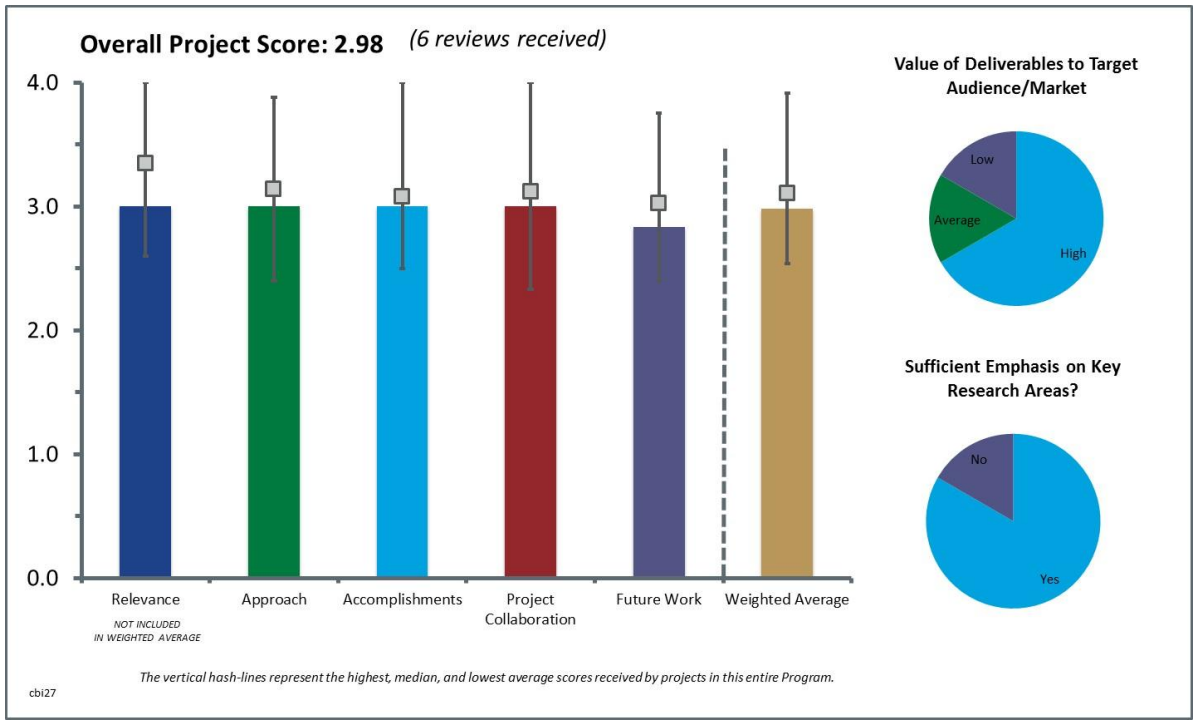
Presenter: Todd Levin, Argonne National Laboratory, tlevin@anl.gov
DOE Manager: Priya Swamy, 202-287-1875, priya.swamy@ee.doe.gov

Project Description

To cost-effectively spur energy efficiency improvements in the small buildings and small portfolios (SBSP) sector, this project is evaluating how to expand commercial upstream incentive approaches to a level that will be nationally replicated. In particular, the project will test a Commercial Upstream Incentive Regional Roll-Out program—which incentivizes business-to-business distributors and suppliers for building maintenance, repair, and operation—to address region-specific challenges, such as regulatory constraints and energy pricing dynamics. By collaborating with regional energy partners and building on expertise from earlier commercial upstream incentive projects, this effort aims to help utility energy efficiency programs overcome common barriers to engaging SBSP audiences.

Summary of Review Comments

Overall, reviewers noted that the project shows promise in changing the buying habits of businesses, although one reviewer felt that this project would have little impact on building energy use. Reviewers commented that the project has made satisfactory progress to date; has partnered with important stakeholders; and has a straightforward, manufacturer-focused approach. However, reviewers also observed that the scope of the project is too narrow and that many states already have similar programs. One reviewer noted that the project fails to address the challenge that leasing relationships do not incentivize landlords or tenants to be concerned with energy savings. Reviewers suggested moving the project's focus beyond simple products, adopting a more holistic approach, and coordinating with similar programs.



Project # CBI-34: Assessment of Evaluation, Measurement, and Verification Methods

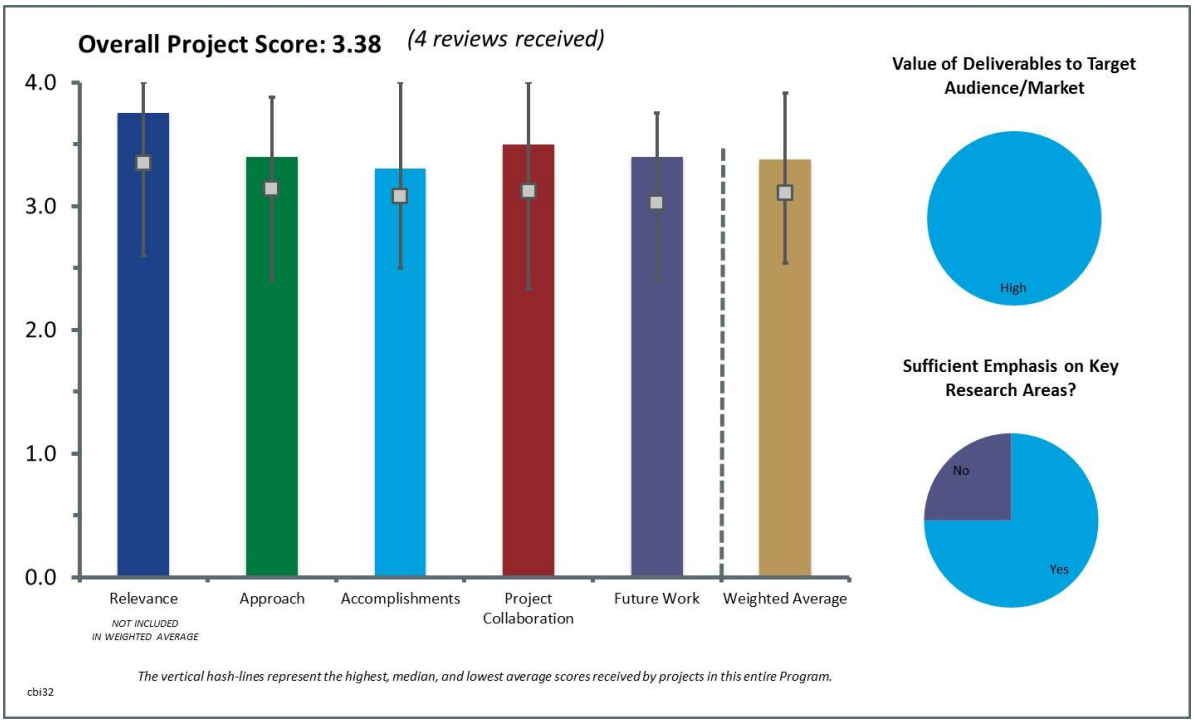
Presenter: Jessica Granderson, Lawrence Berkeley National Laboratory, JGranderson@lbl.gov
DOE Manager: Cody Taylor, 202-287-5842, cody.taylor@ee.doe.gov

Project Description

Common approaches to quantify building energy savings often rely on estimates because actual measured approaches are costly and difficult to scale, among other reasons. To address this issue, the U.S. Department of Energy and Lawrence Berkeley National Laboratory are leveraging smart meters, devices, and analytics to enable the delivery of streamlined measurement and verification (M&V) that reduces cost while increasing the speed and accuracy of measured approaches. Ultimately, these efforts can bring about more pervasive adoption of whole-building-focused energy-saving tactics that move beyond single measures.

Summary of Review Comments

According to reviewers, the project addresses a key market need and features good stakeholder engagement and collaboration. Cited project strengths include (1) a narrow focus that allows core industry needs to be addressed; (2) potential to increase confidence in automated data capture; and (3) a cost-effective approach. Weaknesses identified by reviewers include (1) challenges in demonstrating persistent behavioral impacts, (2) a high error rate, and (3) dependence on buy-in from evaluation contractors. Reviewers recommended (1) bringing M&V data approaches into wider practice, including consolidation and standardization of data acquisition, and (2) conducting more extensive outreach to utilities, both individually and collectively.



Project # CBI-35: Real Performance for Real Buildings

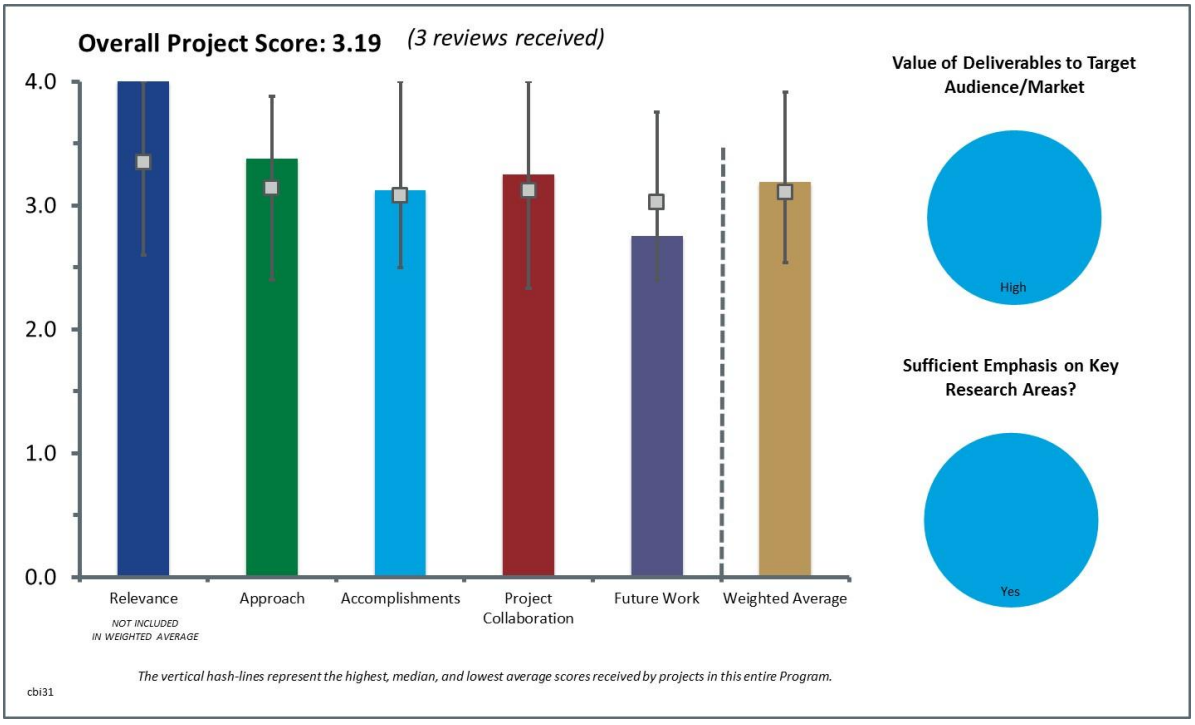
Presenter: Shanti Pless, National Renewable Energy Laboratory, shanti.pless@nrel.gov
DOE Manager: Cody Taylor, 202-287-5842, cody.taylor@ee.doe.gov

Project Description

This project aims to develop deployable resources to assist building decision makers in understanding and replicating the benefits of using measureable energy performance targets to better connect design and operations. By using energy modeling to produce whole-building energy impact ranges, this project will develop a process to help building owners and designers meet energy performance goals and identify technologies that reduce the risk of not realizing energy performance. Project partners also plan to share actions that owners and operators take to meet energy performance goals, including action-focused case studies based on sample buildings.

Summary of Review Comments

Reviewers agreed that the project addresses an important and well-documented problem regarding unrealized energy savings in energy-efficient buildings. The reviewers commended the use of an advisory group with real-world experience in addition to modeling, and they felt the group's composition is a particular strength. They agreed that the project has met key targets thus far and that future success depends on further outreach. One reviewer suggested incorporating change management practices, and another noted the importance of leveraging—and not duplicating—work that has already been done.



Project # CBI-36: Best Practices for Controlling Capital Costs in Net Zero Energy Design and Construction

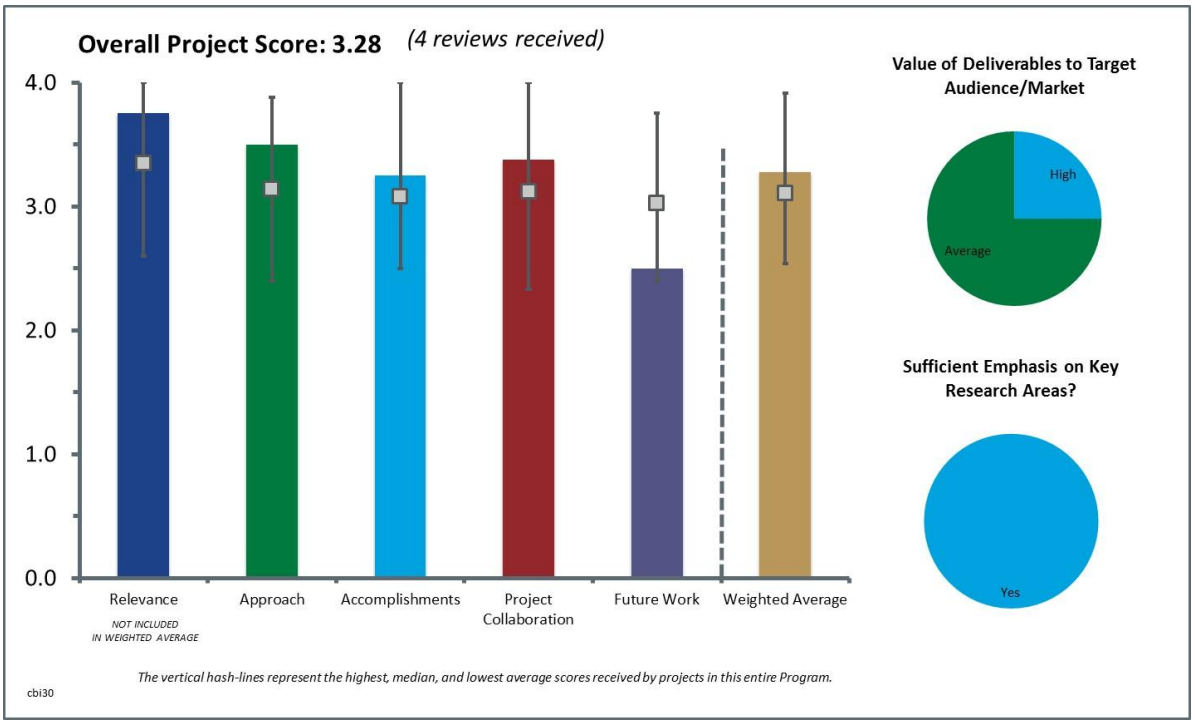
Presenter: Shanti Pless, National Renewable Energy Laboratory, shanti.pless@nrel.gov
DOE Manager: Cody Taylor, 202-287-5842, cody.taylor@ee.doe.gov

Project Description

For net zero energy (NZE) building performance to become the norm in new commercial construction, it is necessary to demonstrate that NZE can be achieved cost effectively. This project aims to increase and accelerate the adoption of NZE design and construction practices by changing the perception of NZE as being cost-prohibitive. To that end, the project is producing a NZE cost control guide and a two-page fact sheet, which project managers plan to share with early adopters. In the meantime, market outreach partners plan to provide training and technical assistance to help NZE building owners and practitioners adopt best practices. In the long term, the project will encourage peer organizations to replicate the successes of early adopters.

Summary of Review Comments

Reviewers agreed that controlling NZE building costs is important to achieving Building Technologies Office goals. They felt the approach is solid and noted the early involvement of key stakeholders. One reviewer was particularly enthusiastic about the U.S. Army's participation. Reviewers commented that the project has the potential to provide value, but noted that the concept is challenging and will not necessarily have broad success. One reviewer cited the difficulty in gathering sufficient information to make the materials useful because much of the information may be proprietary, and another thought a sector-specific approach would be more likely to gain traction. Two reviewers suggested that a clear long-term outreach plan is needed.



Project # CBI-37: Better Buildings Alliance Tech Team Impact Framework

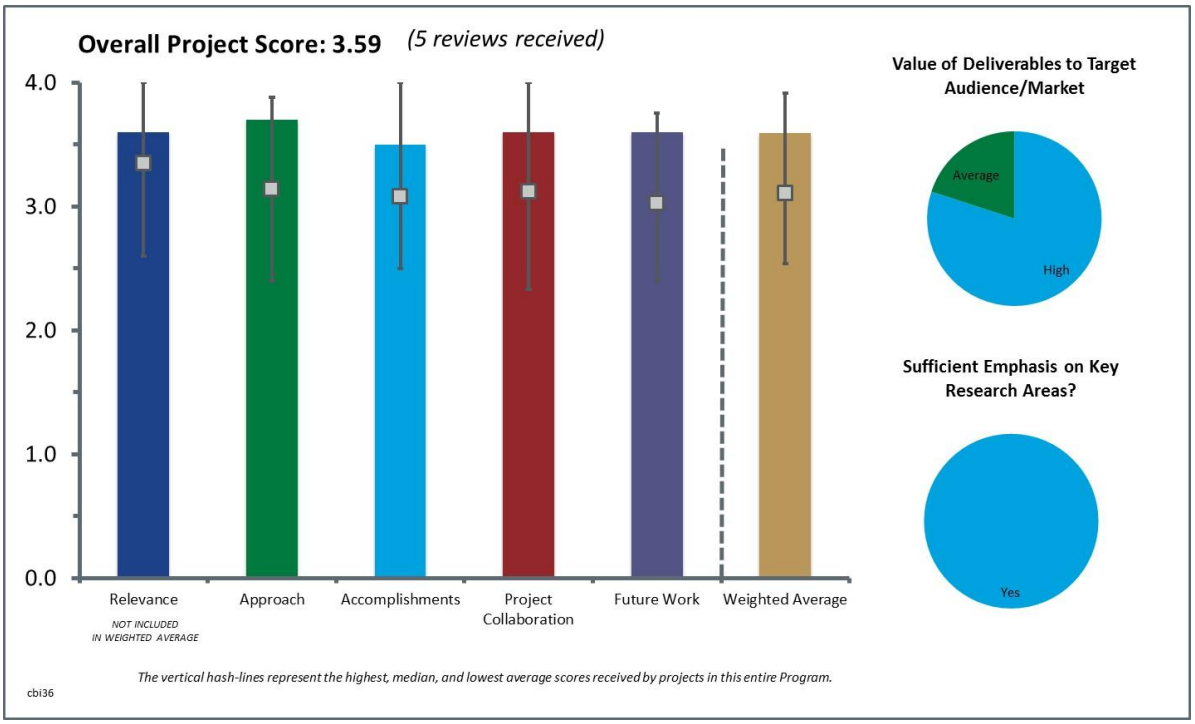
Presenter: Amy Jiron, U.S. Department of Energy, amy.jiron@ee.doe.gov
DOE Manager: Kristen Taddonio, 720-356-1779, kristen.taddonio@ee.doe.gov

Project Description

The High Impact Technology (HIT) catalyst is designed to help identify and prioritize cost-effective, underutilized, energy-efficient technologies. Commercial building owners, operators, and designers; technology providers; utilities; and governments can use this information to focus resource development and deployment activities. The U.S. Department of Energy (DOE) deploys HIT catalysts through partnerships with the commercial buildings industry via the Better Buildings Alliance, federal leaders, regional nonprofits, and efficiency organizations. Short- and mid-term goals include creating a market-facing map of the building technology landscape; long-term goals include collecting data through HIT catalyst deployment activities to support voluntary programs, codes, and standards.

Summary of Review Comments

Reviewers described the project as well aligned with Building Technologies Office goals and valuable to project collaborators. Cited project strengths include that it (1) creates a formal path for introducing new technologies to the marketplace, (2) weaves multiple efforts into an easily understood project, and (3) benefits from effective stakeholder collaboration. Limits in technology, too much reliance on the Alliance in bringing technologies to market, and a lack of consideration of building systems were noted as project weaknesses. Reviewers recommended that the project (1) document and communicate best practices and findings from the HIT campaigns, (2) operate from a robust understanding of the unique market drivers for each technology, and (3) include an assessment of each technology's operation and maintenance needs and strategies to help overcome market reluctance. Reviewers also recommended that any future presentations or communications indicate how this work is integrated with other DOE programs.



Project # CBI-38: Energy Management and Information Systems Study

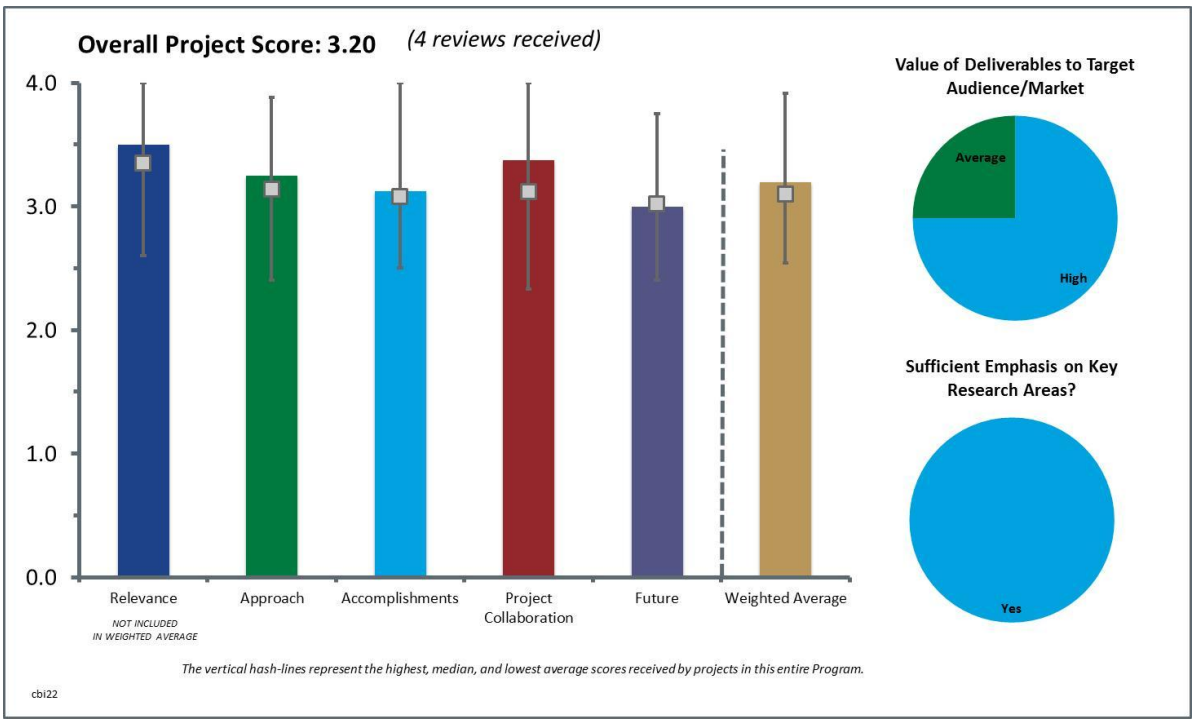
Presenter: Jessica Granderson, Lawrence Berkeley National Laboratory, JGranderson@lbl.gov
DOE Manager: Kristen Taddonio, 720-356-1779, kristen.taddonio@ee.doe.gov

Project Description

This work aims to give Better Buildings Alliance members the information they need to adopt technologies that enable greater building energy savings and persistent low-energy operations. With the right resources, members will be able to overcome barriers to implementing energy management and information systems (EMISs) and use the resulting foundation of common knowledge to ground EMIS technology demonstrations in fiscal year 2015. The project focuses on high-value topics related to the use of data and information systems, including current market offerings, prior research and existing guides, the landscape of utility programs and incentives, and best practices in EMIS use and procurement.

