CLEAN ENERGY CONNECTIONS
AMERICAN RECOVERY AND REINVESTMENT ACT

BEST PRACTICES EXCHANGE
FORUM SUMMARY

June 5th 2012 | Greenfield Massachusetts
June 15th 2012 | Brockton Massachusetts

Massachusetts Department of Energy Resources

June 2012

Executive Summary

The Massachusetts Department of Energy Resources (DOER) received almost $70 million of American Recovery and Reinvestment Act (ARRA) funding from the U.S. Department of Energy (DOE). Using these funds, DOER provided support for hundreds of clean energy projects through grants from the *State Energy Program (SEP)* and *Energy Efficiency and Conservation Block Grants (EECBG),* putting some 2,800 individuals to work, cutting energy costs by hundreds of millions of dollars over project lifetimes, leveraging almost $200 million in additional public and private funds, and supporting the preservation and expansion of local businesses across the Commonwealth. ARRA funds led to a wide variety of innovative initiatives, ranging from deep energy retrofits at commercial and residential buildings that achieved greater than 50% savings, creative new energy outreach strategies, pellet boiler installations at schools and residences, real-time metering at dozens of state facilities, envelope, lighting and HVAC improvements at state and municipal buildings, and over 11 megawatts of solar installations across public and private entities.

While ARRA funding created unique opportunities to initiate and expand clean energy projects, grant recipients also faced a variety of challenges. In order to benefit from their experiences, DOER invited participants of the ARRA SEP and EECBG programs, as well as clean energy stakeholders from across the Commonwealth, to two Best Practices Exchanges in June 2012. DOER asked participants to share their experiences implementing clean energy projects, including challenges encountered, lessons learned and best practices recommended for future clean energy efforts. The Exchanges, held at Greenfield Community College on June 5 and Massasoit Community College Conference Center on June 15, provided forums for hundreds of clean energy stakeholders from all regions of the state to contribute ideas, experiences and recommendations on how to ensure the success of future clean energy projects. Participant feedback indicated that the forums served as successful networking and educational events.

Roundtable and workshop discussions highlighted the important role ARRA has played in moving Massachusetts forward on clean energy goals. Several participants noted that the effort *opened up a huge line of communication between people, agencies, and energy efficiency programs that inspired action and energy savings*. Exchange participants praised DOER staff for helping participants navigate the process of developing clean energy projects and maintain *positive and productive working relationships.* Participants also cited non-energy benefits realized through the ARRA programs, including building the capacity of both professional and volunteer clean energy proponents to successfully plan and manage projects, as well as reducing skepticism surrounding clean energy projects and utility incentive programs.

This report summarizes the lessons learned and best practices identified during the Exchanges. Best practice examples follow:

- Include clear, open planning and implementation as a key component of a successful clean energy project.
- Identify stakeholder goals for energy and cost savings, and the level of risk acceptable to project owners and financiers early during project development.
- Conduct comprehensive audits to identify existing inefficiencies and projects with the highest potential energy savings.

- Connect with utility providers/Mass Save® sponsors early in project planning stages to help identify potential financial incentives and other available utility programs.
- Identify completed projects with similar attributes to the project envisioned in advance, to help determine project feasibility and convince stakeholders to move forward.
- Recruit local experts, including engineers and those with clean energy project experience, to help with the project.
- Engage local residents and businesses early in the decision-making process and during project planning to help establish support for the project and to ensure it meet the needs and expectations of end-users.
- Determine stress points in the project's timeline, including construction start and completion dates and deadlines for financing, to enable proper management of project deadlines.
- Explore a variety of financing approaches and options for a project (some financing models require little or no upfront capital costs while others offer cost savings in the long-run), to find the best one for the project.
- Consider regional performance contracts, which can offer significant advantages through economies of scale and can reduce the upfront capital cost of your clean energy project;
- Plan for operations and continued tracking of performance metrics to ensure your project continues to save energy and operate effectively in the long-run.

Participants were also asked how DOER and other clean energy stakeholders could help future clean energy projects succeed. Results of these discussions and the programmatic recommendations are included under **Recommendations for Statewide Support** section of this report. Examples of recommendations include:

- Support efforts to enable project proponents to track project performance over time and ensure continued energy savings;
- Provide a financial roadmap, demonstrating how the various incentives and financing approaches can be packaged to a community or organization's benefit;
- Provide technical assistance through an energy coach or circuit rider program to help identify financial and technical resources;
- Consolidate and streamline applications and information collected from clean energy projects, reducing redundant information required for utility, state and other incentive programs;
- Establish and maintain consistent guidelines for permitting and procedures for clean energy projects;
- Catalogue relevant information (e.g., engineering data, contracting, permitting and outreach methods) in a clearinghouse and make such information publicly available.

Exchange participants requested that DOER establish ongoing forums to continue dialogue, review best practices and lessons learned, and foster communication among a diverse group of clean energy stakeholders. DOER is in the process of reviewing all recommendations and developing strategies to prioritize and respond to many of them.

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Introduction

In April of 2009, the Massachusetts Department of Energy Resources (DOER) received $70 million from the U.S. Department of Energy (DOE) as part of the American Recovery and Reinvestment Act (ARRA). Over the intervening years, these funds have supported investments in energy efficiency and renewable energy projects and programs throughout the Commonwealth, and have led to the successful implementation of more than 300 clean energy projects in the public and private sectors.

ARRA funds were put to use across a wide range of initiatives that resulted in putting more than 2,000 individuals to work, cutting energy costs by millions of dollars and supporting the preservation and expansion of local businesses across the Commonwealth. Many ARRA projects not only had immediate impact on job creation and energy use and cost reductions, but will also have long-term impacts that may last for decades.

Solar arrays, new heating and cooling equipment and efficient lighting will continue to generate clean energy and reduce energy use for years. Real-time metering installed across 25 million square feet of state buildings will continue to provide actionable energy data for years that will help facility managers address energy anomalies as they occur rather than waiting weeks or months to see them show up on utility bills. And a host of innovative building retrofit projects will serve as effective demonstrations on how deeper energy gains can be achieved and sustained.

All these and other efforts have clearly had a significant impact on the success of clean energy efforts in the Commonwealth. For example, installed solar PV systems have increased from just 3 MW in 2007 to over 174 MW in 2012. Over 15 MW of new solar installed between 2010 and 2012 is the direct result of ARRA funding support (this also includes ARRA funded water and wastewater treatment facility installations). These and other efforts will continue to support the Commonwealth's efforts to lead the nation in energy efficiency and renewable energy and move Massachusetts toward a clean energy economy that puts people to work creating clean energy in Massachusetts rather than sending Massachusetts energy dollars to other states and countries.

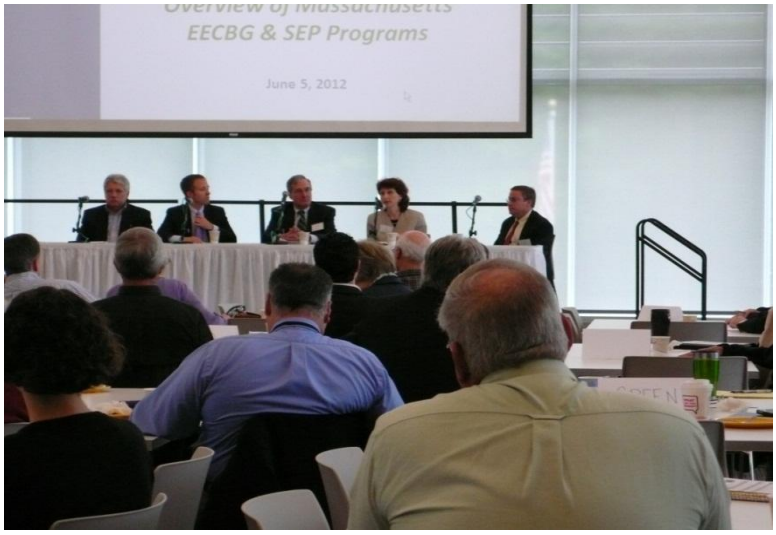
In June 2012, as ARRA neared its end point, DOER sponsored two Best Practices Exchanges to engage project managers and stakeholders involved in ARRA-funded projects and to learn from their experiences. The focus of the Exchanges was to identify successes, challenges, and lessons learned during project implementation, collect recommended best practices from project stakeholders, and develop recommendations for future clean energy efforts.

The **Best Practices and Lessons Learned** section of the report provides a summary of project-level results and experiences identified during the Exchanges, beginning on page 3.

The **Recommendations from Clean Energy Stakeholders** section of this report provides an overview of the feedback DOER received for future program and policy efforts, beginning on page 21.

Included in this introduction is a description of the rationale and goals for hosting the Exchanges, a summary of logistics, an overview of groups and stakeholders that participated in the Exchanges, and a description of the event format.

Exchange Participants and Logistics



Alice Dasek, DOE (2nd from the right), presents details of successful ARRA projects at the Greenfield Best Practice Exchange.