Summary of Review Comments

Reviewers agreed that the project is well aligned with Building Technologies Office efforts to promote commercialization and accelerate adoption of energy efficiency technologies. They noted building owners'/ operators' prevailing confusion about EMIS, stating that the "Cliff Notes"-type education, common language, and credible performance metrics offered through this project are just what building owners need to make decisions. Reviewers agreed that the project team represents a well-rounded group of stakeholders, noting the importance of growing the collaboration in later project stages. There was some concern about system costs (upgrades and labor) and some confusion about metrics. One reviewer stated that EMIS is defined broadly and suggested identifying systems by type when collecting data.



Project # CBI-39: CBEI: Demonstrating and Deploying Integrated Retrofit Technologies and Solutions

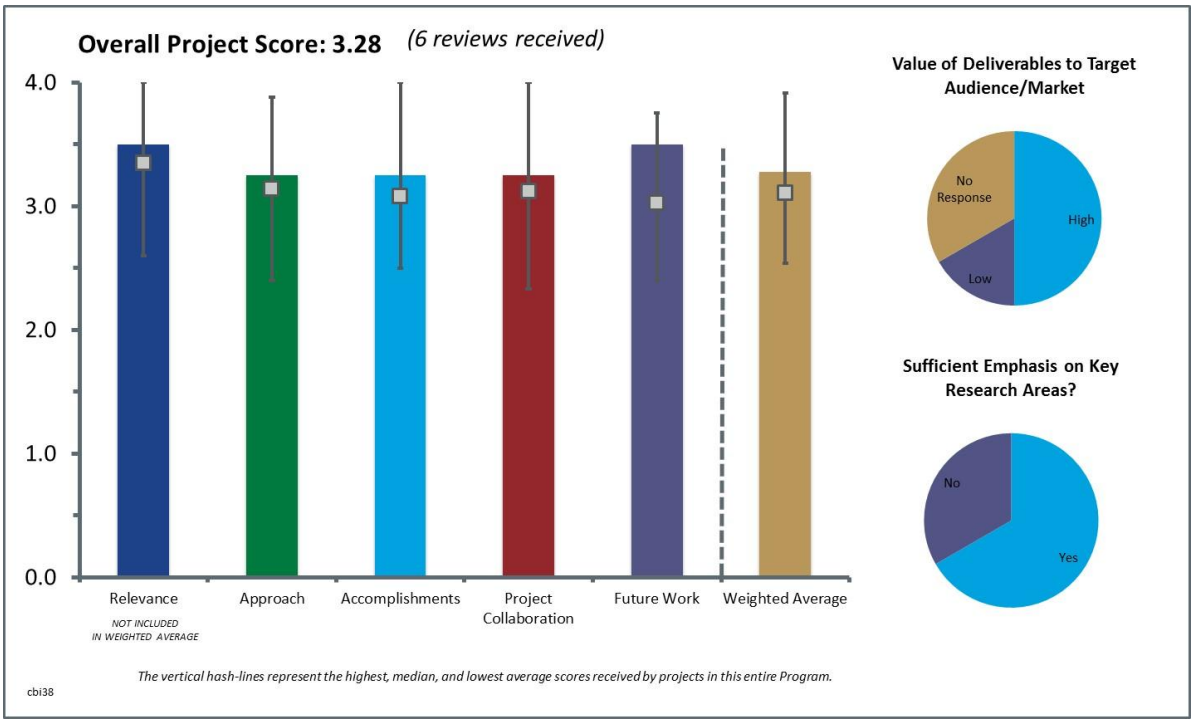
Presenter: Mark Stutman, The Pennsylvania State University Consortium for Building Energy Innovation, mbstutman@engr.psu.edu
DOE Manager: Cody Taylor, 202-287-5842, cody.taylor@ee.doe.gov

Project Description

The Penn State Consortium for Building Energy Innovation (CBEI) focuses on the development, demonstration, and deployment of energy-saving technologies and solutions that can achieve 50% energy reduction in small- and medium-sized commercial buildings (SMSCBs). The Penn State Consortium collaborates with other research institutions, nonprofits, and market partners across the United States to bring its regionally focused activities to a national audience, with the goal of replicating best practices and lessons learned at a local level. In this way, the Consortium aims to demonstrate and deploy elements of affordable, broadly applicable, validated methods to support the integration of technology and and deep energy efficiency retrofit solutions into the 5–10 year renovation/asset management plans of SMSCBs.

Summary of Review Comments

Reviewers praised the project's efforts to provide retrofit solutions to existing SMSCBs, a sector that reviewers noted has much potential for energy savings. Although one reviewer felt that the project needs a sharper focus, most of them stated that the project is well planned; has established good collaborations; and is retrofitting real buildings, which provides credible results. One reviewer was concerned about potential problems at bypasses and wall junctures, and another was concerned there is not enough outreach to relevant audiences. Reviewers suggested including more buildings in the study to confirm results, educating building owners on the best available technologies, and collaborating on financing mechanisms.



Project # CBI-40: CBEI: Cost-Effective Wall Retrofit Solution for the Interior Side of Building's Exterior Wall that Supports a Phased Retrofit Cost Model

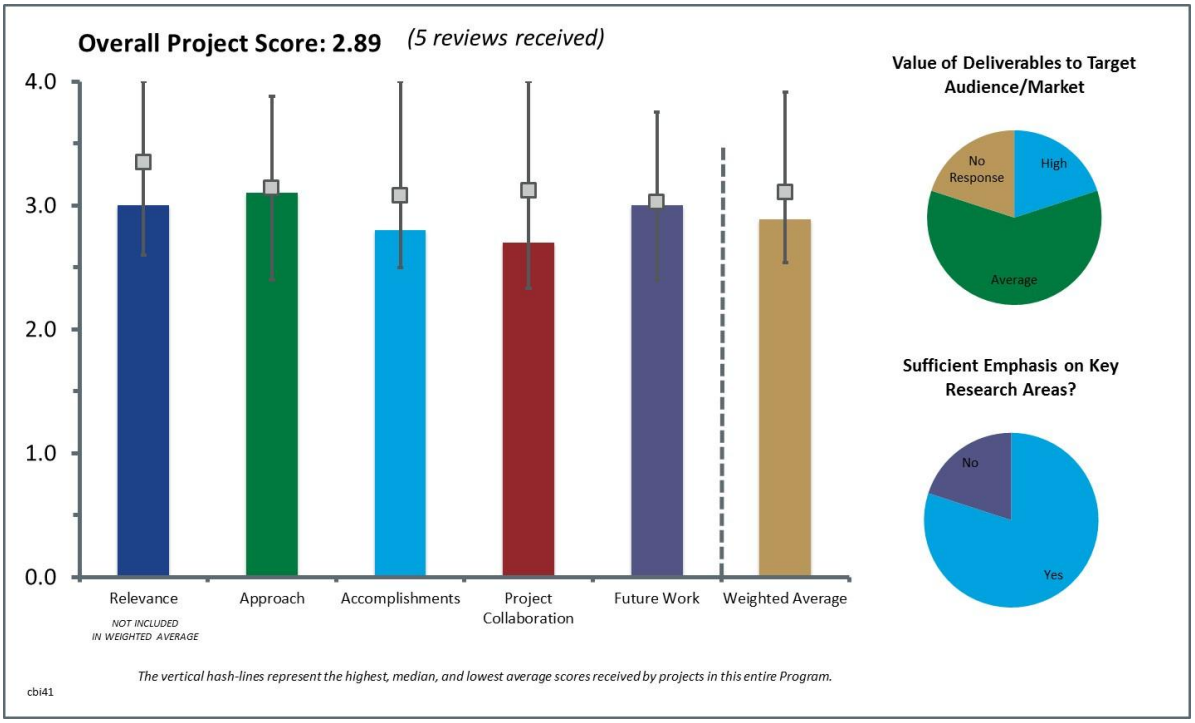
Presenter: Amy Wylie, Bayer MaterialScience/The Pennsylvania State University Consortium for Building Energy Innovation, amy.wylie@bayer.com
DOE Manager: Cody Taylor, 202-287-5842, cody.taylor@ee.doe.gov

Project Description

In order to achieve the required airtight envelope, commercial buildings with masonry facades in Climate Zones 4 and 5 are faced with the decision between vapor-permeable or impermeable insulation, as well as whether retrofits are needed to implement continuous insulation instead of conventional discontinuous insulation. Improper insulation and disregard for air and moisture transfer through a masonry wall system can lead to faster deterioration of brick and poor thermal performance. The goal of this project is to develop effective, energy-efficient retrofit solutions for building envelopes that can then be deployed to the commercial retrofit market and provide substantial energy and cost savings.

Summary of Review Comments

Reviewers had varied opinions on this project. Most believed that the project addresses an important need and that the stated objective is relevant to commercialization and adoption of an energy-efficient building technology. However, one reviewer saw the project goal as too broad and far-reaching and not representative of the project's stated objective. Another felt the proposed technology is not well characterized, and a third said the technology is too specific and would have limited market penetration. One reviewer thought the project team has clearly identified barriers and is taking a good approach, applauding the use of a flexible resource platform, while another felt that the barriers are clear but the solutions less so. A third reviewer said that the barriers are not clear. Some felt that this work had already been done by the Air Barrier Association of America. Reviewers also raised concerns about the price-sensitive and impact-to-tenant-sensitive nature of the target market, and the project team's lack of ability to address the non-technical issues.



Project # CBI-41: Green Leasing Deployment Portfolio

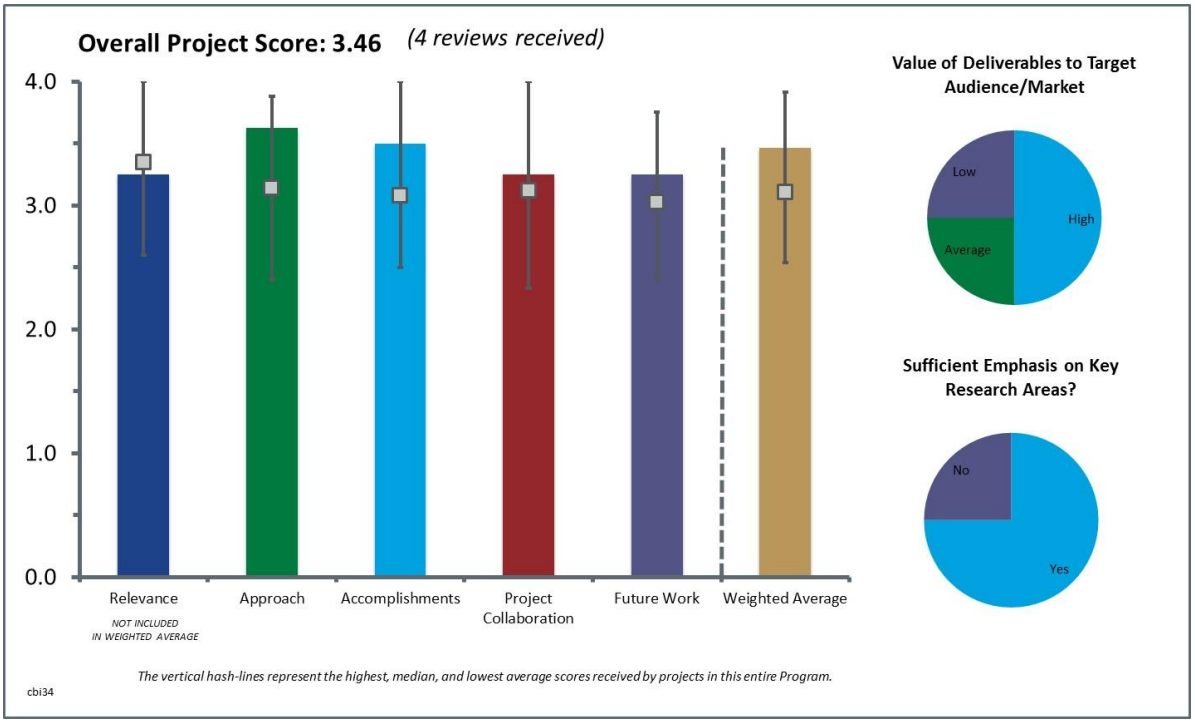
Presenter: Deb Cloutier, JDM Associates, dcloutier@jdmgmt.com
DOE Manager: Kristen Taddonio, 720-356-1779, kristen.taddonio@ee.doe.gov

Project Description

The goal of this project is to define and encourage the adoption of green leasing in commercial real estate by sharing tools, resources, and successes with landlords, tenants, and brokers. Green leasing is a powerful mechanism to improve the energy performance of existing commercial buildings. However, this potential often is not fully realized because of the "split-incentive" issue, which occurs when energy-cost savings from an investment accrue to a party that did not fund the project. To address this issue and ensure that green lease language is incorporated into leasing transactions, the project will help make green lease terms consistent and equitable. Ultimately, the efforts aim to expand norms for commercial lease terms such that energy-alignment features become commonplace in the industry.

Summary of Review Comments

According to reviewers, the project has the potential to substantially impact energy efficiency in the large market of leased space within commercial buildings. Reviewers noted that the project has addressed key barriers, established an excellent approach, developed a strong national education plan, and identified key stakeholders. However, one reviewer was concerned that the project does not deliver any information that is not already available to the public via other sources. Reviewers also noted that more work is necessary to appeal to commercial tenants. Reviewers recommended including specific metrics to identify the project's actual energy-saving potential, generating more outreach materials for the public, and developing key leaders within broker and leasing communities to promote the use of the project tools to their peers.



Project # CBI-42: Better Buildings Case Competition

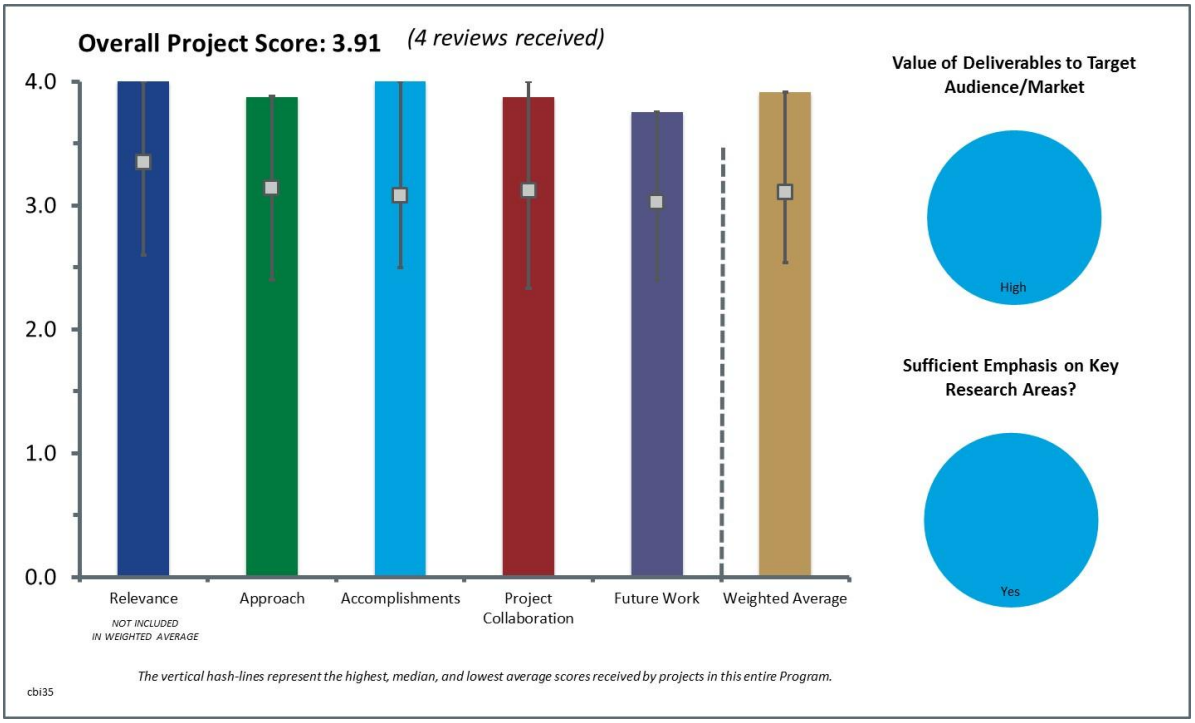
Presenter: Elena Alschuler, U.S. Department of Energy, elena.alschuler@ee.doe.gov

Project Description

The U.S. Department of Energy's annual Better Buildings Case Competition (BBCC) engages the next generation of engineers, entrepreneurs, and policymakers to develop creative solutions to real-world energy efficiency problems for businesses and other organizations across the marketplace. The BBCC works with building owners to describe barriers to implementing cost-effective, energy-efficient technologies in a "case." Once the case is developed, BBCC challenges interdisciplinary student teams to come up with innovative and replicable solutions. With these solutions, BBCC aims to help building owners achieve the Better Buildings 20% energy savings goal, while also preparing students for careers in clean energy and energy efficiency.

Summary of Review Comments

Reviewers saw the project as a low-cost, effective method of growing the energy efficiency workforce—the "next generation of energy efficiency champions," as one reviewer wrote—with a secondary benefit of producing innovative solutions to energy usage challenges. Reviewers noted that the project has been very successful in terms of enthusiastic participation. They were less certain about whether the solutions have been implemented and ultimately effective, or whether students did indeed go into successful careers in relevant areas. While they felt such follow-up information would be beneficial, one reviewer noted that it could be difficult to obtain.



Project # CBI-43: Demonstrations of Integrated Advanced Rooftop Unit Controls and Automated Fault Detection and Diagnostics

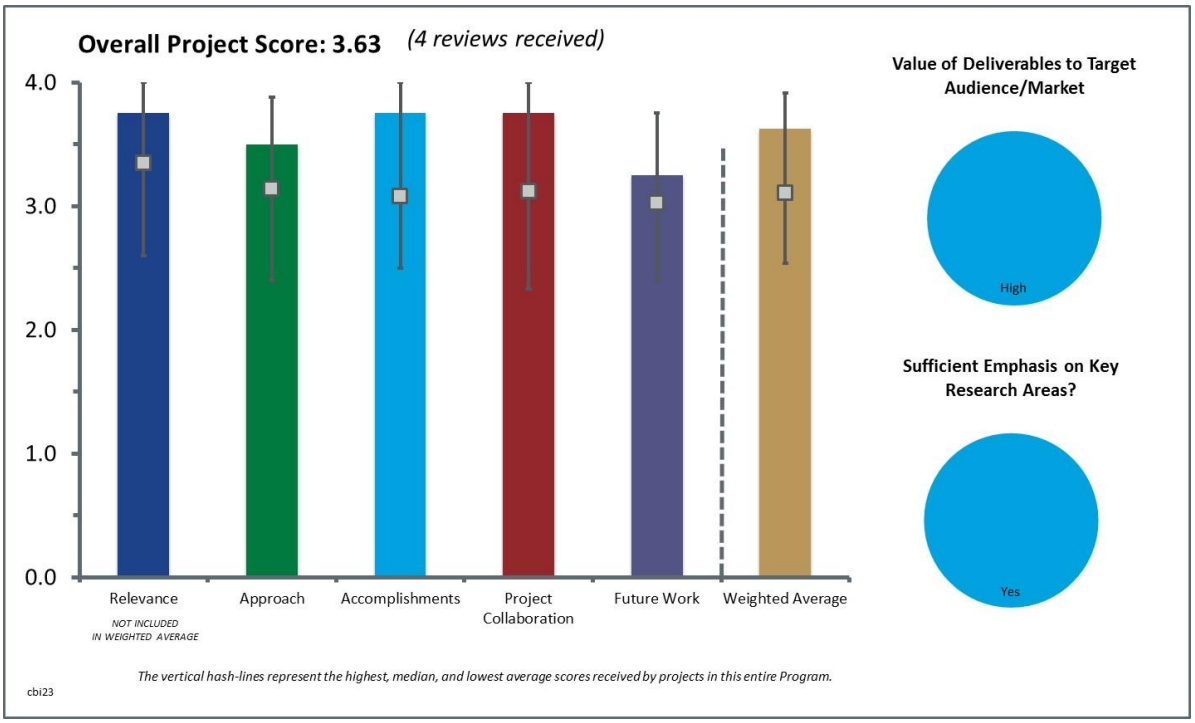
Presenter: Srinivas Katipamula, Pacific Northwest National Laboratory, Srinivas.Katipamula@pnnl.gov
DOE Manager: Charles Llenza, 202-586-2192, charles.llenza@ee.doe.gov

Project Description

This multiyear research and development project aims to determine the magnitude of energy savings achievable by retrofitting existing packaged rooftop air conditioner units (RTUs) with advanced control strategies not ordinarily used for packaged units. An extensive field demonstration confirmed that advanced RTU controllers can achieve heating, ventilation, and air conditioning (HVAC) energy and cost savings of more than 40% over the typical packaged air conditioners and heat pumps (with constant-speed supply fans) installed on commercial buildings. The technology saves energy by alerting owners and service providers of the need to service units, and it is suitable for use with existing and new RTUs to improve maintenance of neglected HVAC equipment. Energy savings in the project will be measured for five climate zones to provide direct, measured evidence of the benefits of this relatively low-cost technology.