DOER convened the ARRA Best Practices Exchanges at Greenfield Community College on June 5 and at the Conference Center at Massasoit Community College in Brockton, Massachusetts on June 15, 2012. Invitations to participate in the Exchanges were sent to recipients of ARRA funds through the EECBG and SEP program staff. Additionally, DOER invited clean energy stakeholders from across Massachusetts to participate, including Commonwealth Solar Stimulus program participants, representatives of Massachusetts Green Communities, the board of directors for the Solar Energy Business Association of New England, the board of the New England Association of Energy Engineers, investor-owned utilities, and energy efficiency and renewable energy experts and consultants. Presenters at the Exchanges were identified by DOER based on their experience implementing and supporting ARRA-funded clean energy projects.

Exchange Format

The Exchanges provided participants an opportunity to trade feedback and recommendations with peers, clean energy stakeholders, and program implementers throughout each day. The program was divided into three segments: an overview of clean energy achievements and ARRA-impacts in Massachusetts, roundtable discussions and best practice workshops.

Welcoming remarks delivered by Mark Sylvia, Commissioner of the Massachusetts Department of Energy Resources and Jeffrey Simon, Director of the Massachusetts Recovery and Reinvestment Office, provided an overview of DOER's ARRA programs energy savings, carbon emissions reductions, and job creation statistics.

At the Greenfield event, Alice Dasek, the DOE Project Officer for ARRA State Energy Programs, detailed the achievements of Massachusetts' efforts. At the Massasoit Exchange, Anna Maria Garcia, Acting Program Manager for the Weatherization and Intergovernmental Program at DOE, detailed Massachusetts' accomplishments in clean energy investment. Presidents of the community colleges hosting the Exchanges welcomed attendees and spoke about clean energy efforts on their campuses. DOER project managers also highlighted a wide range of projects and programs initiated using ARRA funds, including examples of innovative and far-reaching efforts that have received national attention.

Roundtable Discussions

Immediately following the opening session, Exchange attendees participated in roundtable discussions designed to help DOER understand what lessons had been learned during implementation of clean energy projects and to identify how the DOER and other stakeholders can assist in streamlining and facilitating the successful implementation of future clean energy projects. DOER tasked each roundtable with answering a specific question (from the list below). Findings are summarized in the *Best Practices and Lessons Learned* and *Recommendations from Clean Energy Stakeholders* sections of this report.

Greenfield Roundtable Discussion Topics:

- Discuss how you worked to build consensus within the community and with other project stakeholders during the planning/ implementation phase of your project.
- Discuss the role of long-term financial planning, analyzing costs versus benefits, and/or obtaining leveraged funding in the planning and implementation phases of your clean energy project.
- Discuss the extent to which sufficient information and resources were available to help in the planning or implementation phases of your clean energy project.
- Discuss how you navigated existing regulations and permitting while planning and implementing your clean energy project.
- Discuss whether and how you integrated measurement and verification and/or long-term operations and maintenance (O&M) into your project design.

Following the Greenfield event, the specific discussion topics were revised based on feedback received from event participants.

Massasoit Roundtable Discussion Topics:

- Discuss the availability and adequacy of information, resources, and data related to clean energy project analysis, development and implementation. Discuss the role of information in building consensus for clean energy projects.
- Discuss the role financial analysis and identification of long-term costs and benefits played in supporting successful implementation of clean energy projects. Talk about the key stakeholders engaged in these analyses and the degree to which long-term benefits other than energy savings were important, such as maintenance savings, comfort, durability, etc.
- Discuss the support received from statewide clean energy entities, such as utilities, DOER, the Massachusetts Clean Energy Center, etc. and how this support contributed to the successful implementation of clean energy projects. This includes, but is not limited to, financial incentives, technical assistance, analysis, oversight, measurement and verification, procurement, networking, etc.

Afternoon best practice workshops featured clean energy industry experts and implementers of successful and innovative ARRA-funded clean energy projects from across Massachusetts. Workshop topics included:

- Building Efficiency: Deep Energy Retrofits
- Clean Energy Communications
- Energy Management through Data Analysis
- High Performance Buildings: Biomass
- Clean Energy Financing
- Solar Photovoltaic (PV)
- Building Efficiency.

About this Report

This report summarizes the proceedings of the Best Practices Exchanges, including workshop presentations and roundtable discussions. Where possible, paraphrased quotes from Exchange participants and presenters are included in the report texts and are denoted using highlighted text.

About the Massachusetts Department of Energy Resources (DOER)

The Massachusetts Department of Energy Resources (DOER) develops and implements policies and programs aimed at ensuring the adequacy, security, diversity, and cost-effectiveness of the Commonwealth's energy supply within the context of creating a cleaner energy future. To that end, DOER strives to:

- Ensure deployment of all cost-effective energy efficiency;
- Maximize development of clean energy resources;
- Create and implement energy strategies to assure reliable supplies and improve the cost of clean energy relative to fossil-fuel based generation;
- Support Massachusetts' clean energy companies and spur Massachusetts' clean energy employment.