Summary of Review Comments

The review team praised the project for developing market-ready deliverables that demonstrate significant energy savings results. Specific cited strengths include the project's focus on a broad range within the target audience, its successful engagement with manufacturers and industry stakeholders, and its significant focus on commercialization. Reviewers commented that this project has few weaknesses. They suggested integrating and testing more control strategies and considering future engagement with regional, state, and utility energy efficiency programs to enable further market awareness and traction.



Project # CBI-44: CBEI: Control and Diagnostics for Rooftop Units

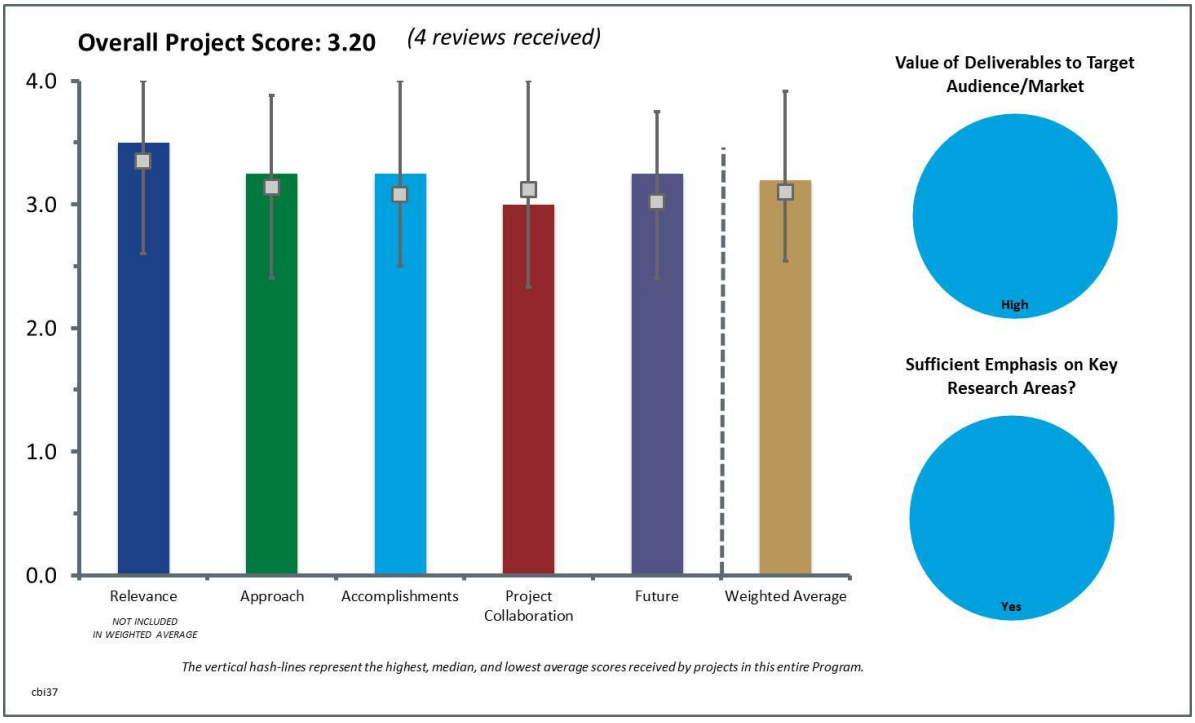
Presenter: Jim Braun, Purdue University (The Pennsylvania State University Consortium for Building Energy Innovation), jbraun@purdue.edu
DOE Manager: Cody Taylor, 202-287-5842, cody.taylor@ee.doe.gov

Project Description

This project aims to develop and validate cost-effective methods for rooftop air conditioning unit (RTU) coordination and diagnostics in small commercial buildings. To this end, the project is using "virtual" sensors to reduce the cost of embedded diagnostics. In addition, the project is using self-learning "lumped disturbance" models to reduce cost and improve scalability for optimal RTU coordination. The project has already developed virtual sensors, demonstrated an integrated diagnostic system, and evaluated a "plug-and-play" learning controller for RTU coordination. Future project outputs include the demonstration of both embedded RTU diagnostics and plug-and-play RTU coordination.

Summary of Review Comments

Reviewers commended the project for demonstrating significant energy savings in both a laboratory setting and in a real small commercial building. They gave the project strong marks for (1) developing useful nomenclature, (2) putting together a strong project team, (3) engaging with major market players, (4) developing clear and logical plans to address scalability issues, and (5) working in a sector where many energy efficiency gains are possible. Reviewers noted that market adoption activities are not receiving enough emphasis, and one reviewer was concerned that there may not be enough time to complete the remaining tasks on schedule. Reviewers recommended making a clearer argument that the problem addressed by the project is a common one, demonstrating scalability, and engaging partners focused on market adoption.



Project # CBI-45: CBEI: Pre-Commercial Demonstration of Cost-Effective Advanced HVAC Controls

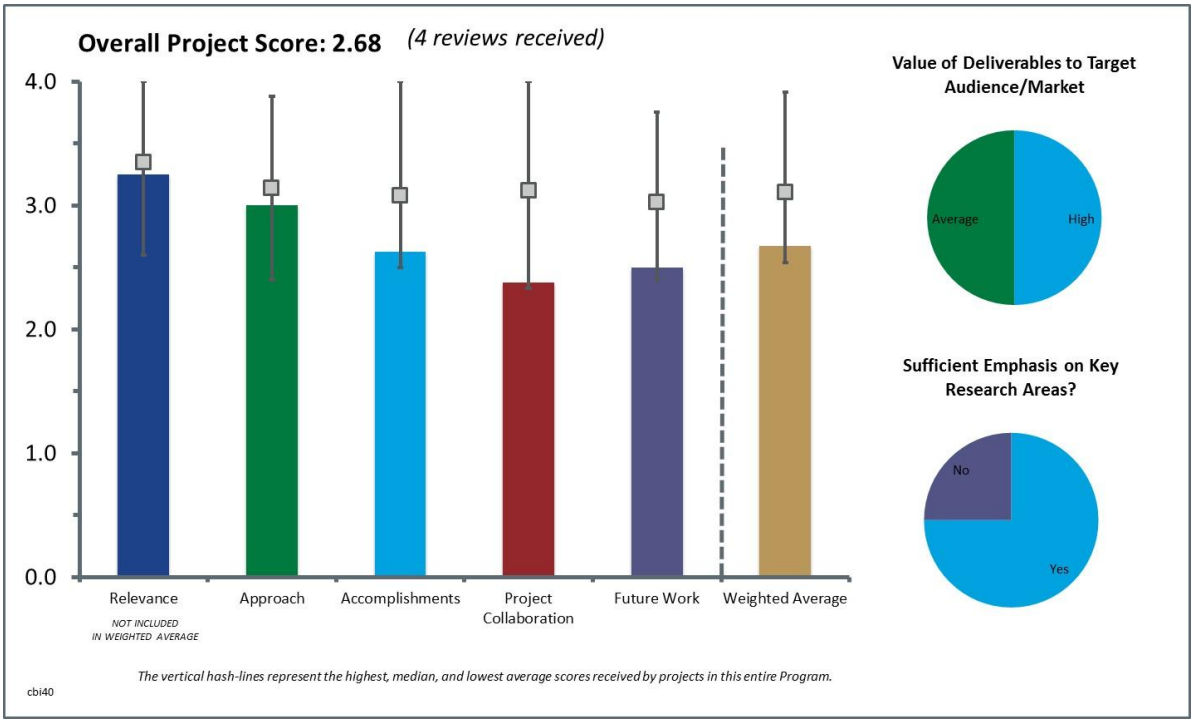
Presenter: Hayden Reeve, United Technologies Research Center (The Pennsylvania State University Consortium for Building Energy Innovation), reevehm@utrc.utc.com
DOE Manager: Cody Taylor, 202-287-5842, cody.taylor@ee.doe.gov

Project Description

Optimal control coordination of heating, ventilation, and air conditioning (HVAC) equipment can reduce energy by more than 20% over current building automation systems (BASs) but is not widely deployed owing to challenges with complexity, scalability, and deployment. The goal of this project is to demonstrate cost-effective and scalable deployment of optimal controls that achieve more than 20% HVAC energy reduction versus state-of-the-art BASs. This technology targets BASs for medium-size buildings with central HVAC systems; medium and large market segments account for ~35% of commercial building HVAC energy use (1.9 quads).

Summary of Review Comments

According to reviewers, the project has good market potential and utilizes a logical approach to optimizing HVAC equipment using existing hardware and sensors. However, reviewers felt the project lacks sufficient research and clear future plans. Reviewers noted that the project has the potential to demonstrate more than 20% energy savings in the demo building, but they were unclear about scalability to the market. Reviewers suggested conducting further research on scalability, including more demonstration sites, and generating a commercialization plan.



Project # CBI-46: CBEI: Compatible and Cost-Effective Fault Diagnostic Solutions for Air Handling Unit–Variable Air Volume and Air Handling Unit–Constant Air Volume Systems

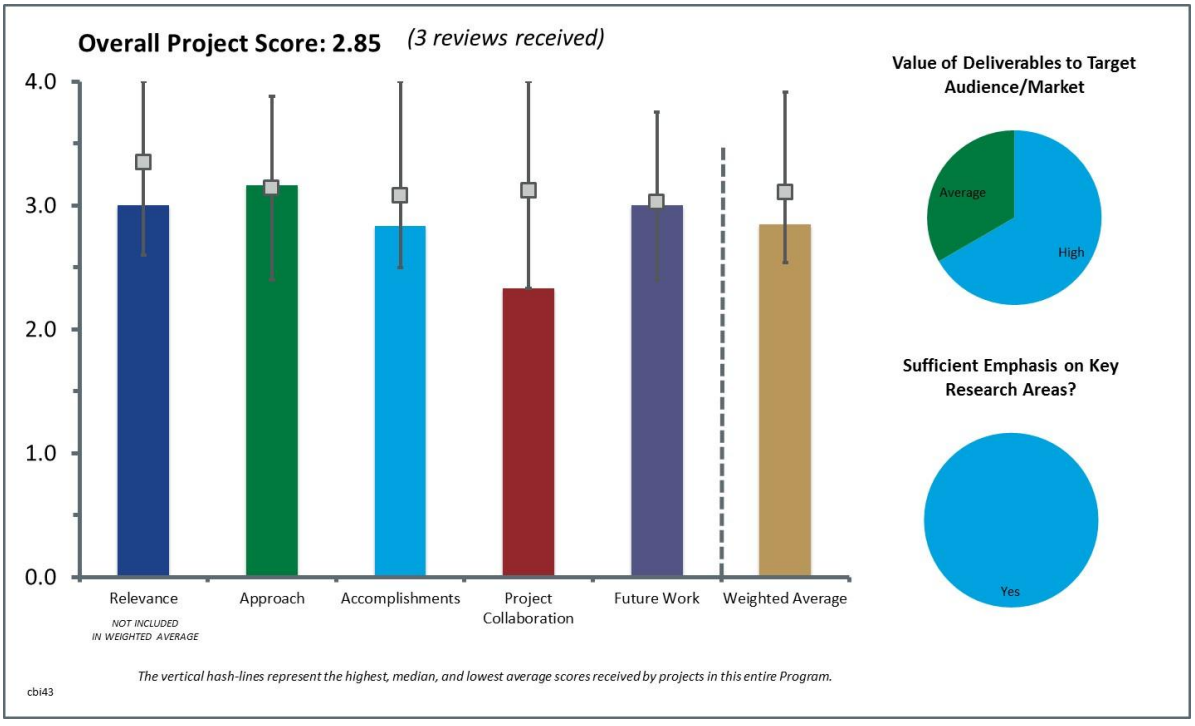
Presenter: Jin Wen, Drexel University (The Pennsylvania State University Consortium for Building Energy Innovation), jinwen@drexel.edu
DOE Manager: Cody Taylor, 202-287-5842, cody.taylor@ee.doe.gov

Project Description

The goal of this project is to develop and demonstrate a library of diagnostics decision-support tools for medium-to-large-sized commercial buildings that use air handling unit (AHU) systems that can enable cost-effective diagnostics solutions (both embedded and add-on solutions) for existing buildings. The project will focus on buildings that utilize built-up AHUs with variable-air-volume (VAV) and constant-air-volume (CAV) systems. This project is part of a set of projects from the Consortium for Building Energy Innovation that focus on low-cost approaches to improving building operations with little or no additional investment in equipment.

Summary of Review Comments

Reviewers agreed that fault detection in VAV and CAV systems is important for building energy efficiency. However, one reviewer noted that the project is unlikely to demonstrate energy savings by the end of the project. Reviewers felt that technical barriers and solutions are clearly identified—although one reviewer stated that demonstrations in in-use buildings would be preferable—and that the project is making steady progress toward the stated objective of developing and demonstrating a library of diagnostic and decision-support tools. The one overall concern was an unclear path to market adoption. Reviewers recommended that the project team do a better job of showing that the technology will actually save energy.



Project # CBI-47: Metal Buildings

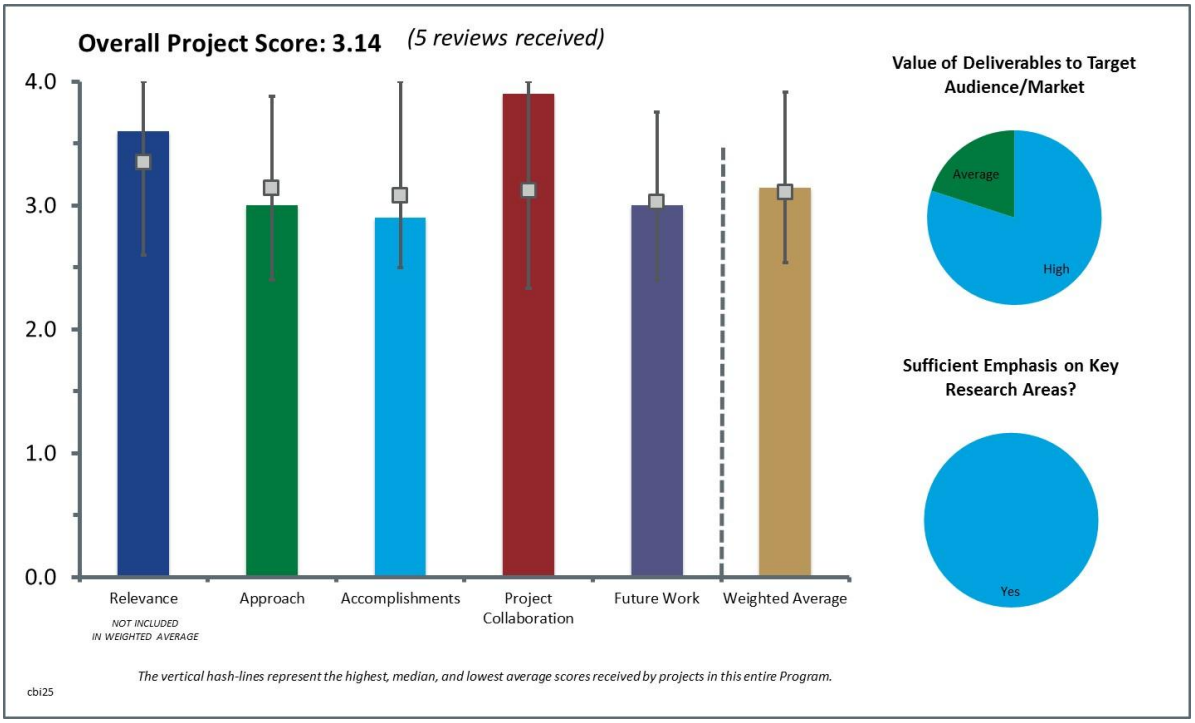
Presenter: Heather Buckberry, Oak Ridge National Laboratory, buckberryhl@ornl.gov
DOE Manager: Amy Jiron, 720-339-7475, amy.jiron@ee.doe.gov

Project Description

This project aims to increase energy efficiency in metal buildings through research into areas specifically targeted by metal building industry leaders. In collaboration with the Metal Building Manufacturer Association (the principal technical resource for the metal building industry), the project addresses infiltration issues that can reduce heating, ventilation, and air conditioning building source usage for single-story metal buildings in commercial applications. Final products of this research—including the demonstration of multiple energy efficiency measures, as well as literature and training—can be used in the design, fabrication, installation, and operation of new buildings, as well as in the retrofit of existing metal buildings.

Summary of Review Comments

Reviewers commended the project for addressing energy efficiency measures in metal building construction, noting that the project has the potential to make a significant impact. Specifically, reviewers praised the project for (1) identifying critical barriers, (2) developing a 5-year research roadmap for the metal industry, (3) fostering good collaborations with key stakeholders, and (4) building the test facility. They expressed concern about (1) the lack of time to evaluate the different design options and deliver a set of solutions to the industry, (2) the number of buildings studied, and (3) the lack of clarity about how easily the facility can adjust to allow for testing of many different concepts. Reviewers recommended that the project team develop relationships with educational institutes that train skilled labor and have its research findings incorporated into educational material.



Project # CBI-48: Better Buildings Workforce Guidelines for Facility Energy Manager

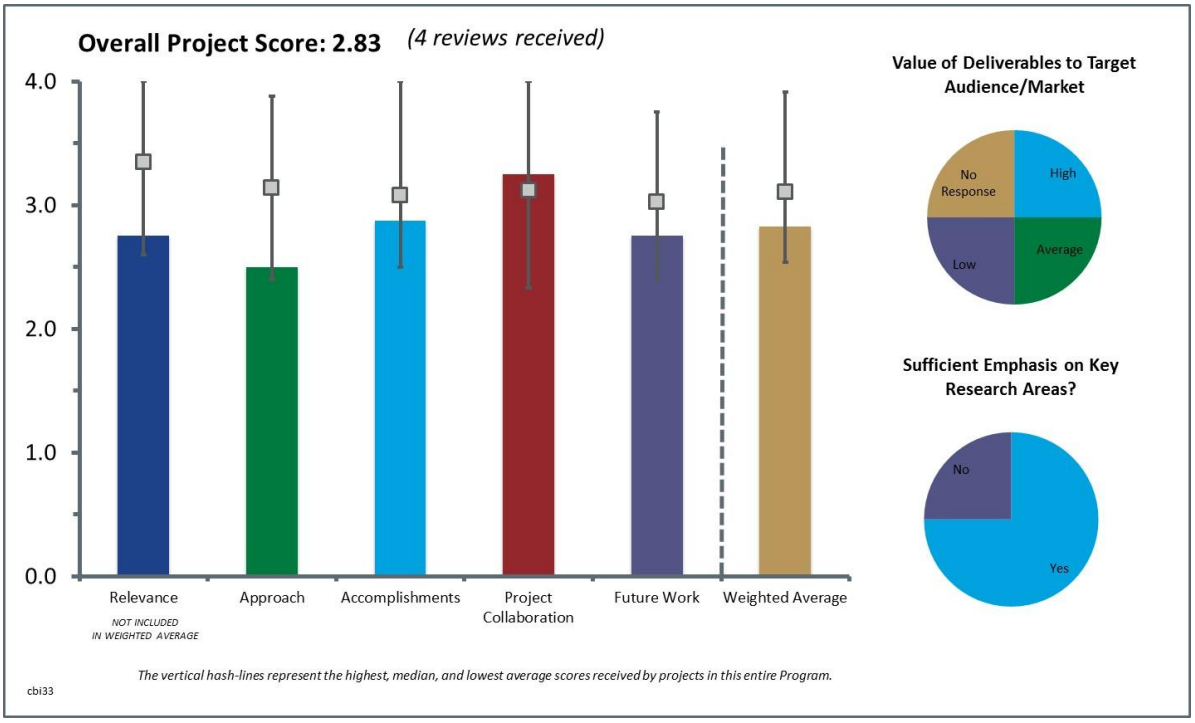
Presenter: Phil Coleman, Lawrence Berkeley National Laboratory, colemanpr@ornl.gov
DOE Manager: Cody Taylor, 202-287-5842, cody.taylor@ee.doe.gov

Project Description

By making technical contributions to the Better Buildings Workforce Guidelines, this project addresses the absence of consistent national guidelines in commercial workforce credentialing programs related to energy use, as well as the proliferation of competing certifications. In partnership with the U.S. General Services Administration, the Federal Energy Management Program, and the U.S. Department of Defense, this project will develop requirements for an Energy Manager certification (including energy management system business processes), as well as develop an implementation plan for a Federal Facility Manager certification (meeting Federal Buildings Personnel Training Act requirements and energy management system business processes).

Summary of Review Comments

Reviewers commented that the success of the certification project truly depends on market buy-in, and they provided mixed views on the need for an Energy Manager certification. Reviewers praised the project team for (1) engaging key stakeholders, (2) promoting energy efficiency and job creation, and (3) being on track to meet its initial milestones. Reviewers noted the difficulty in defining a job description for energy managers because of their diverse duties. They also stated that (1) the industry is resistant to programs that are not vetted or discussed with them, and (2) certification programs cannot capture all of the required characteristics of successful energy managers. Reviewers recommended (1) incorporating persistence commissioning and a holistic approach to energy management, (2) engaging all of the large industry certification groups, and (3) ensuring that not just the top-quality certifications are eligible for the certification endorsement.



Project # CBI-49: CBEI: Advanced Critical Advanced Energy Retrofit Education and Training and Credentialing

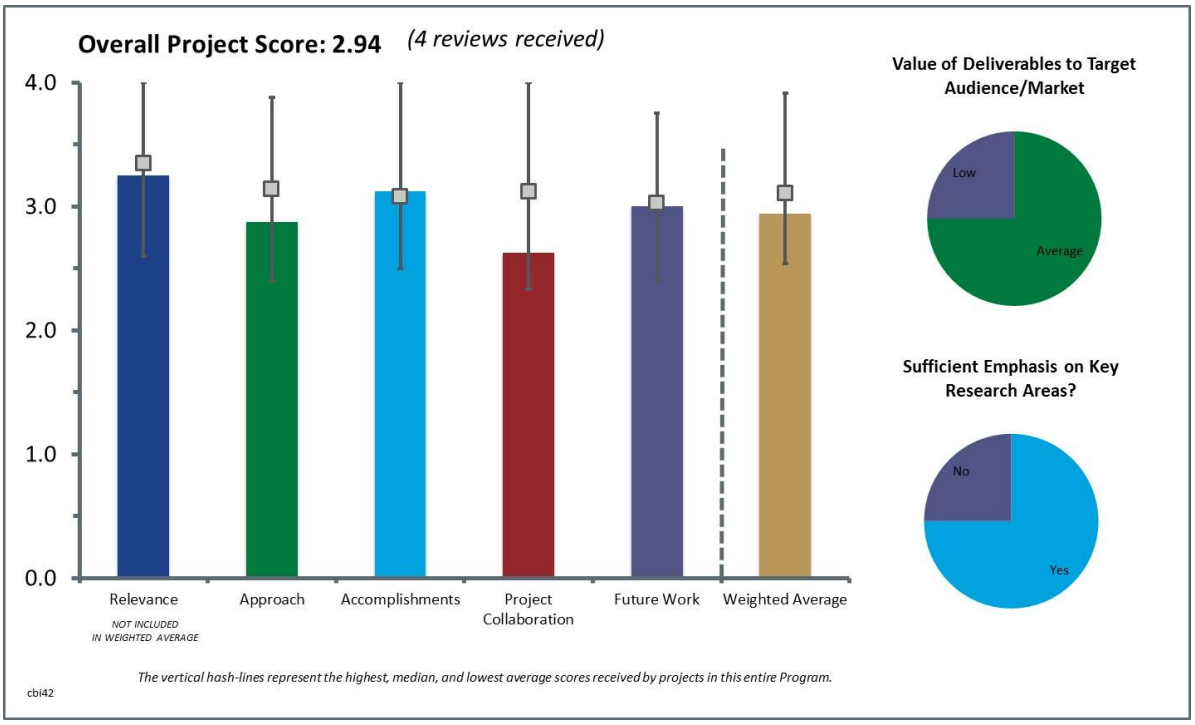
Presenter: David Riley, The Pennsylvania State University Consortium for Building Energy Innovation, driley@engr.psu.edu
DOE Managers: Cody Taylor, 202-287-5842, cody.taylor@ee.doe.gov

Project Description

Targeting professionals, employers, and education program leaders in selected advanced energy retrofit (AER) project fields (including energy auditors, building operators, energy managers, and commissioning authorities), this project addresses the need for clearly defined competencies in critical fields supporting AER projects. The goal of this project is to develop and translate clear competencies, workforce development pathways, and career ladders that align with new national building energy efficiency workforce guidelines for four of the advanced energy job titles: Energy Manager, Building Operations Professional, Energy Auditor, and Commissioning Professional.

Summary of Review Comments

Several reviewers praised the project for increasing training opportunities and clarifying career paths, while one reviewer stated that these job definitions have already been established and questioned whether the project is necessary. Reviewers also stated that (1) expected outcomes and tasks are not clearly described, (2) plans to engage stakeholders are not clear, and (3) there are existing training and educational opportunities in building energy management. Reviewers recommended (1) reaching out to community colleges, universities, or educationally focused organizations or events; (2) engaging industry organizations prior to setting the criteria; (3) identifying the shortcomings of current education programs in building energy management; and (4) conducting a workforce survey for existing partners to establish whether the future plans, goals, and objectives are appropriate.



4. Residential Buildings Integration

4.1 Program Overview

The Residential Buildings Integration Program collaborates with home builders, energy professionals, state and local governments, utilities, product manufacturers, and researchers to improve energy performance in existing and new homes. To identify cost-effective solutions that reduce energy consumption beyond minimum codes, the Program focuses on research and development activities as well as innovative approaches to accelerate the adoption of energy-efficient technologies, including information dissemination, infrastructure development, and model program deployment.

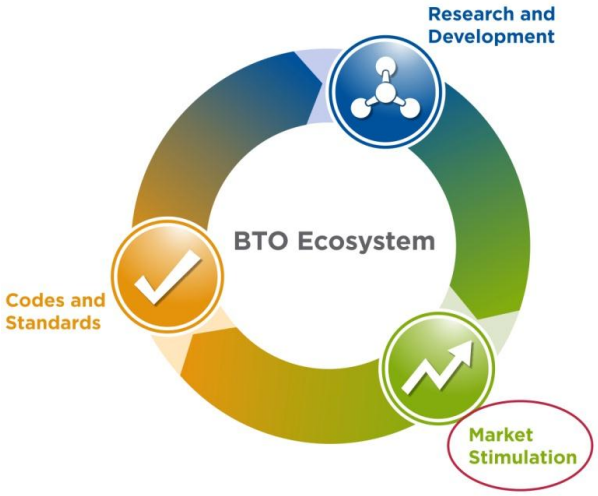


Figure 6. The role of the Residential Buildings Integration Program in the BTO Ecosystem

The Program's mission is to accelerate energy performance improvements by developing, demonstrating, and deploying a suite of technologies, tools, and programs to achieve cost-effective peak performance in new and existing homes. The Program's *vision* for 2030 is:

- Cost-effective whole-house solutions are standard practice markets.
- Zero Energy Ready (ZER) homes are constructed at scale and meet high-performance specifications that ensure comfort, durability, and good indoor air quality.
- Robust, competitive markets exist for home improvements that increase comfort and indoor air quality, as well as offer cost-effective energy savings.
- Industry standards and building codes exist that ensure energy savings at a national scale, following voluntary adoption by market leaders.

For *new* homes, the Program's 2025 goal is to demonstrate at scale a 50% reduction in energy use, while improving overall indoor air quality, durability, and comfort. For *existing* homes, the Program's 2025 goal is to demonstrate at scale an average energy use reduction of 25% in typical homes.[4] The reductions are relative to the 2009 International Energy Conservation Code[5] for new homes and the *Annual Energy Outlook 2010* baseline[6] for existing homes. To track its progress toward achieving these goals, the Program will analyze and evaluate the impacts of Program-funded activities on building energy codes and standards, and on the residential building market.

[4] BTO goals were updated after this report was generated. The updated goals will appear in the 2015 BTO Peer Review Report and in BTO's Multi-Year Program Plan, which will be published in the Fall of 2015.
[5] International Code Council, Inc., *International Energy Conservation Code®*, January 2009.
[6] U.S. Energy Information Administration, *Annual Energy Outlook 2010*, DOE/EIA-0383(2010), April 2010.

4.2 Summary of Peer Review Feedback

Project # RBI-02: DOE Zero Energy Ready Home

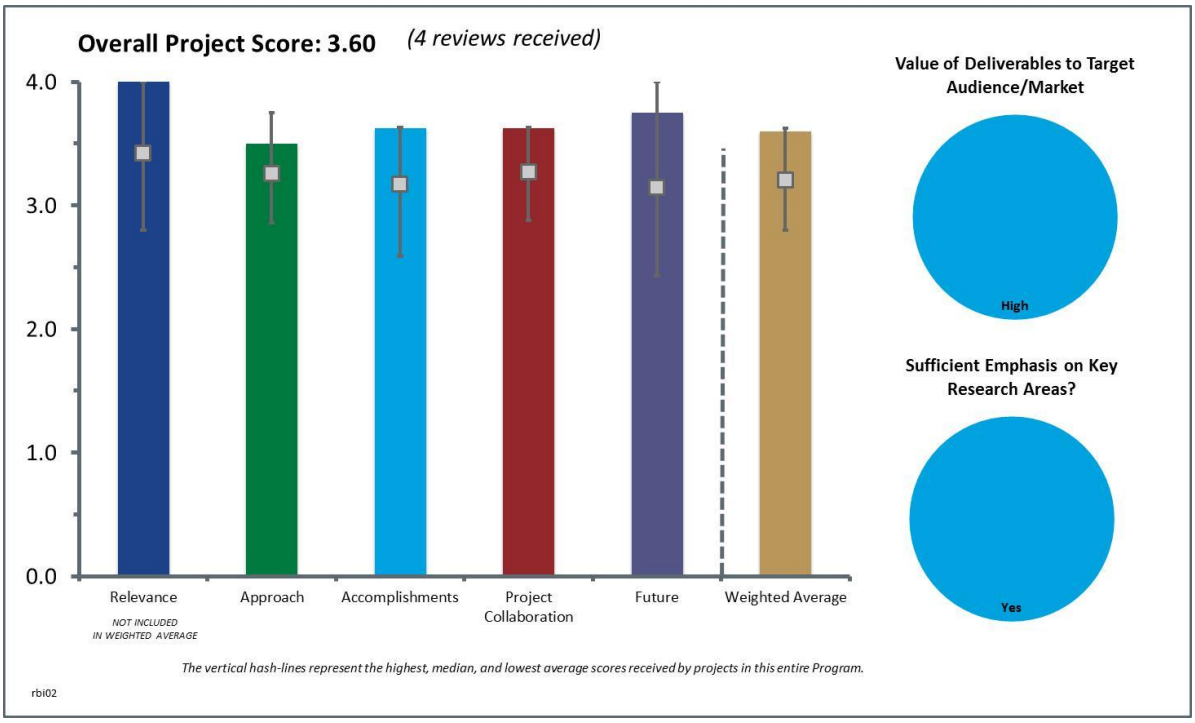
Presenter: Samuel Rashkin, U.S. Department of Energy, samuel.rashkin@ee.doe.gov
DOE Manager: Eric Werling, 202-586-0410, eric.werling@ee.doe.gov

Project Description

The goal of the U.S. Department of Energy (DOE) Zero Energy Ready Home (ZERH) program, formerly known as the DOE Challenge Home program, is to transform the housing market to high-performance homes that are so energy efficient they can offset most or all of their annual energy consumption with renewable energy. This in fact is DOE's definition of zero energy ready homes. The program supports the application of proven innovations from the DOE Building America Program that deliver 40%–50% savings above the 2009 International Energy Conservation Code, while effectively managing builder and homeowner risks. Stringent program requirements, such as complying with ENERGY STAR for Homes, help to ensure comprehensive building science and full alignment with a related federal government program. The resulting homes offer high levels of energy savings, comfort, healthful living, and durability. DOE ZERH homes are verified by a qualified third party and carry a label to convey they have met program requirements.

Summary of Review Comments

Reviewers commented that with clear targets identified and continued support from collaborators, the project is likely to achieve success; however, they also noted potential barriers to address. Cited project strengths include (1) a good systems-level design and installation approach based on other successful projects and (2) strong collaboration with builders. Identified weaknesses include the project's marketing efforts and the complexity of requirements. Reviewers recommended that labeling issues be addressed and that appropriate metrics for confirming the project's end goals be developed.



Project # RBI-05: Home Performance with ENERGY STAR

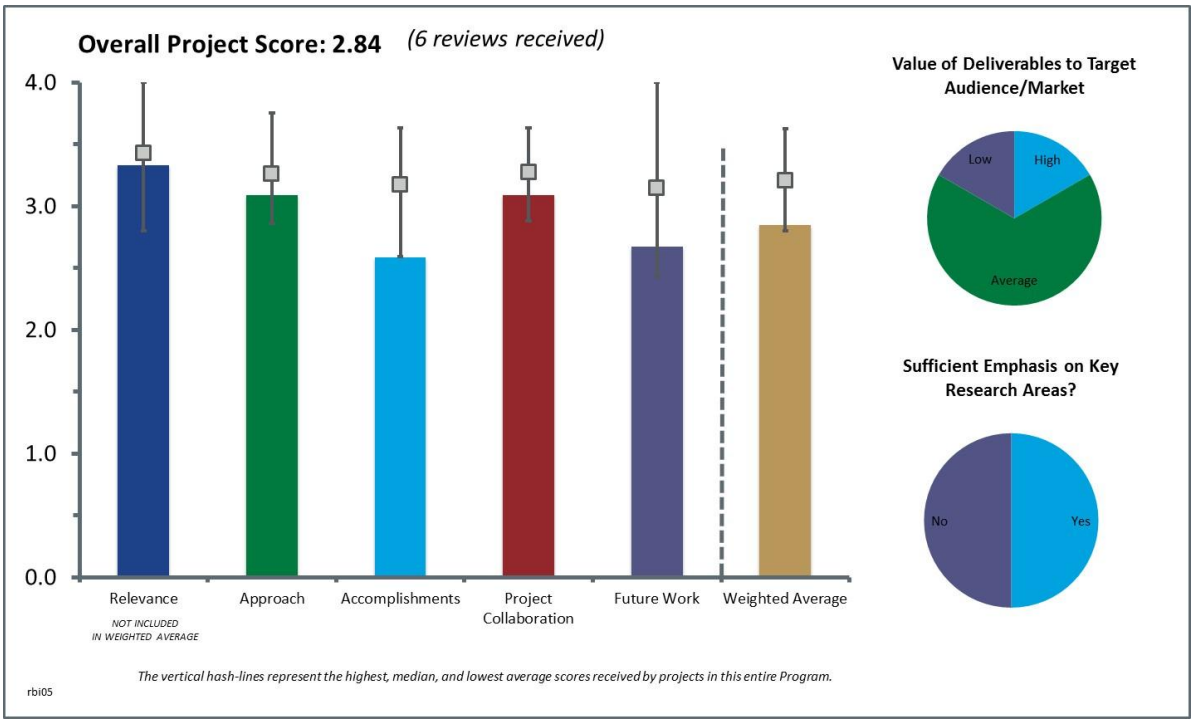
Presenter: Ely Jacobsohn, U.S. Department of Energy, ely.jacobsohn@ee.doe.gov

Project Description

The goal of Home Performance with ENERGY STAR (HPwES) is to help homeowners improve the efficiency and comfort of their homes using a systematic, whole-house approach, while also helping to protect the environment. HPwES provides homeowners with resources to identify trusted contractors to recommend and perform energy improvements so that homeowners can understand their home's energy use. The U.S. Department of Energy works in conjunction with the U.S. Environmental Protection Agency to support local Program Sponsors, such as utilities, state energy offices, local government, non-profit organizations, financial institutions, and others that qualify. Contractors are recruited, trained, qualified, and supported by Sponsors to ensure they meet program requirements. As of April 2014, HPwES has upgraded more than 330,000 homes since 2002, with average homeowner savings of more than $500 annually after retrofit. The Program is working to facilitate the achievement of scale in the home performance industry by demonstrating value and moving toward replicable delivery models that support expanded participation in the HPwES Program.

Summary of Review Comments

According to reviewers, the project has a high profile and a strong likelihood of achieving its goals, as long as key barriers are addressed. Project growth, sponsorship, branding, and market outreach were cited as project strengths. Reviewers noted areas where the project could improve: (1) identify and communicate a clear value proposition for HPwES to homeowners and other market actors, (2) reduce delivery costs, (3) test specific strategies and tactics to expand impact, and (4) clearly articulate plans to expand HPwES. Reviewers recommend that, within available resources, project efforts be accelerated and more partners and sponsors be obtained.



Project # RBI-07: Building America Team—Building America Partnership for Improved Residential Construction (BA-PIRC)

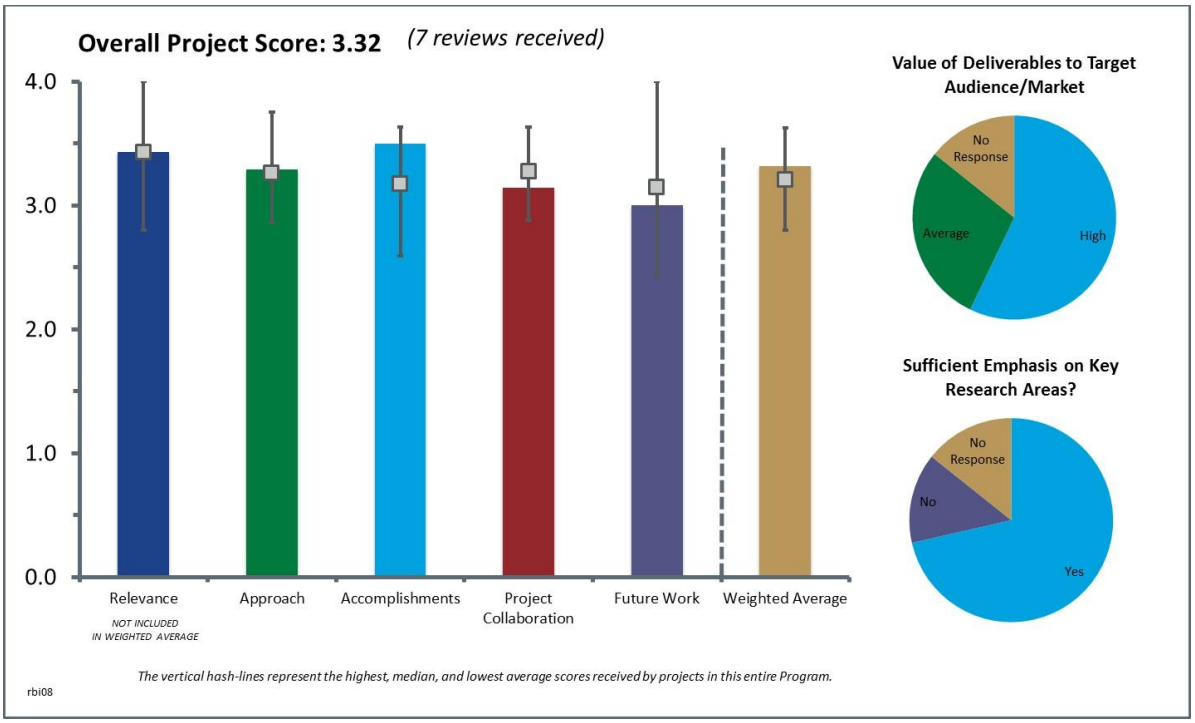
Presenter: Eric Martin, Florida Solar Energy Center (FSEC), martin@fsec.ucf.edu
DOE Manager: Eric Werling, 202-586-0410, eric.werling@ee.doe.gov

Project Description

Building America research projects develop and demonstrate market-ready building solutions that improve the energy efficiency of new and existing homes, increasing comfort, health, safety, and durability. When fully deployed, Building America's proven solutions will reduce building-related energy use in new and existing residential building stock by 30% and 25%, respectively, by 2020, and by 50% and 40% by 2030. The Building America Partnership for Improved Residential Construction (BA-PIRC) team focuses on cost-effective efficiency solutions for new and existing homes in hot-humid and marine climates. BA-PIRC is led by the Florida Solar Energy Center, a research institute of the University of Central Florida. BA-PIRC works closely with industry and utility partners to develop real-world solutions that achieve significant energy and cost savings for homeowners, builders, and remodelers.

Summary of Review Comments

Reviewers praised the project's progress to date. Cited strengths include the project's (1) excellent use of management structure and feedback, (2) good technical understanding and approaches to analyzing data, (3) well-designed combination of shallow and deep retrofits, (4) unique ability to address Florida's climate, and (5) market value that engages a broad audience. Noted project weaknesses include the (1) lack of information and analysis of indoor air quality, (2) small scale of the project's impact, and (3) unsupported claim that university affiliation plays a role in budget and deliverable accountability. Reviewers recommended that the team compare a BEopt™ analysis of its chosen packages to performance field data, and that the focus be broadened beyond Florida.



Project # RBI-08: Building America Team—IBACOS

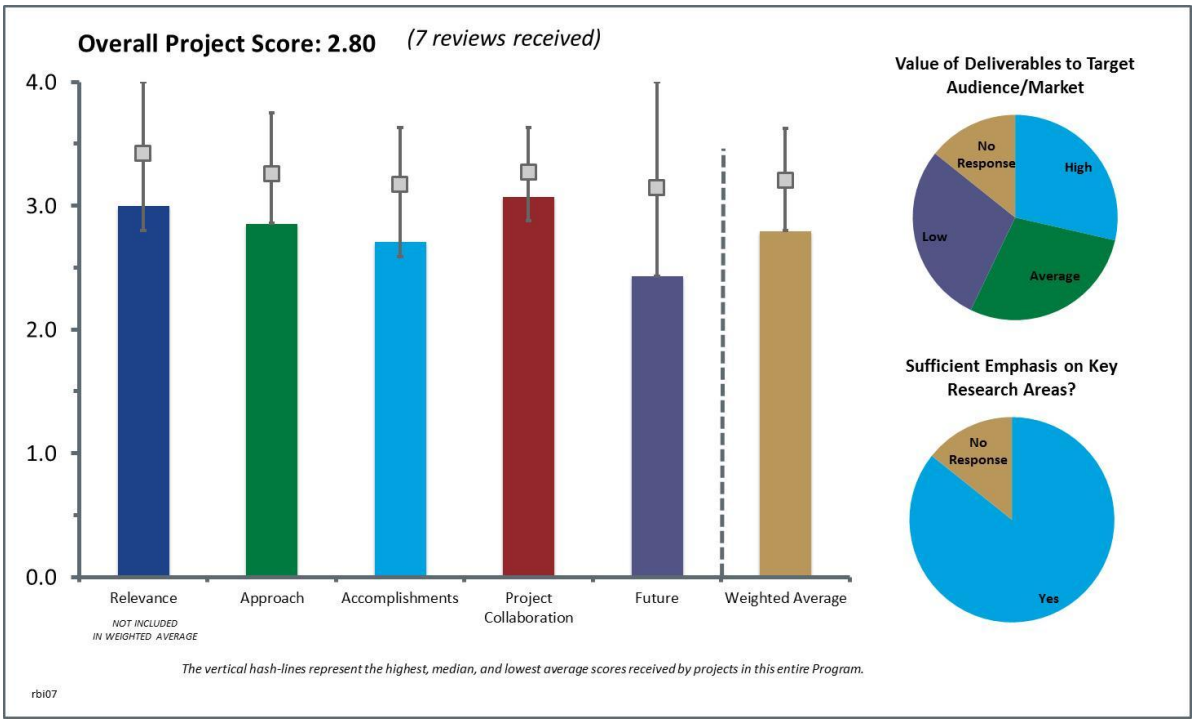
Presenter: Duncan Prahl, IBACOS, dprahl@ibacos.com
DOE Manager: Eric Werling, 202-586-0410, eric.werling@ee.doe.gov

Project Description

Building America research projects develop and demonstrate market-ready building solutions that improve the energy efficiency of new and existing homes, increasing comfort, health, safety, and durability. When fully deployed, Building America's proven solutions will reduce building-related energy use in new and existing residential building stock by 30% and 25%, respectively, by 2020, and by 50% and 40% by 2030. IBACOS conducts research with manufacturing and building partners to verify the performance of new equipment/technology, including simplifying space conditioning; proven performance of houses; business success metrics; and a range of retrofit areas to aid in the advancement of newer, better, and more cost-effective options.

Summary of Review Comments

Reviewers applauded the project's engagement with a broad range of builders and its focus on issues relevant to the marketplace. However, they noted that the project team did not clearly explain how it will turn its research results into actual improvements in building energy performance. Reviewers had mixed views on the value of the deliverables and their potential impact on the market, and they noted that the project's future plans are unclear. Reviewers recommended that the project (1) be more directly involved in the energy and fire code amendment process, (2) focus on specific activities and outcomes, (3) articulate how the outcomes will achieve project goals and Building Technologies Office goals, and (4) consider utilities' and subcontractors' business models.



Project # RBI-09: Building America Team—The Consortium for Advanced Residential Buildings (CARB)

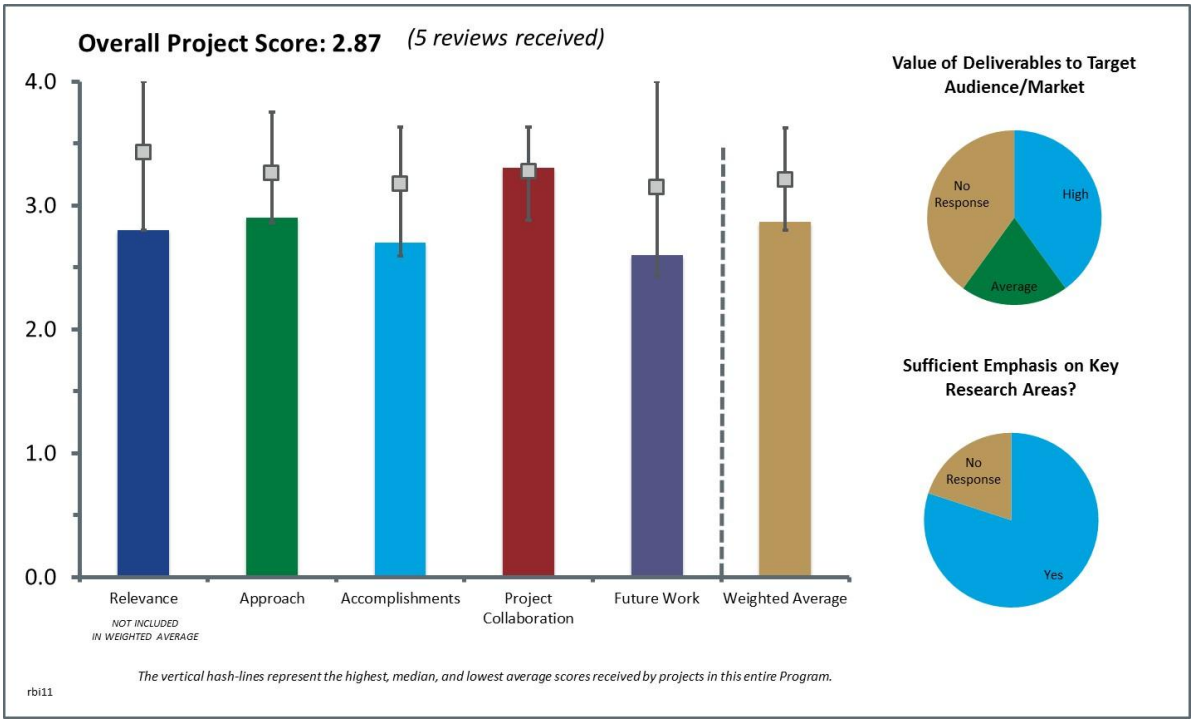
Presenter: Dianne Griffiths, Steve Winters Associates, dgriffiths@swinter.com
DOE Manager: Eric Werling, 202-586-0410, eric.werling@ee.doe.gov

Project Description

Building America research projects develop and demonstrate market-ready building solutions that improve the energy efficiency of new and existing homes, increasing comfort, health, safety, and durability. When fully deployed, Building America's proven solutions will reduce building-related energy use in new and existing residential building stock by 30% and 25%, respectively, by 2020, and by 50% and 40% by 2030. The Consortium for Advanced Residential Buildings (CARB) focuses on improving new and existing homes (specializing in multifamily and affordable housing) by leveraging new technologies, underutilized technologies, and innovative market delivery strategies. CARB researches advanced building systems and whole-house performance and then transfers that knowledge to the marketplace in order to elevate home performance industry-wide.

Summary of Review Comments

Reviewers expressed mixed views on the project. According to some reviewers, the project has been successful in affecting major standards and providing valuable information to target audiences. Specific project strengths cited include the well-identified barriers, focus on practical and achievable results, and engagement of a broad spectrum of stakeholders. However, some reviewers commented that the project lacks the criteria needed to assess its value and described the project's impact on the target market as unclear. Reviewers suggested gathering and presenting more data on energy efficiency results and better quantifying the project's impact.



Project # RBI-10: Building America Team—National Association of Home Builders Research Center (NAHBRC)

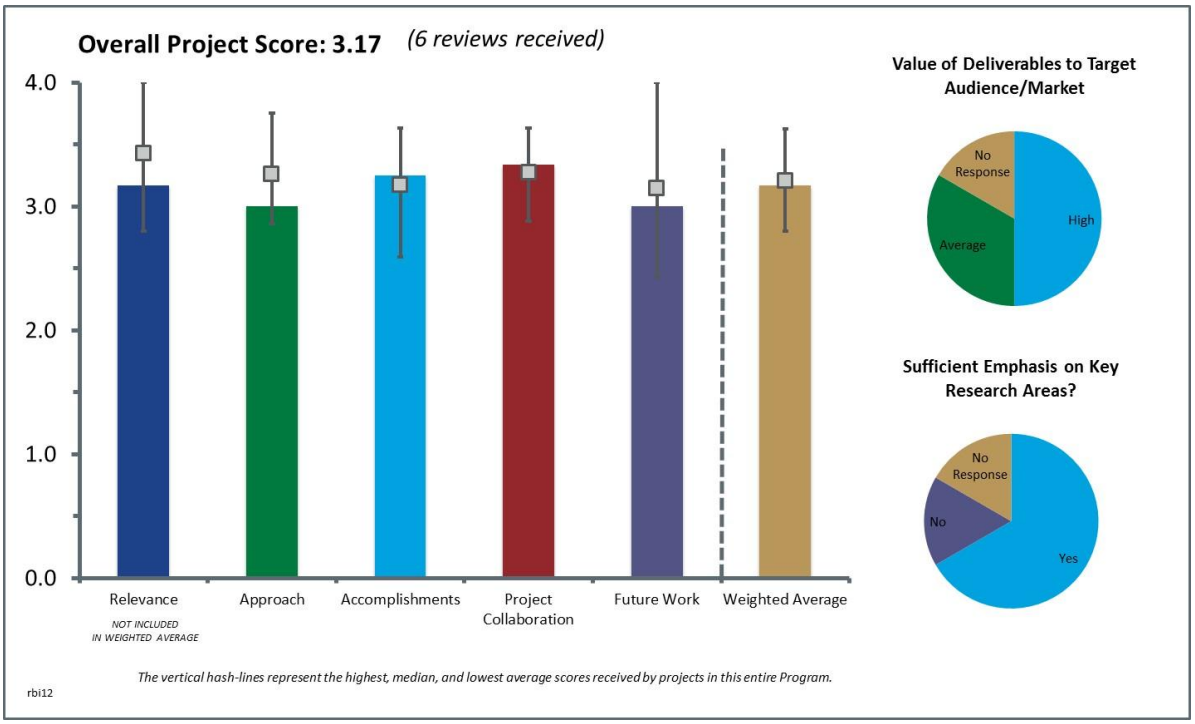
Presenter: Vladimir Kochkin, Home Innovation Research Labs, vkochkin@homeinnovation.com
DOE Manager: Eric Werling, 202-586-0410, eric.werling@ee.doe.gov

Project Description

Building America research projects develop and demonstrate market-ready building solutions that improve the energy efficiency of new and existing homes, increasing comfort, health, safety, and durability. When fully deployed, Building America's proven solutions will reduce building-related energy use in new and existing residential building stock by 30% and 25%, respectively, by 2020, and by 50% and 40% by 2030. In this project, the Partnership for Home Innovation is conducting research with manufacturing and building partners to verify the performance of new equipment/technology and aid in the advancement of newer, better, more cost-effective options.

Summary of Review Comments

Reviewers commended the project's progress in advancing energy efficiency and its influence on builders. There was a general consensus that one of the project's greatest strengths is its identification of stakeholders and its collaboration efforts, specifically its relationship with builders. Also, reviewers noted that the project deliverables provide high-value options to constituents and that the project team is very capable and experienced. However, one reviewer expressed concerns about the project's lack of focus on cost savings and cost effectiveness. Suggested improvements include developing a strategy for gaining code approval, providing additional ways to publicize products, and focusing more on holistic packaging of options for builders.



Project # RBI-11: Project Impact Assessments—Building America Fiscal Year 2014 Field-Test Technical Support

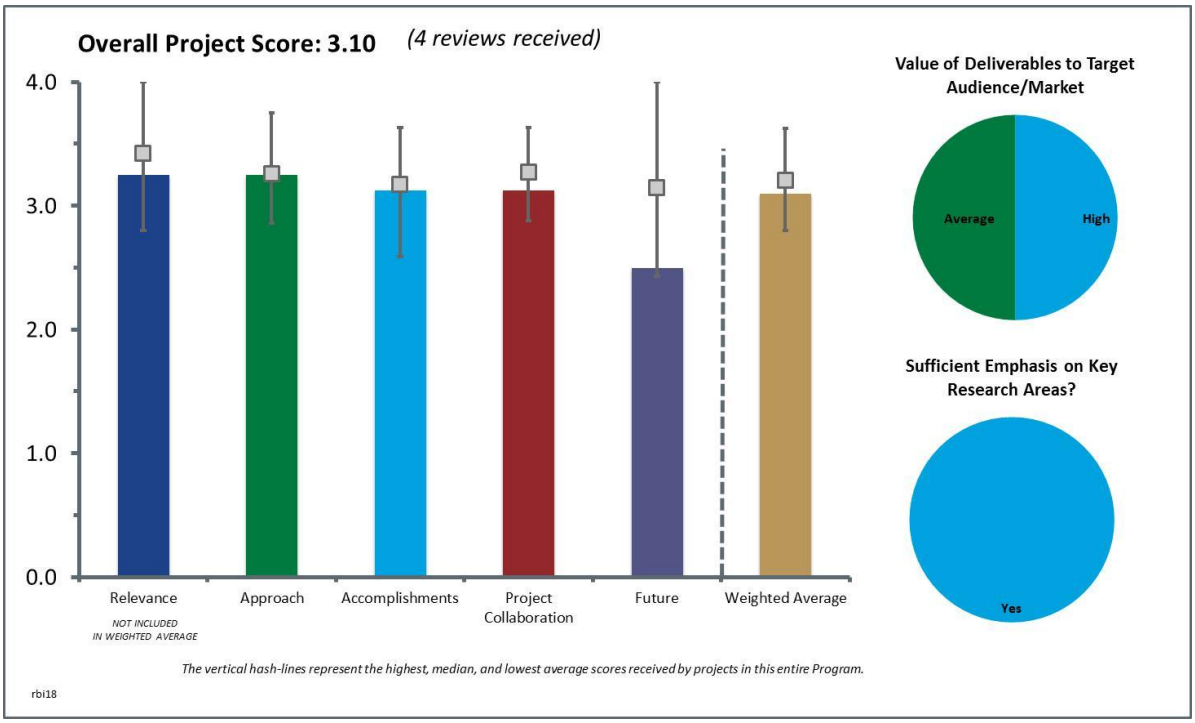
Presenter: Lieko Earle, National Renewable Energy Laboratory, lieko.earle@nrel.gov
DOE Manager: Eric Werling, 202-586-0410, eric.werling@ee.doe.gov

Project Description

The goal of this project is for the National Renewable Energy Laboratory to provide extensive, hands-on technical support to Building America teams in the areas of experiment design, provision of research-grade measurement hardware, energy modeling, and analysis. Building America's field tests—regularly conducted by both Building America teams and national laboratories—demonstrate the program's best house system innovations. The tests enable cost-effective evaluation of real-world performance and help ensure that all field tests result in high-impact findings that push builders and homeowners to higher levels of savings.

Summary of Review Comments

According to reviewers, this project provides the centralized tools and technical support essential to supporting other Building America teams. Reviewers noted that there is strong coordination among the existing Building America teams. Some reviewers commended the project's production of high-quality technical data, noting that it will enable other researchers to execute field experiments more efficiently. However, one reviewer found it difficult to assess the project's real value to the teams. Also, there was concern that the project is too focused on simply continuing its service. Hence, reviewers recommended finding ways to expand the project's impact, such as by holding workshops and seminars and by producing more publications on best practices.



Project # RBI-12: Analysis—Technologies Targeting Zero Net Energy

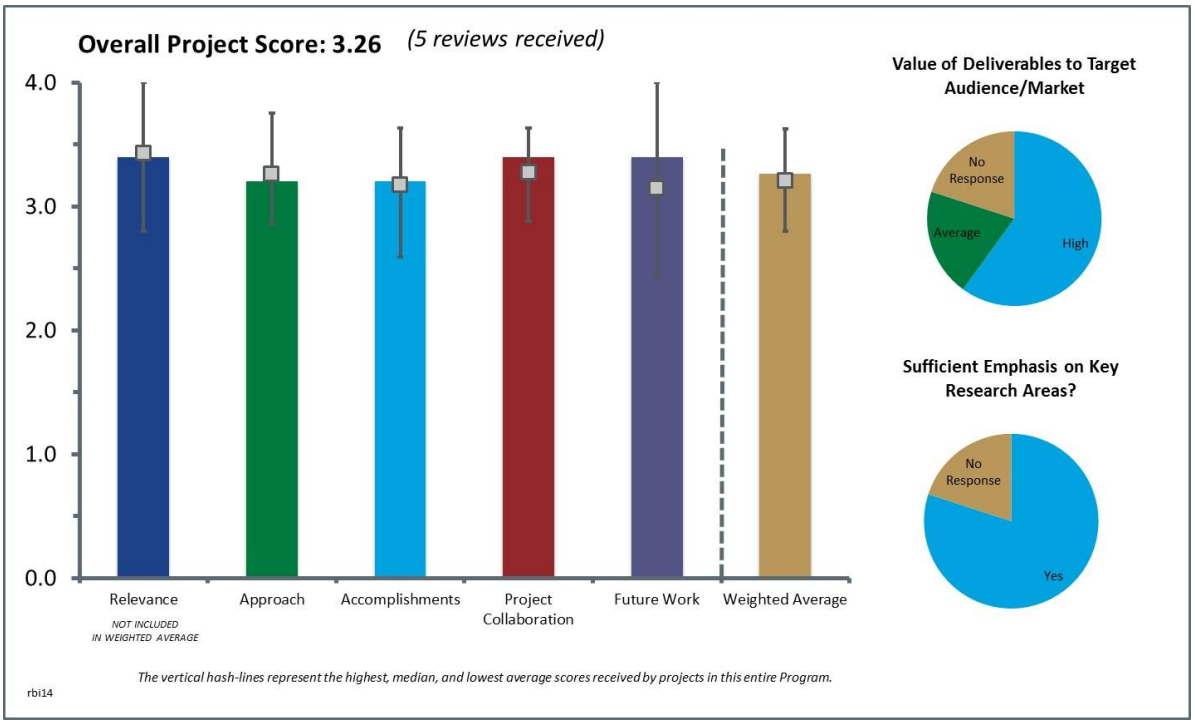
Presenter: Scott Horowitz, National Renewable Energy Laboratory, scott.horowitz@nrel.gov
DOE Manager: Eric Werling, 202-586-0410, eric.werling@ee.doe.gov

Project Description

Development of whole-house, zero-energy-ready solutions requires accurate models for a full range of enclosure and equipment technologies. The primary goal of this project is to provide an accurate analysis for Building America program planning, emerging technologies, and zero net energy packages for new construction and existing homes by using cost-based optimization and detailed, physics-based EnergyPlus simulations for the residential sector. The project's objectives include improving consistency, accuracy, and data exchange in whole-house energy analysis through two primary activities: (1) residential technology modeling in EnergyPlus, and (2) an empirically based method of testing for private-sector residential energy software.

Summary of Review Comments

Reviewers commented favorably on the project for developing a software analysis tool focused on comparing the expected and actual performance of different technologies and strategies. They observed that industry financial support for this tool indicates that the deliverables are of high value. There was some concern about whether all the critical barriers are addressed to a sufficient extent. In addition, reviewers suggested adding more builders to the project. One reviewer suggested that the project should try to close the loop between modeled and actual performance.



Project # RBI-13: Building America Solution Center

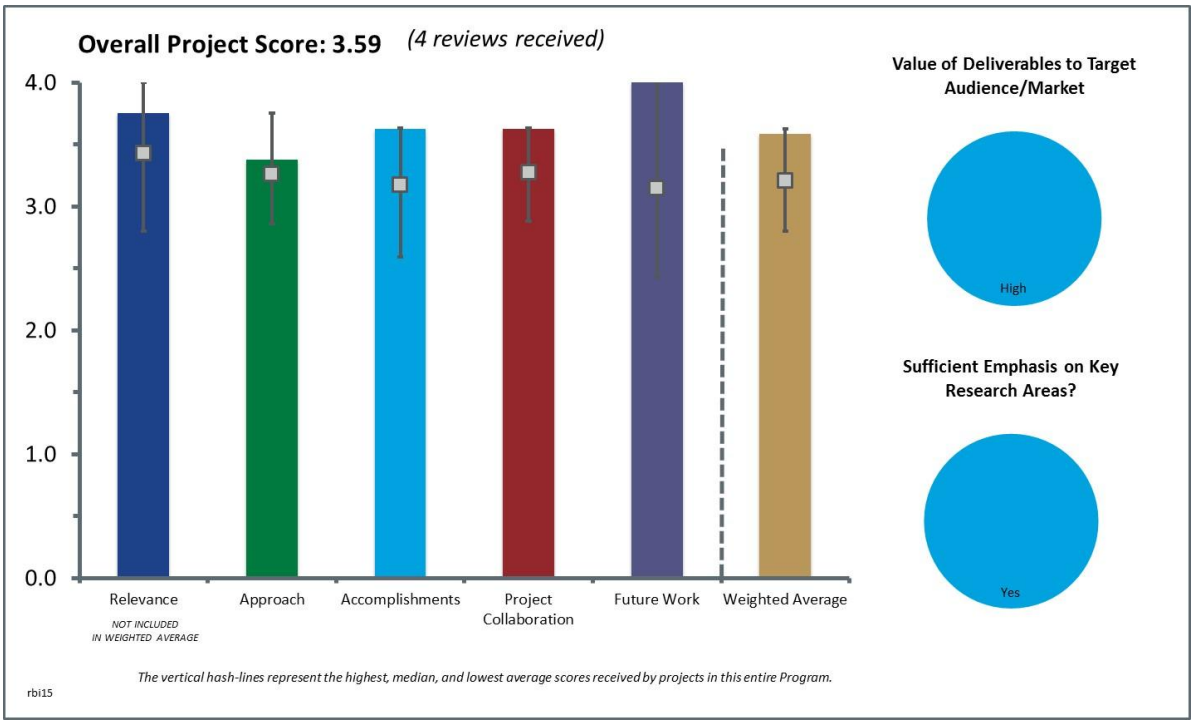
Presenter: Michael Baechler, Pacific Northwest National Laboratory, michael.baechler@pnnl.gov
DOE Manager: Eric Werling, 202-586-0410, eric.werling@ee.doe.gov

Project Description

The Building America Solution Center is a community-driven online resource that provides residential building professionals with access to validated information on high-performance design and construction. Topics include air sealing and insulation; heating, ventilation, and air conditioning components; windows; indoor air quality; and more. Each topic offers a variety of resources, such as scopes of work, installation guidance, computer-aided design drawings, relevant codes and standards, and labeling program compliance. The goal of the Solution Center is to make best practices accessible and accelerate their dissemination, leading to better-educated stakeholders and fostering a community of users who will translate building science research into practice.

Summary of Review Comments

According to reviewers, the project provides a lively and regularly updated online resource with valuable information on high-performance building design and construction. Reviewers commented that the tool is well designed and offers in-depth and accessible information for the industry and the public, although one reviewer commented that there should be more information on the value and benefits of the various technologies. Reviewers also noted that the project has good partnerships; however, one reviewer felt that the project is missing two vital audiences—homeowners and building operators. Reviewers suggested allowing users to rate the usefulness of information and working to market the tool to a larger audience. Also, reviewers felt that increased collaboration with industry and government partners would greatly improve the project.



Project # RBI-14: Resolving Code and Standard Barriers to Building America Innovations

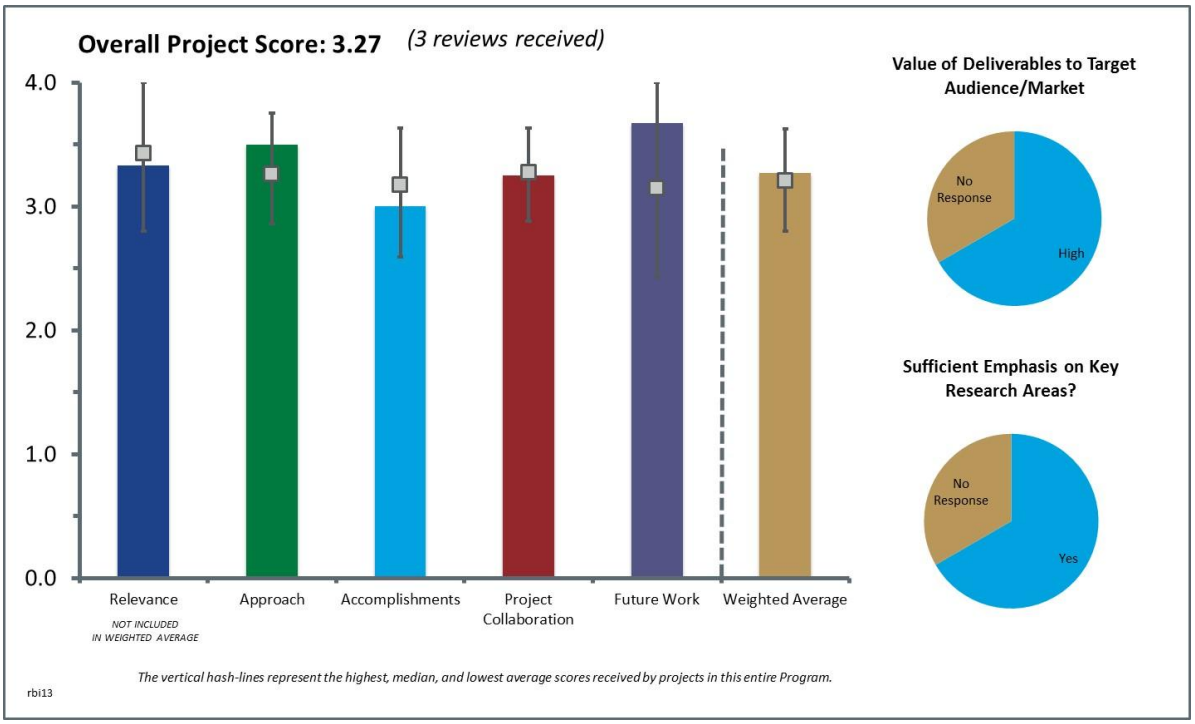
Presenter: Pam Cole, Pacific Northwest National Laboratory, pam.cole@pnnl.gov
DOE Manager: Eric Werling, 202-586-0410, eric.werling@ee.doe.gov

Project Description

This project is developing processes and resources for a Codes and Standards Innovation (CSI) team to assist research partners and industry in overcoming codes and standards barriers to high-performance innovations. The goal of this project is to speed the market adoption of residential high-performance innovations and technologies facing code and standard barriers by utilizing tools and resources developed by the CSI team and others to address these barriers. The Building America program supports codes and standards by identifying and filling gaps in building science and system knowledge that may limit effective implementation of new and existing standards.

Summary of Review Comments

Reviewers praised the project for developing valuable connections between existing technology and practices and the codes and standards community. According to reviewers, the project has established realistic goals, identified the right stakeholders, and developed a solid understanding of the barriers hindering innovation and deployment of emerging technologies. One reviewer was concerned that the project's impacts may be limited if the codes and standards audiences are not included early in the process. Reviewers suggested focusing on the reasons for why new technologies should be integrated, and prioritizing each barrier based on considerations of the possible impact, cost, and energy savings..



Project # RBI-15: Better Buildings Residential Program

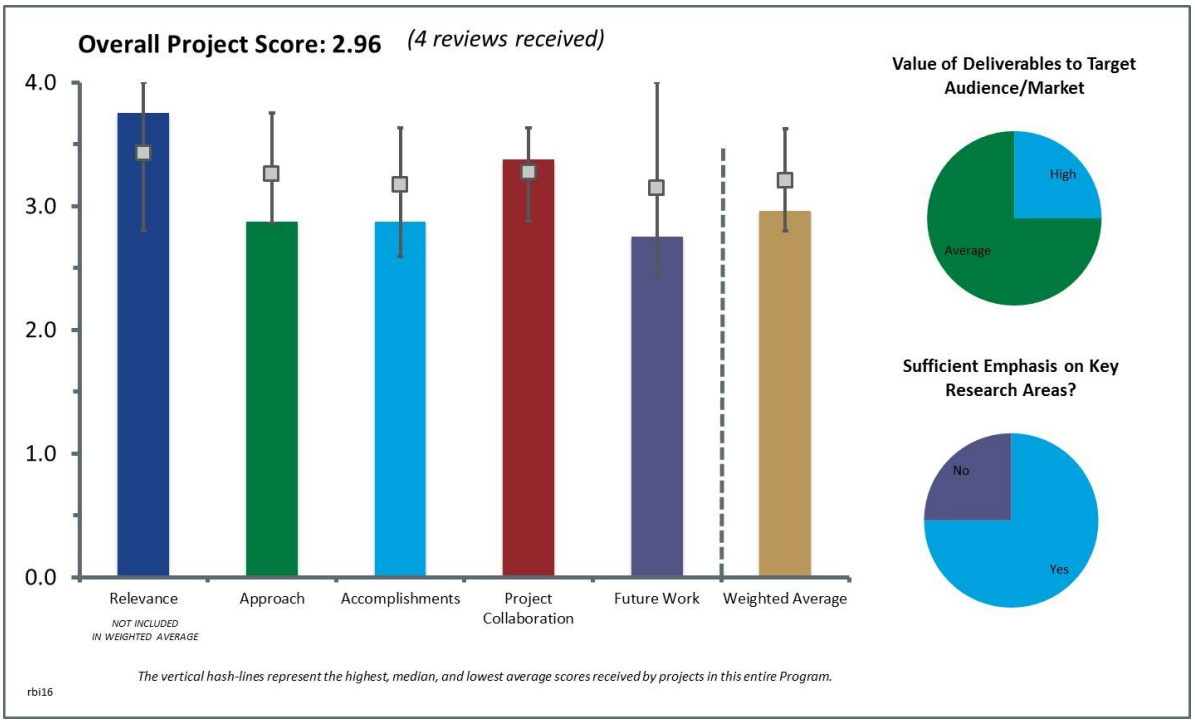
Presenter: Danielle Byrnett, U.S. Department of Energy, danielle.byrnett@ee.doe.gov

Project Description

The Better Buildings Residential (BBR) program works with residential efficiency programs and their partners to improve homeowners' lives, the economy, and the environment by increasing the number of high-performing, energy-efficient existing homes in the United States. The program provides strategic planning support, program information tracking, communications and outreach, program participant communication, and peer exchange opportunities for partners to share and discuss strategies and innovative approaches . The program's goal is to demonstrate at scale market-based programs offering savings of 20% or more to existing buildings by 2020, 25% by 2025, and 50% or more by 2030. BBR has developed a suite of solutions for energy efficiency program administrators to leverage to expand energy efficiency in existing homes according to their budgets, experience, and goals. These resources provide a combination of advice, tools, and data to overcome market barriers in the residential efficiency marketplace.

Summary of Review Comments

According to reviewers, the project addresses the difficult challenges involved in improving energy efficiency in the residential sector. Specific project strengths cited include the identification of key stakeholders in the industry, the creation of high-quality deliverables, and the emphasis on developing a comprehensive approach to the residential energy efficiency market. However, one reviewer noted that the project's ambitious goals might hinder the project. Also, reviewers were concerned that actual energy savings are not clear and that the team has failed to identify the most significant barriers. Reviewers suggested that the team thoroughly review the most significant barriers, paying particular attention to barriers that have limited homeowners' investments in efficiency retrofits.



Project # RBI-16: Better Buildings Neighborhood Program Data Structure

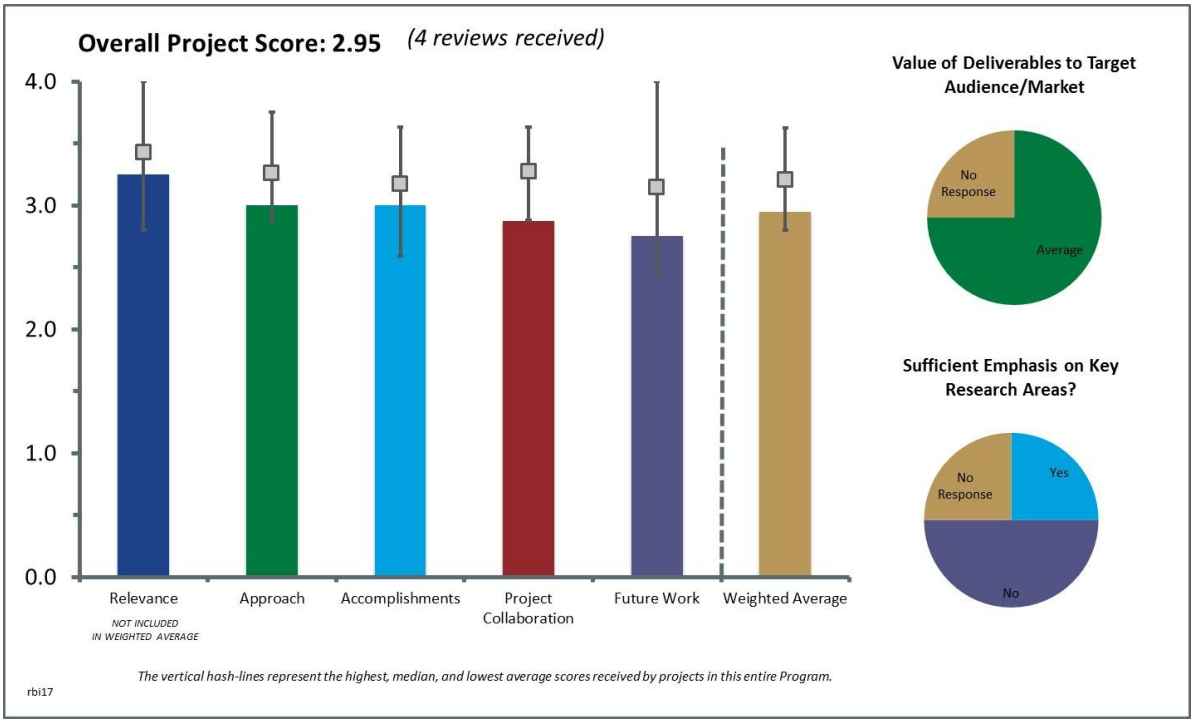
Presenter: Dale Hoffmeyer, U.S. Department of Energy, dale.hoffmeyer@ee.doe.gov

Project Description

The purpose of this project is to collect data from organizations awarded federal financial assistance (i.e., Better Buildings Neighborhood Program [BBNP] grantees) to test energy upgrade business models and improve building energy efficiency across the country. This data is used to populate the Building Technologies Office's (BTO's) Buildings Performance Database, track grantee progress, evaluate impact, and identify successful strategies. This project further supports the missions of both the Office of Energy Efficiency and Renewable Energy and BTO to lower barriers to energy efficiency in buildings—specifically, their efforts related to improving program design and more efficient data management.

Summary of Review Comments

Reviewers remarked that analyzing data and results from the American Recovery and Reinvestment Act–funded BBNP projects is critical to BTO objectives, and that the findings could have great value, despite potential issues with data quality. Reviewers noted that data collection issues came about because the original evaluation and data collection plan was developed late in the program planning cycle, while also applauding efforts to address the resulting challenges. Reviewers generally praised the project's accomplishments, but they also remarked on the limitations of the data collected. One reviewer also commented that the actual energy savings are unclear. Reviewers recommended (1) providing a project template that would stand alone or integrate other documentation tools, (2) putting more emphasis on evaluation, (3) including more collaboration from the field, and (4) providing an alignment tool the entire industry could use.



Project # RBI-17: Performance Maps

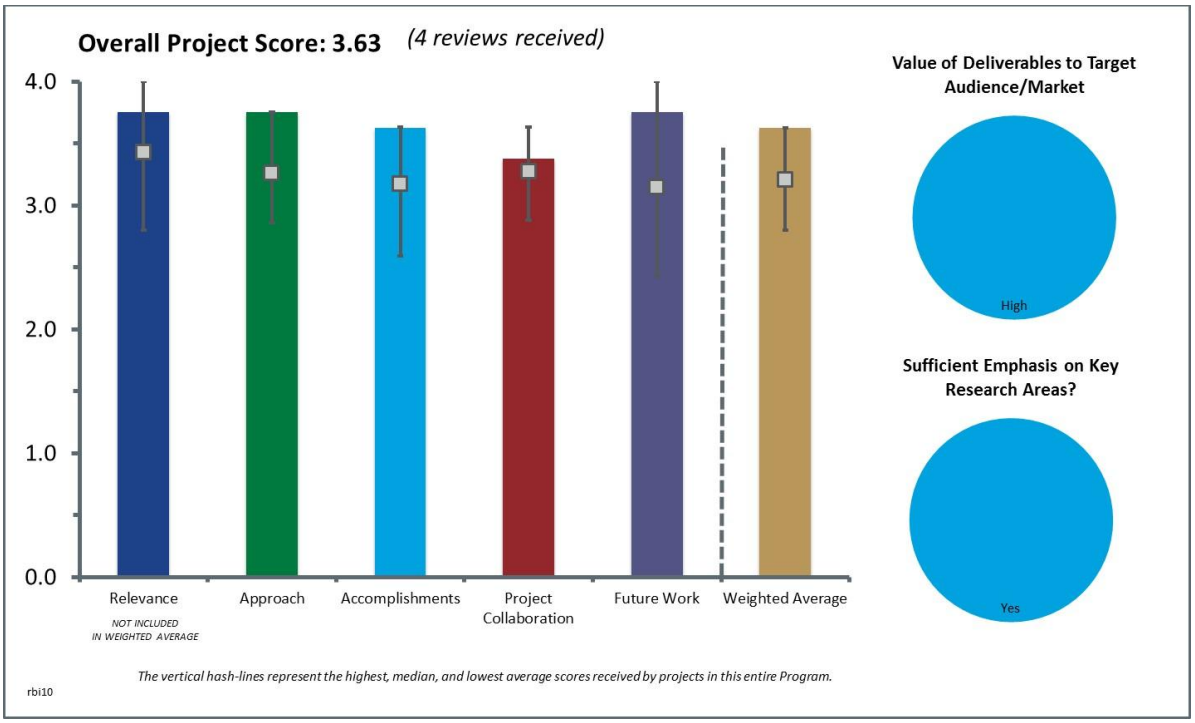
Presenter: Dane Christensen, National Renewable Energy Laboratory, dane.christensen@nrel.gov
DOE Manager: Eric Werling, 202-586-0410, eric.werling@ee.doe.gov

Project Description

Through laboratory evaluation, this project will develop detailed data sets, termed "performance maps," of certain types of heat pumps. In fiscal year 2014, the National Renewable Energy Laboratory will develop performance maps of residential variable-speed heat pumps (VSHPs). The U.S. Department of Energy's Building America program and similar programs rely on performance maps to accurately evaluate product energy use and cost effectiveness in a whole-building context, across varying climates and conditions.

Summary of Review Comments

Reviewers praised the project for addressing a key gap in predicting variable-speed heating, ventilation, and air conditioning performance. They also commented positively on the project's strong focus, logical approach, efforts to address critical barriers, and potential to improve the accuracy of energy simulation models. Some reviewers expressed concern that products provided by the small number of manufacturing partners (three) do not sufficiently characterize the wide range of performance strategies available in the marketplace. Reviewers recommended testing other sizes of VSHPs, increasing partnerships with heat pump manufacturers, considering the effects of predicted energy usage due to improper installation techniques, and adding alternative delivery methods for the project findings.



Project # RBI-18: Smart Ventilation

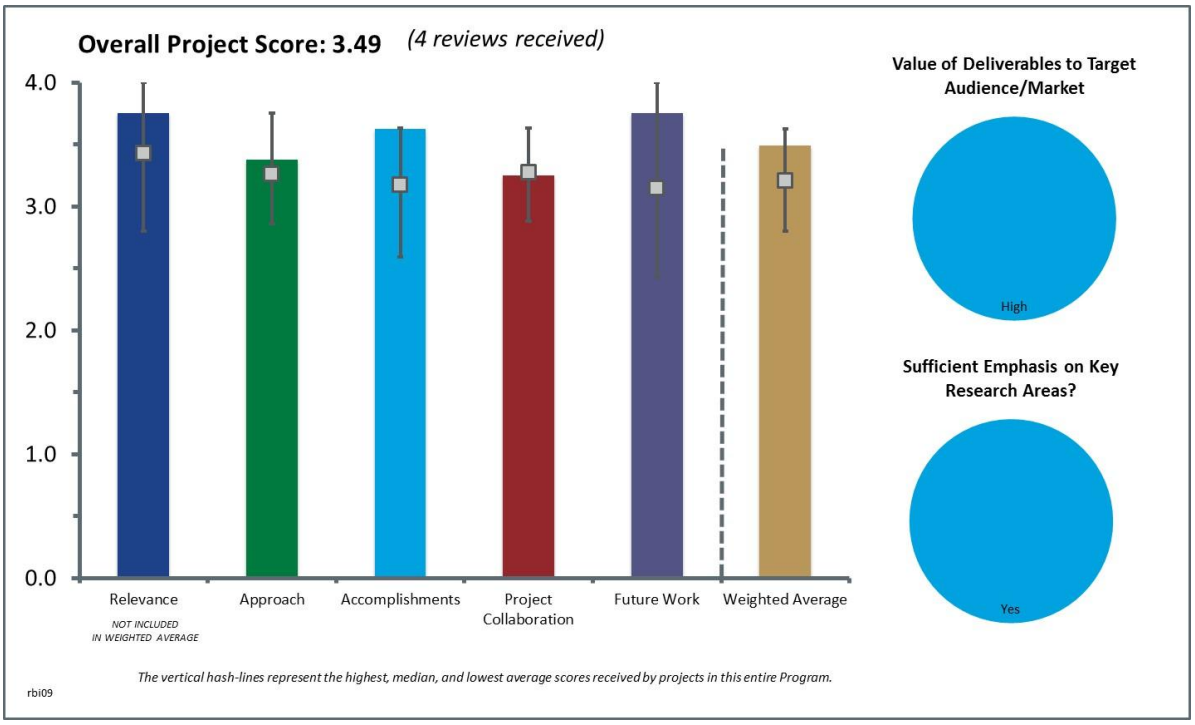
Presenter: Brett Singer, Lawrence Berkeley National Laboratory, BCSinger@lbl.gov
DOE Manager: Eric Werling, 202-586-0410, eric.werling@ee.doe.gov

Project Description

The objective of this project is to minimize the energy required to provide acceptable indoor air quality. High-performance homes built with tight envelopes will benefit most from this technology. Smart ventilation is expected to save at least 40% on energy and peak demand. The project is seeking to create an industry partnership to commercialize the current Residential Integrated Ventilation Controller and is collaborating with Building America's research teams to improve its control algorithms.

Summary of Review Comments

Reviewers commented favorably on the project for addressing the critical need to reduce outside air under specific circumstances. They also praised the project for participating on the ASHRAE 62.2 committee, delivering output that is industry licensed, and providing guidance to manufacturers of residential ventilation systems and to home developers on energy-efficient ventilation control. Specific weaknesses cited include the following: (1) the price point of the product is not well known, (2) a small number of equipment manufacturers is involved, and (3) the team has not considered the ventilation manufacturers that do not allow third-party software/hardware to control their equipment. Reviewers recommended partnering with heating, ventilation, and air conditioning primary equipment manufacturers or industry associations; including relative humidity as one of the control variables; and further demonstrating the finished design in Building America projects.



5. Building Energy Codes

5.1 Program Overview

The Building Energy Codes Program supports efforts to increase the energy efficiency of buildings by developing and implementing model codes and standards. Building energy codes and standards are designed to set minimum efficiency requirements for new and renovated buildings so as to reduce energy use and emissions over the life of the building. The Building Energy Codes Program and the Appliance & Equipment Standards Program drive BTO's efforts to "lock in the savings" of building efficiency technologies through regulatory activities.

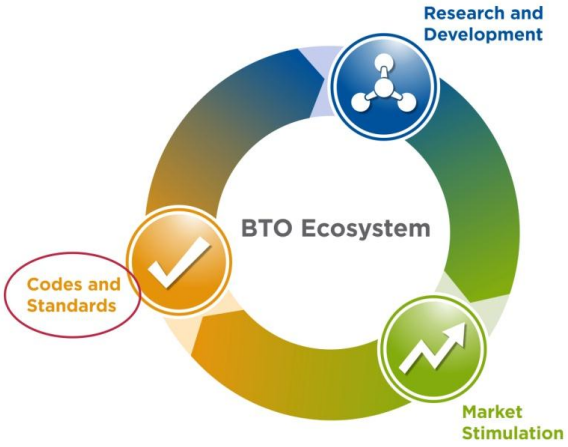


Figure 7. The role of the Building Energy Codes Program in the BTO Ecosystem

In addition to participating in the industry-led processes that develop model energy codes and standards, the Building Energy Codes Program does the following:

- Supports energy code adoption and implementation in states and local jurisdictions.
- Assists building industry stakeholders and enforcement officials in improving compliance with energy codes.
- Establishes regulations for energy efficiency in federal buildings and manufactured housing.
- Provides compliance tools, training materials, and technical assistance options.

The Program's *mission* is to support building energy code and standard development, adoption, implementation, and enforcement processes to achieve the maximum practicable, cost-effective improvements in energy efficiency while providing safe, healthy buildings for occupants.

The Program's 2020 goal is to support the development and implementation of codes targeting consumer energy savings of approximately 0.7 quads (compared to a 2010 baseline[7]), representing a cumulative savings of 10.2 quads since program inception in 1992. The Program's 2030 goal is to achieve primary energy savings of approximately 1.2 quads (compared to a 2010 baseline), representing a cumulative savings of 24.6 quads.[8] To track its progress toward achieving these goals, the Program will monitor state- and local-level building energy code adoption and compliance to assess its effectiveness in influencing changes in code development, adoption, and compliance.

[7] U.S. Energy Information Administration, *Annual Energy Outlook 2010*, DOE/EIA-0383(2010), April 2010.
[8] BTO goals were updated after this report was generated. The updated goals will appear in the 2015 BTO Peer Review Report and in BTO's Multi-Year Program Plan, which will be published in the Fall of 2015.

5.2 Summary of Peer Review Feedback

Project # COD-01: State and Local Code Implementation: State Energy Officials

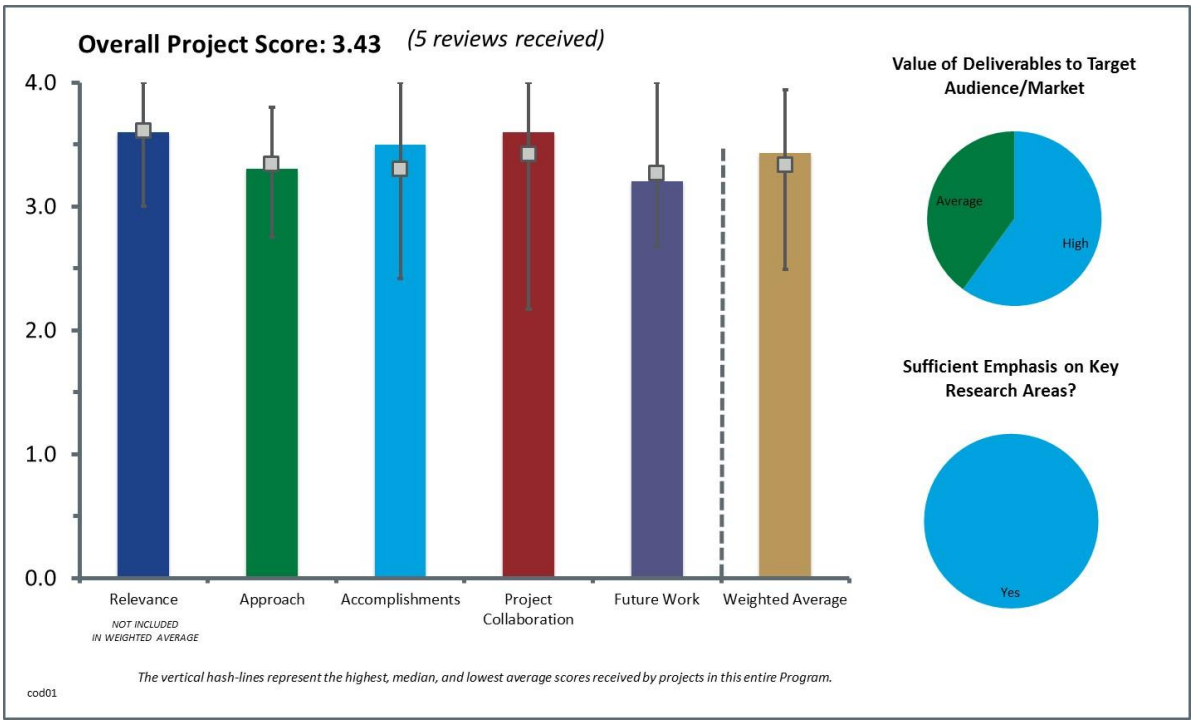
Presenter: Chris Wagner, National Association of State Energy Officials, cwagner@naseo.org
DOE Manager: Jeremiah Williams, 202-287-1941, jeremiah.williams@ee.doe.gov

Project Description

The primary goal of this project is to engage, through technical assistance, state energy offices (SEOs) in energy code adoption, implementation, and compliance activities. Objectives include the facilitation of interactions between SEOs and utilities, coordination of code support based on individual state needs, and creation of case studies and other resources. Through its unique relationship with SEOs, the National Association of State Energy Officials (NASEO) has the capacity to disseminate its technical knowledge, support, and resources to this key stakeholder group, as well as communicate their needs up to the national level. These activities increase SEO involvement in adoption and compliance, which helps to ensure state-level support.

Summary of Review Comments

The review team commended the project for its focus on assisting SEOs to improve building energy codes and code compliance through a wide range of activities. According to reviewers, specific strengths include assisting its members in planning, developing best practices, providing useful resources on a variety of issues, and collaborating with a wide range of entities. One reviewer was concerned that the project is spread too thin and, consequently, might struggle to cover the critical issues. Another reviewer was concerned that the project is too focused on inputs and recommended that more attention be given to outputs. Reviewers recommended increasing efforts to coordinate with stakeholders, reducing program overlaps, and focusing more on promoting energy efficiency in areas in which NASEO has a strong leadership history.



Project # COD-02: State and Local Code Implementation: Midwest Region

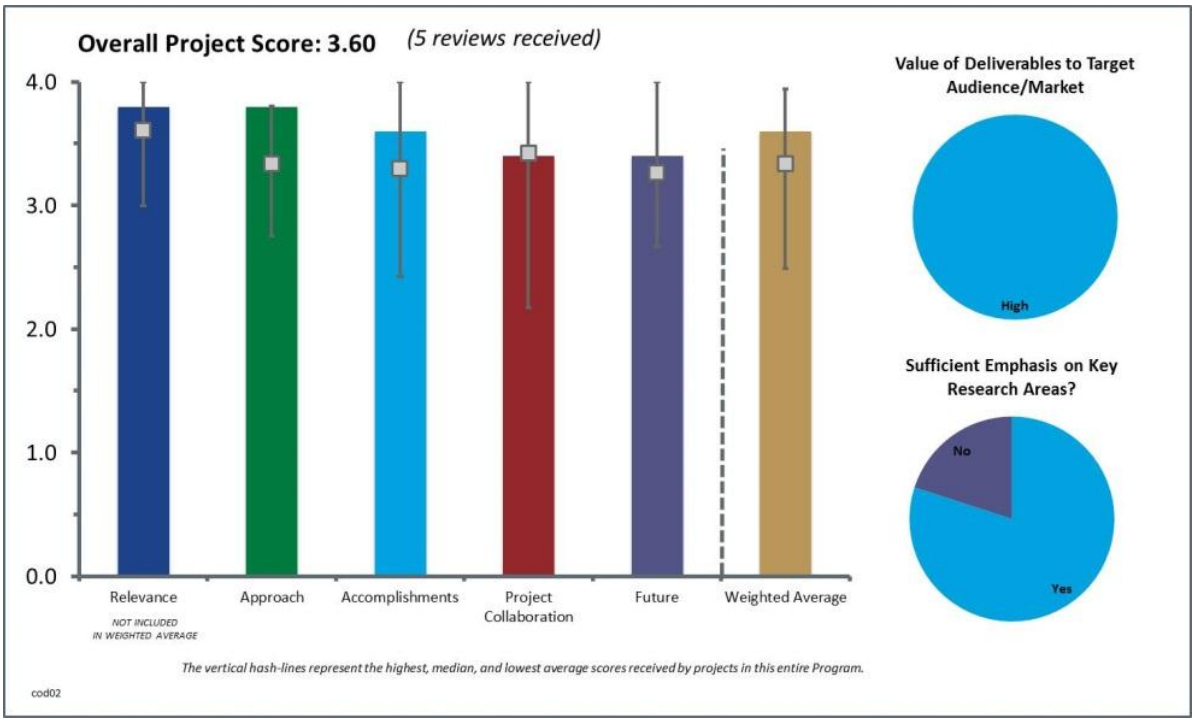
Presenter: Isaac Elnecave, Midwest Energy Efficieny Alliance, ielnecave@mwalliance.org
DOE Manager: Jeremiah Williams, 202-287-1941, jeremiah.williams@ee.doe.gov

Project Description

The goal of the Midwest Energy Efficiency Alliance (MEEA) project is to provide technical assistance and stakeholder engagement in support of energy code activities in states and municipalities in the Midwest. Specific objectives include adoption technical assistance, compliance technical assistance, and collaboration with the National Collaborative on Energy Codes. MEEA maintains a reputation as the technical expert for energy code issues in the Midwest, and through this project, it can identify opportunities for code advancement, direct necessary resources to states and jurisdictions in need, and respond to issues as they arise. As such, MEEA's project helps to ensure that states and municipalities throughout the Midwest adopt more stringent energy codes and implement them effectively.

Summary of Review Comments

Reviewers noted that the project is highly relevant to the Building Technologies Office's mission and goals and will result in significant energy savings in the Midwest. Reviewers identified the following strengths: (1) positive impact on code adoption, (2) innovation in energy efficiency improvements, and (3) successful engagement with a variety of partners and stakeholders. Cited project weaknesses include (1) the lack of broad stakeholder participation, (2) the lack of resources, and (3) the failure to explain capability gaps. Reviewers recommended that MEEA's history and technical strengths be shared with newer stakeholders, and that MEEA conduct an assessment of its available resources and education needs.



Project # COD-04: State and Local Code Implementation: Southeast Region

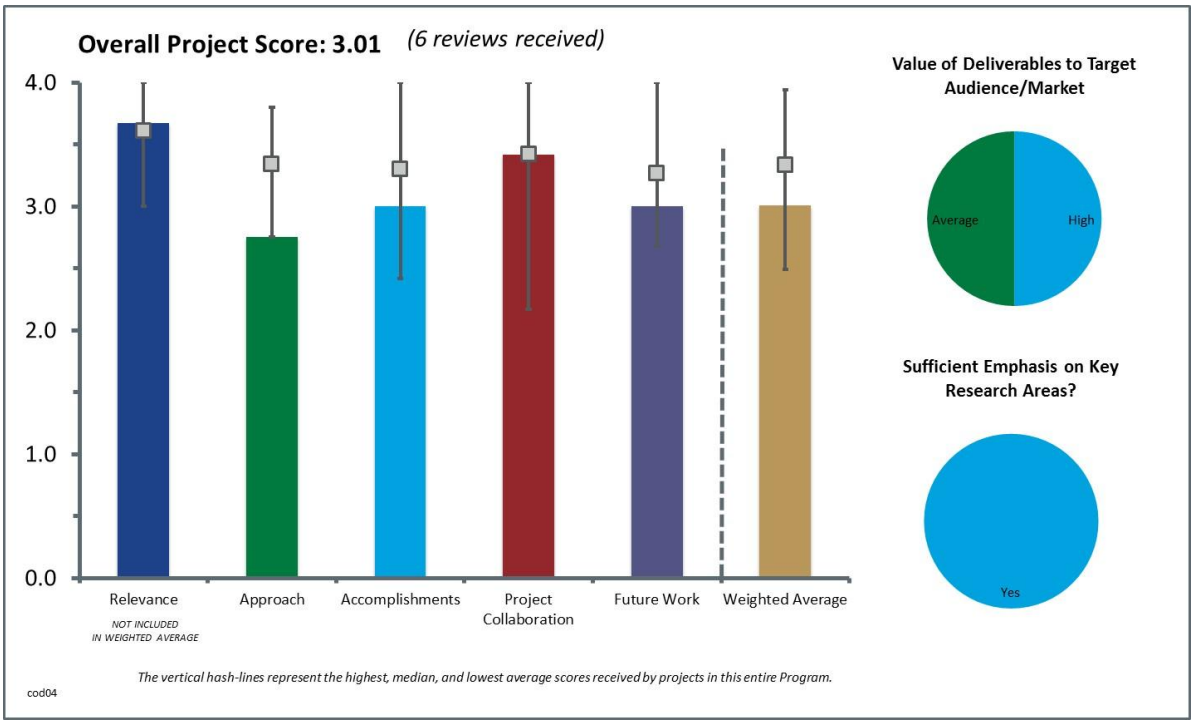
Presenter: Lauren Westmoreland, Southeast Energy Efficiency Alliance, lwestmoreland@seealliance.org
DOE Manager: Jeremiah Williams, 202-287-1941, jeremiah.williams@ee.doe.gov

Project Description

The goal of this Southeast Energy Efficiency Alliance (SEEA) project is to provide technical assistance and regional stakeholder support for energy codes in the Southeast. Specific objectives include adoption technical assistance, compliance technical assistance, and collaboration with the National Collaborative on Energy Codes. SEEA meets these objectives by seeking strategic locations for adoption support and implementation programs, promoting regional and national best practices in "laggard" areas, and training stakeholders on new and updated energy codes. Through its on-the-ground support, SEEA's project has played a role in a number of regional success stories, increasing code adoption and compliance while coordinating with the U.S. Department of Energy and the rest of the National Collaborative on Energy Codes.

Summary of Review Comments

The review team commended the project for focusing on energy code adoption, training, and support in the Southeast, a region with great potential for energy efficiency improvements. According to reviewers, the project has taken into consideration the unique characteristics of each state when developing custom strategies; has a good understanding of the challenges it faces in each state; has developed a robust group of stakeholders, collaborators, and subcontractors; and has created useful code compliance guidebooks. However, reviewers felt that the barriers are not fully addressed and that a large number of the interactions envisioned may not be feasible. Reviewers suggested increasing the focus on a few critical issues, expanding activities into all 11 states, and taking advantage of partners and subcontracts. Also, reviewers recommended that SEEA move beyond its facilitator role and take on additional leadership roles.



Project # COD-05: Building Energy Codes Program Overview

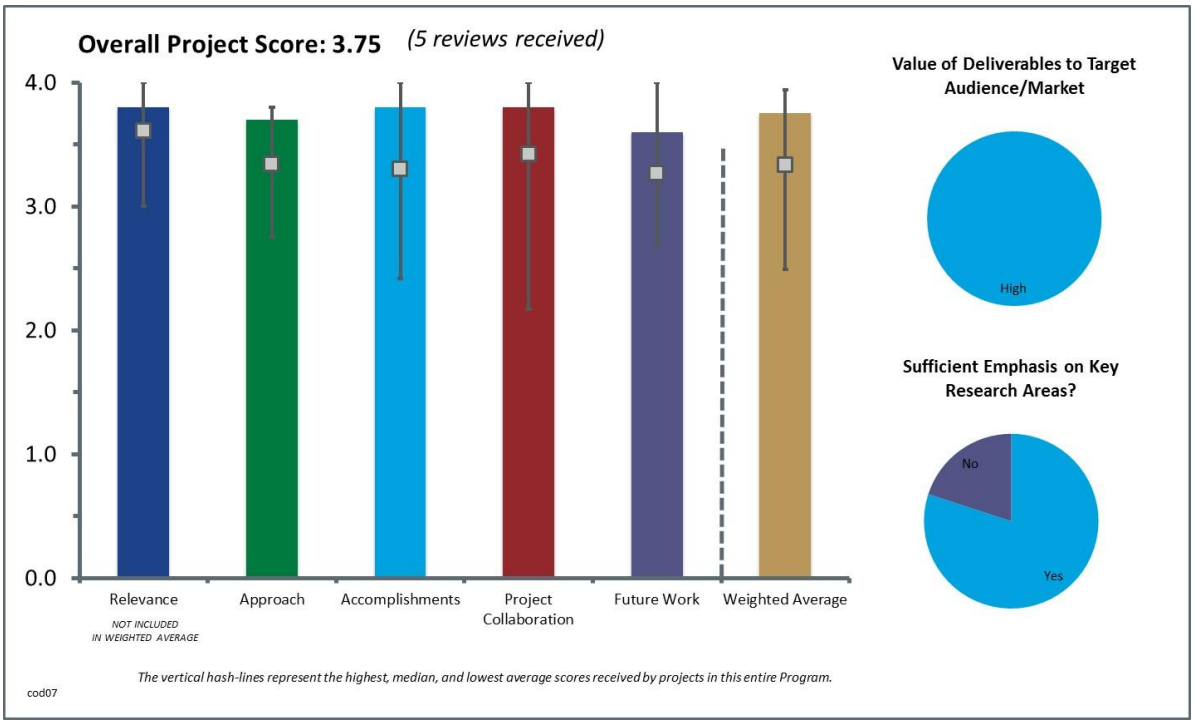
Presenter: Bing Liu, Pacific Northwest National Laboratory, bing.liu@pnnl.gov
DOE Manager: Jeremiah Williams, 202-287-1941, jeremiah.williams@ee.doe.gov

Project Description

This project directly supports the U.S. Department of Energy (DOE) Building Energy Codes Program in meeting its statutory directives, including participating in model energy code development and providing technical assistance to states. The objectives of this project are to seek improvements to model energy codes that lead to cost-effective energy savings and improved usability, and to assist states in adopting and complying with building energy codes. Program efforts are anticipated to result in a higher-performing building stock on the national scale and an estimated primary energy savings of 1.1 quads by 2020.

Summary of Review Comments

The review team praised the project for providing relevant and timely resources for code adoption, implementation, and enforcement processes. According to reviewers, the project provides essential information to states and non-government organizations via valuable deliverables. Reviewers also noted that the project has strong future plans and good collaborations with stakeholders, and that it has identified key barriers related to building energy code adoption and compliance. One reviewer was concerned that the project is spread too thin. Reviewers recommended the following: (1) increasing the use of actual utility data in the analysis, (2) performing additional cost-effectiveness analysis, (3) providing technical assistance to support DOE in completing statutory directives, (4) continuing to focus on major innovations, and (5) placing greater emphasis on simpler ways of implementing codes and standards.



Project # COD-06: State and Local Code Implementation: Northeast Region

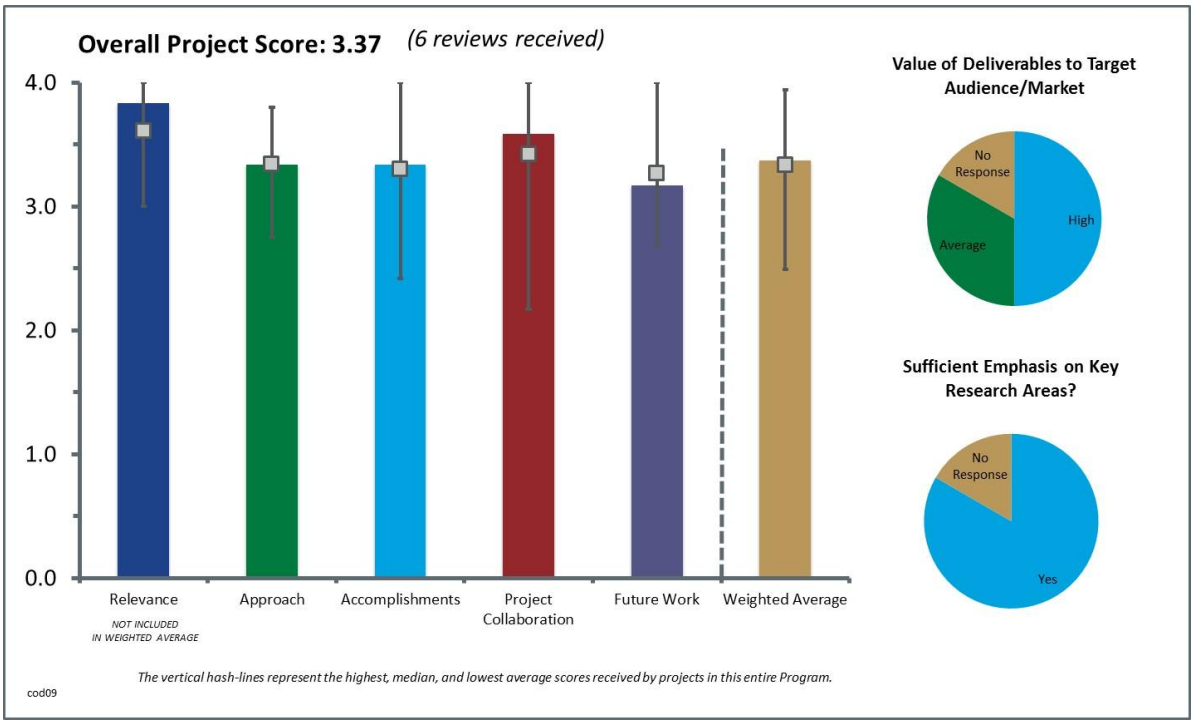
Presenter: Carolyn Sarno, Northeast Energy Efficiency Partnerships, cgoldthwaite@neep.org
DOE Manager: Jeremiah Williams, 202-287-1941, jeremiah.williams@ee.doe.gov

Project Description

The Northeast Energy Efficiency Partnerships (NEEP) project is a continuation of a regional effort started in 1998 to help states maintain a commitment to progressive building energy codes with full compliance. The project's goal is to help the Northeast/Mid-Atlantic region save energy by providing states with resources to develop, implement, and comply with building energy codes. NEEP's region includes Maine; New Hampshire; Vermont; Massachusetts; New York; Connecticut; Rhode Island; Washington, D.C.; Pennsylvania; Delaware; New Jersey; and Maryland. The project is working to advance state and regional adoption and implementation of progressive building energy codes and to help these 11 states and Washington, D.C., establish an infrastructure to achieve code compliance.

Summary of Review Comments

Reviewers praised the project's success in advancing energy code adoption in the Northeast. Cited project strengths include (1) effective relationships with organizations in the region and a good understanding of stakeholder needs, (2) improvements in building energy codes adoption, and (3) a solid history of leadership and expertise in the region's energy issues. Noted project weaknesses include (1) the lack of relationships in areas where building codes adoption and compliance is lagging, (2) too much dependence on the state's political situation, and (3) the lack of quantifiable results/data for each effort to inform future decisions. Reviewers recommended that the project continue to educate and empower local leaders to promote energy efficiency in their home states.



Project # COD-07: State and Local Code Implementation: Southwest Region

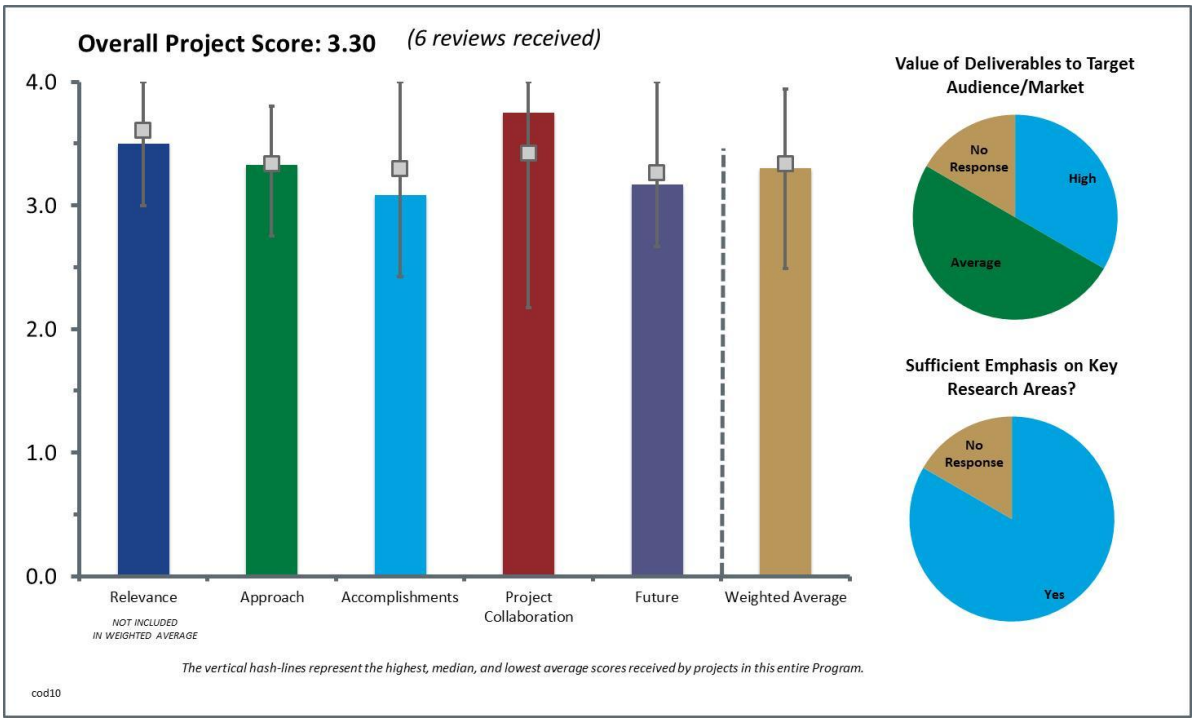
Presenter: Jim Meyers, Southwest Energy Efficiency Project, jmeyers@swenergy.org
DOE Manager: Jeremiah Williams, 202-287-1941, jeremiah.williams@ee.doe.gov

Project Description

The Southwest Energy Efficiency Project (SWEEP) works extensively on energy code adoption and compliance as well as above-code programs to advance energy efficiency in buildings, industries, and vehicles in the Southwest. SWEEP works in conjunction with multiple U.S. Department of Energy programs as well as utilities, state and local governments, and other stakeholders within Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming. The project's goal is to advance the adoption of newer energy codes and standards that provide up to 30% savings compared to the baseline, and prioritize code compliance among code officials and design and construction professionals.

Summary of Review Comments

Reviewers commented favorably on the project's progress in improving energy codes and compliance in the Southwest region, a challenging area because of the diversity of the states and the lack of state-wide codes. Reviewers noted that the team has been able to (1) identify and resolve a wide range of issues, (2) craft excellent strategies to advance energy efficiency in each state via grassroots methods, (3) masterfully pull together key stakeholders, and (4) focus resources on high-impact issues. However, reviewers were concerned that the project team is too small and that the strategic studies appear to be limited to small efforts that do not reach the state level. The reviewers recommended implementing quantifiable goals and identifying metrics that can be assessed to determine areas of improvement.



Project # COD-08: State and Local Code Implementation: South-Central Region

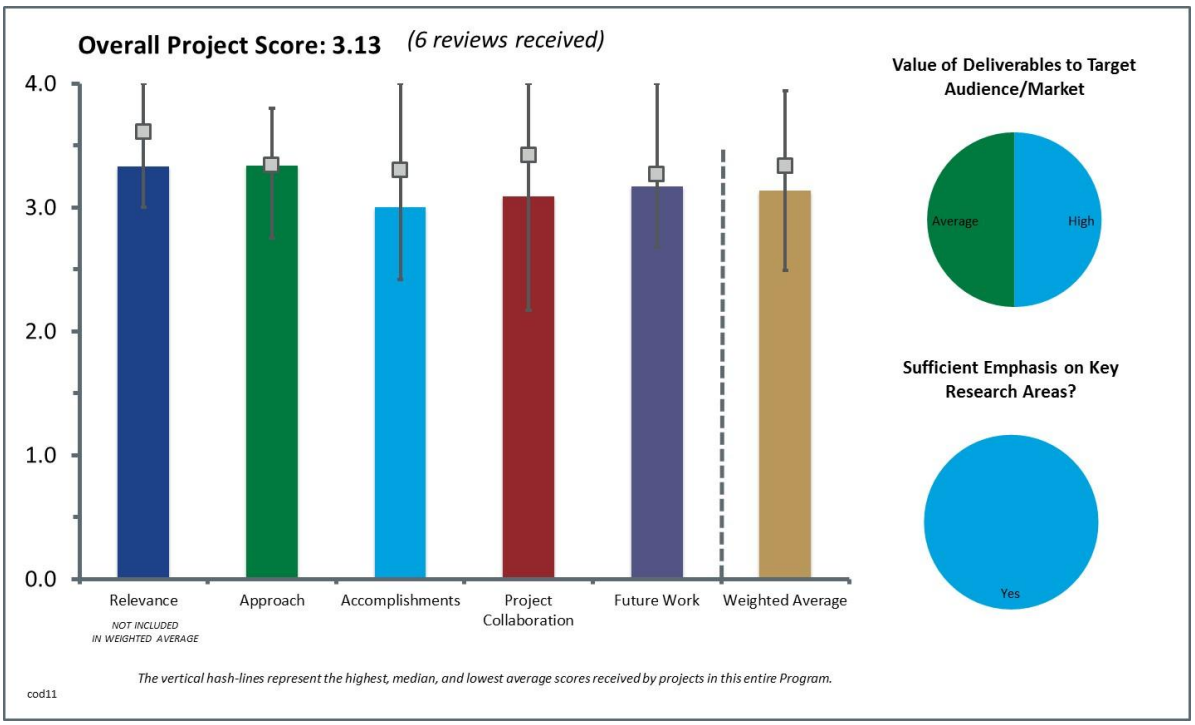
Presenter: Christine Herbert, South-Central Partnership for Energy Efficiency as a Resource, cherbert@eepartnership.org
DOE Manager: Jeremiah Williams, 202-287-1941, jeremiah.williams@ee.doe.gov

Project Description

The South-central Partnership for Energy Efficiency as a Resource (SPEER) is working to provide enhanced coordination among stakeholders, provide education and training for building officials and professionals, and communicate with other regional energy efficiency organizations to replicate best practices. The goal of this project is to increase adoption, implementation, compliance, and enforcement of building energy codes through outreach, collaboration, and education. SPEER seeks to accelerate the adoption of energy efficiency through regional collaborations with state and local governments, utilities, industry, environmental and consumer groups, and other stakeholders.

Summary of Review Comments

According to reviewers, the project has been successful in achieving its goals so far; however, reviewers noted that certain states still have issues to address. Cited project strengths include (1) the formation of strong partnerships and future plans, (2) a good focus on code-related activities and compliance, and (3) significant accomplishments over a short time. Reviewers cited a lack of resources as a potential weakness and noted the need for the project to expand its outreach to jurisdictions that currently do not prioritize codes. Reviewers suggested that more concrete information be provided about the project's efforts and increased collaborations take place with non-governmental organizations, cities, and regional and national stakeholders.



Project # COD-09: State and Local Code Implementation: Northwest Region

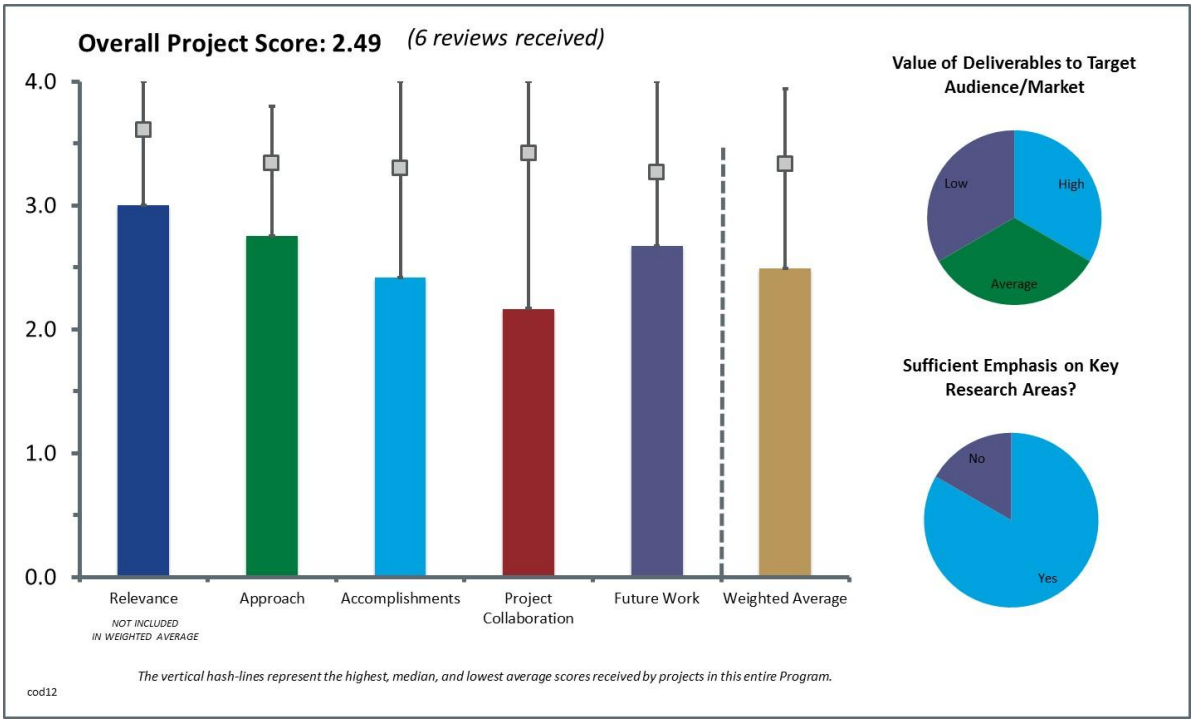
Presenter: Ken Baker, Northwest Energy Efficiency Alliance, kbaker@neea.org
DOE Manager: Jeremiah Williams, 202-287-1941, jeremiah.williams@ee.doe.gov

Project Description

This project seeks to accelerate the adoption of energy efficiency in Oregon, Washington, Idaho, and Montana through regional collaborations with state and local governments, utilities, industry, environmental and consumer groups, and other stakeholders. The goal of this project is to develop a strategy for small cities to address the energy performance of their whole building stock. The project focuses on improving the performance of the poorest-performing buildings within targeted, small-to-medium-sized cities (those with populations of less than 300,000) that are large enough to have a significant amount of commercial building stock in the 25,000–50,000 square-foot range.

Summary of Review Comments

Reviewers commented that the project is addressing the important issue of increasing energy efficiency in existing buildings that have poor energy usage performance, but they questioned the project's alignment with the Building Technologies Office's Building Energy Codes Program. They stated that the information could be very useful if the benchmarking plan is successful, but some had issues with the number of buildings that will be upgraded as a result of the project. They also noted that the plan builds on policy initiatives from across the country. Identified weaknesses include (1) the lack of detail on the outcome-based code program, (2) the lack of clarity on how the project will achieve the desired results, and (3) whether the "name and shame" approach will really foster participation from building owners. Reviewers recommended (1) expanding collaboration efforts and engaging building owners, (2) having the project be an add-on to an existing code effort, and (3) working with a standards writing organization so that it could incorporate the project's results.



Project # COD-10: Technical Assistance: Increasing Code Compliance

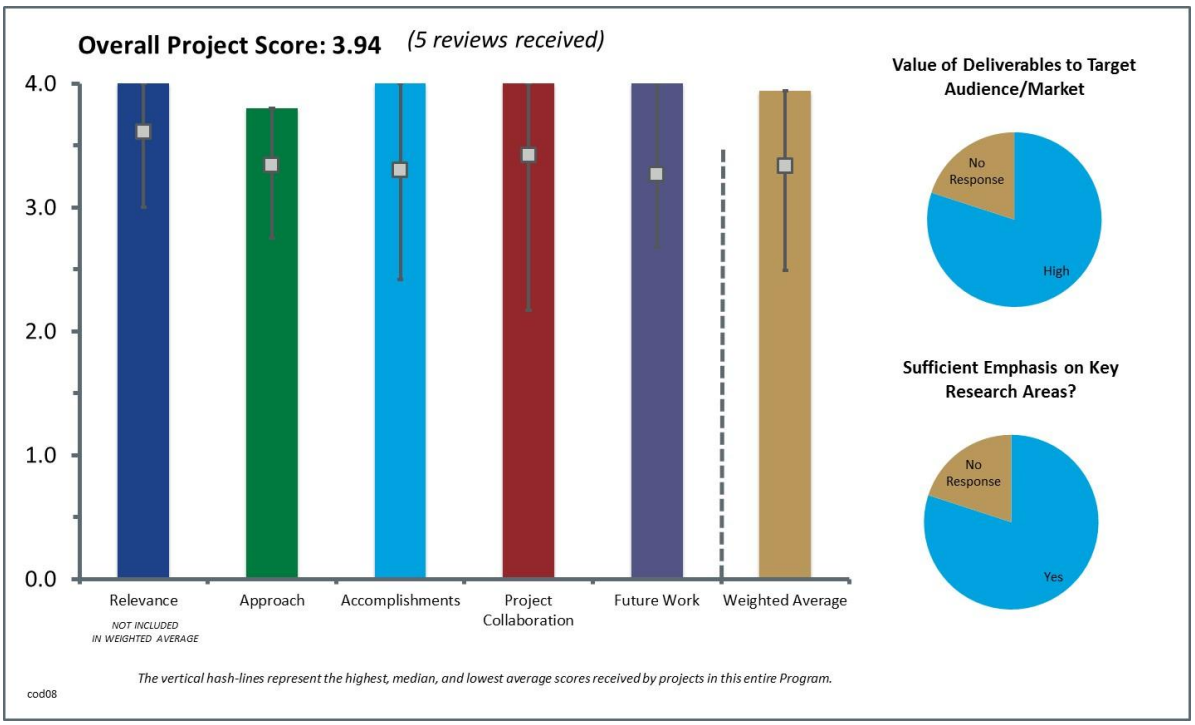
Presenter: Rosemarie Bartlett, Pacific Northwest National Laboratory, rosemarie.bartlett@pnnl.gov
DOE Manager: David Cohan, 202-287-1983, david.cohan@ee.doe.gov

Project Description

The primary goal of this project is to support the U.S. Department of Energy in providing technical assistance to states. This technical assistance will be used to implement building energy codes, including increasing and verifying compliance to ensure consumer benefits. This project will include software development to streamline the code compliance process as well as provide resources and technical guidance to states to increase code compliance.

Summary of Review Comments

Reviewers gave the project very high marks and considered it to have strong potential for improving building energy code compliance and enforcement. Specifically, reviewers praised the project for (1) seeking and responding to feedback from key stakeholders in building efficiency; (2) its well-designed, practical compliance tools for code users and building codes stakeholders; and (3) its focus on the needs of states and local jurisdictions. One reviewer stated that the project team should consider how often new versions of the software should be released, noting the trade-off between making new versions available as soon as possible versus allowing users to become familiar with the product. Recommendations include (1) increasing communication with key stakeholders early in the project, (2) completing the update of the RES*check* compliance tools and the updated compliance methodology, (3) including the implementation stakeholders among the target audience, and (4) prioritizing improving the software's usability and demonstrating the software's benefits to state building code agencies.



Appendix A: Final List of Reviewers

Abramson, Alexis
Case Western Reserve University

Actman, Laurie
Energy Efficient Buildings Hub

Amann, Jennifer
American Council for an Energy-Efficient Economy

Aoki-Kramer, Michael
RDH Building Sciences, Inc.

Auburn, Walt
Consultant

Balbach, Chris
Performance Systems Development of NY, LLC

Bargatin, Igor
University of Pennsylvania

Braham, William
University of Pennsylvania

Callahan, Jack
Bonneville Power Administration

Chiu, Wilson
University of Connecticut

Coulter, Jonathan
Advanced Energy

Crawley, Dru
Bentley Systems, Inc.

Culp, Thomas
Birch Point Consulting LLC

Doria, Jordan
Ingersoll Rand

Early, Michael
U.S. Department of Housing and Urban Development

Eger, Bill
City of Alexandria

Elling, Jennifer
Xcel Energy

Garries, Ray
Jeld-Wen

Gonzalez, Jorge
The City College of New York

Guttman, Maureen
Alliance to Save Energy

Hartman, Tom
The Hartman Company

Haugh, Jennifer
Iconic Energy Consulting

Hosni, Mo
Kansas State University

Jacobsen, Grant
University of Oregon

Karava, Panagiota
Purdue University

Kismohr, Steve
MEEA

Knight, Dennis
Whole Building Systems, LLC

Kolkebeck, Ken
FirstFuel Software

Konis, Kyle
Consultant

Kosny, Jan
Fraunhofer USA

Krarti, Moncef
University of Colorado at Boulder

Kumar, Ashok
U.S. Army Engineer Research and Development Center

Kumar, Sneh
Alcoa

Lacey, Eric
Responsible Energy Codes Alliance

Lam, Khee Poh
Carnegie Mellon University

Larson, Samara
LINC Housing

LeBaron, Robin
National Home Performance Council, Inc.

Lord, John
Loudoun County Public Schools

Mansy, Khaled
Oklahoma State University

Marston, Annie
Baumann

Modera, Mark
University of California, Davis

Mrozowski, Tim
Michigan State University

Novoselac, Atila
The University of Texas at Austin

O'Connor, Brendan
North Carolina State University

Pate, Michael
Texas A&M University

Petersen, Jim
Consultant

Porst, Kinga
U.S. General Service Administration

Potter, Dean
K. Hovnanian Homes

Powell, Kevin
U.S. General Services Administration

Reddy, T. Agami
Arizona State University

Reed, Robert
University of Missouri, Columbia

Rosensweig, Perry
Pepco Energy Services

Sachs, Harvey
The American Council for an Energy-Efficient Economy

Sailor, David
Portland State University

Sanders, Marci
D&R International

Schleusner, Greg
HOK

Scott, John
Colliers International

Settlemyre, Kevin
Sustainable IQ, Inc.

Sherif, SA
University of Florida

Smyth, Ed
DNV KEMA Energy & Sustainability

Talbott, John
Consultant

Tao, Yong
University of North Texas

Tariku, Fitsum
British Columbia Institute of Technology

Vitale, Phil
Naval Facilities Engineering Command

Vowles, Mira
Bonneville Power Administration

Watson, Tom
Daikin Applied

Welch, Zelinda
Enovity, Inc.

Whitehouse, Kamin
University of Virginia

Whitney-Schulte, Liesel
Franklin Energy

Zhang, Rui
IBM, T.J. Watson Research Center

Appendix B: Project Evaluation Form

This evaluation form was used by reviewers to provide project ratings and comments during the 2014 Building Technologies Office Peer Review.

PeerNet Evaluation Criteria: Project Evaluation Form

Provide specific, concise comments to support your evaluation.

A. Relevance (Stand Alone Metric)—Degree to which the project supports BTO goals and objectives.

1 – Poor: Project provides little or no support to BTO objectives.
2 – Fair: Project provides some support to BTO objectives.
3 – Good: Most project aspects align with BTO objectives.
4 – Outstanding: Project is critical to the BTO and fully supports BTO objectives.

- ☐ Poor
- ☐ Fair
- ☐ Good
- ☐ Outstanding

Comments on Relevance:

B. Approach (30%):

1. Degree to which the project is focused on the critical barriers. **(15%)**

1 – Poor: Project has identified few, if any relevant barriers.
2 – Fair: Project has identified some of the relevant barriers; no critical barriers identified.
3 – Good: Most of the critical barriers are identified, but a few relevant barriers were omitted.
4 – Outstanding: All critical barriers are identified; difficult to identify missed barriers.

- ☐ Poor
- ☐ Fair
- ☐ Good
- ☐ Outstanding

2. Degree to which the project's design addresses the barriers identified. **(15%)**

1 – Poor: Project is unlikely to contribute to overcoming the barriers.
2 – Fair: Has significant weaknesses; but may have some impact on overcoming barriers.
3 – Good: Generally effective but could be improved; contributes to overcoming most barriers.
4 – Outstanding: Sharply focused on overcoming critical barriers; difficult to improve the project approach.

- ☐ Poor
- ☐ Fair
- ☐ Good
- ☐ Outstanding

Comments on Approach:

C. Accomplishments/Progress/Impact (40%):

1. Degree to which the project ***has*** made progress towards achieving the stated ***project*** goals. **(20%)** (Note: New projects should be scored in relation to the length of time the project has been active.)

1 – Poor: Little or no demonstrated progress towards project goals.
2 – Fair: Modest progress toward meeting project goals.
3 – Good: Significant demonstrated progress toward project goals.
4 – Outstanding: Excellent, measurable progress toward project goals.

- ☐ Poor
- ☐ Fair
- ☐ Good
- ☐ Outstanding

2. Degree to which the project ***will*** significantly contribute to the achievement of its ***program's*** goal. **(20%)**

1 – Poor: Weak evidence presented, contribution to program's goal is unlikely.
2 – Fair: Some evidence presented, contribution to program's goal will likely be small.
3 – Good: Substantial evidence presented, meaningful contribution to program's goal is likely.
4 – Outstanding: Strong evidence presented, transformative contribution to program's goal is likely.

- ☐ Poor
- ☐ Fair
- ☐ Good
- ☐ Outstanding

Comments on Accomplishments/Progress/Impact:

D. Project Integration and Collaborations (20%):

1. Degree to which the presenter has demonstrated an understanding of the key stakeholders necessary to accelerate movement of technologies or practices into the market. **(10%)**

1 – Poor: The presenter has demonstrated a rudimentary familiarity with the key stakeholders, many stakeholders were omitted.
2 – Fair: The presenter has demonstrated a basic understanding of the key stakeholders, a few stakeholders were omitted.
3 – Good: The presenter has demonstrated a deep understanding of the key stakeholders, no key stakeholders were omitted from the presentation.
4 – Outstanding: The presenter has demonstrated an exceptional level of understanding of the key stakeholders, no key stakeholders were omitted from the presentation.

- ☐ Poor
- ☐ Fair
- ☐ Good
- ☐ Outstanding

2. Degree to which the project staff collaborates or coordinates with industry or other relevant stakeholders. **(10%)**

1 – Poor: Most work is done at the sponsoring organization with little outside collaboration or coordination.
2 – Fair: Collaboration and coordination exist, but could be significantly improved.
3 – Good: Some collaboration exists; partners are fairly well coordinated.
4 – Outstanding: Close, appropriate collaboration with industry and/or other institutions; partners are full participants and are well coordinated.

- ☐ Poor
- ☐ Fair
- ☐ Good
- ☐ Outstanding

Comments on Project Integration and Collaborations:

E. Proposed Future Work (10%)—Degree to which the project has effectively planned its future in a logical manner by incorporating appropriate decision points, considering impediments to its goals, and, when sensible, mitigating risk by providing alternate pathways. (Note: Ending projects will not be evaluated on this criterion; leave blank if project is ending.)

1 – Poor: Current plans are unrelated to past work, have little likelihood of eliminating barriers or meeting project or BTO objectives.
2 – Fair: Plans build on past work and may lead to improvements, but need better focus on overcoming barriers; many risks are not addressed in future plans that threaten the achievement of project or BTO objectives.
3 – Good: Plans build on past progress and focus on overcoming barriers, some risks exist that could prevent the achievement of project or BTO objectives.
4 – Outstanding: Plans clearly build on past progress and are sharply focused on barriers; risks that could prevent the achievement of project or BTO objectives are appropriately addressed.

- ☐ Poor
- ☐ Fair
- ☐ Good
- ☐ Outstanding

Comments on Proposed Future Work:

Please substantiate your score with comments about the project's strengths:

Please substantiate your score with comments about the project's weaknesses:

Please offer any additional recommendations you have for the project:

How would you rate the value of the deliverables produced by the project to its target audience/market?

- ☐ High
- ☐ Average
- ☐ Low

Explain:

Are the key research areas/deployment activities relevant to the project scope receiving sufficient emphasis?

- ☐ Yes
- ☐ No

Explain:

2014 PROGRAM PEER REVIEW

U.S. DEPARTMENT OF ENERGY
BUILDING TECHNOLOGIES OFFICE

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