DOER is an agency of the Executive Office of Energy and Environmental Affairs (EEA).

Key DOER staff members involved in the planning and implementation of the Best Practices Exchanges include (in alphabetical order): Dan Burgess, Lisa Capone, Sarah Cassanego, Edward Dobbin, Eric Friedman, Diane Gray, Louis Harris, Michael Judge, Susan Kaplan, Meg Lusardi, Maggie McCarey, Alex Sherman, Charlie Tuttle, Maria Andrea Urrutia, and Thomas Witkin.

Greenfield Community College

Located in the Pioneer Valley of western Massachusetts, Greenfield Community College is committed to practicing what it teaches, conserving energy and using renewable energy sources. In GCC's Renewable Energy and Energy Efficiency programs, students and community members develop the knowledge and skills necessary to help individuals, business, and their communities *go green*. GCC benefited from an ARRA grant implemented by Sandri that included installing high-efficiency wood pellet boilers and solar thermal technology at multiple institutional sites throughout Western Massachusetts.

The college, working with the Division of Capital Asset Management (DCAM), also installed a 77 kilowatt (kW) ground-mounted solar PV system, funded in part by ARRA.

Massasoit Community College

Located in Brockton and Canton, Massachusetts, Massasoit Community College is committed to reducing its environmental footprint through comprehensive energy programs and installation of renewable energy, improving day to day energy management, and educating its students in clean energy programs. The College was a 2011 Leading by Example Award recipient and most recently completed installation of 370 kW of rooftop solar PV across five campus buildings, partially funded by ARRA.

The Cadmus Group, Inc.

Selected by DOER through a competitive procurement to support the Best Practices Exchanges, the Cadmus Group, Inc. assisted DOER staff conveying the Exchanges by providing recommendations on Exchange format, support and note-taking during the Exchanges, and drafting the Forum Summary. An employee-owned environmental and energy consulting firm based in Waltham, Massachusetts, Cadmus supports the clean energy industry in Massachusetts, providing owner's agent technical services to Massachusetts communities, and consulting services to the Massachusetts DOER, Clean Energy Center, and the Massachusetts investor-owned utilities and energy efficiency service providers.

Roundtable Discussions, Best Practices and Lessons Learned

Experiences from State Energy Program and Energy Efficiency Conservation Block Grant Projects

During the morning roundtable sessions held at the Massasoit and Greenfield Exchanges, participants identified numerous challenges, lessons learned, and best practices that are likely to help clean energy advocates maximize economic and environmental benefits obtained from clean energy projects. Each roundtable used prompts (included under the **Roundtables Discussions** section of this document) to direct and encourage dialogue, so that participants could best share their experiences implementing clean energy projects. At the end of an hour-long discussion, each roundtable reported their findings to the entire assembled group.

A. Information Availability & Data Collection

Participants discussed the extent to which informational resources were available and sufficient to aid in the planning and implementation of clean energy projects. Discussions covered three time periods during the ARRA-funded projects:

- Grant application;
- Design and development; and
- Project construction and oversight.

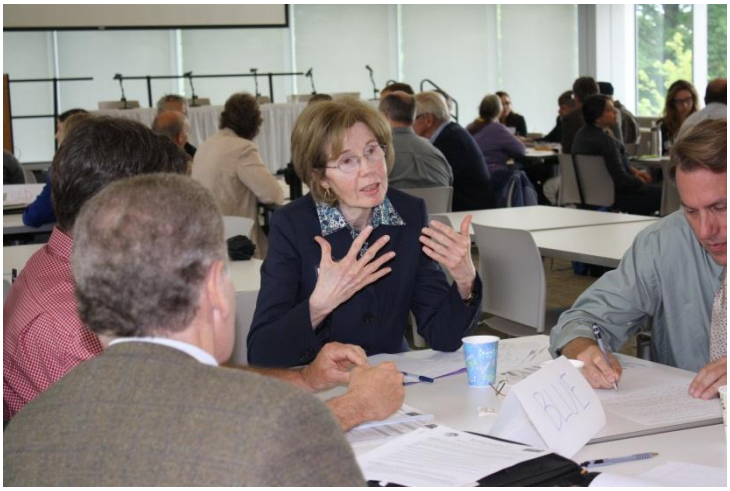
Challenges and Lessons Learned

Participants reported that there was often little or only sparse information *available to aid towns, private entities, and agencies in initiating clean energy projects and complete grant proposals for funding*. As an example, some cited difficulty identifying completed projects to serve as models for their efforts. This was particularly true for deep energy retrofit projects, for which few examples are available given the uniqueness of such retrofits. Others spoke of a lack of a centralized compilation of detailed project descriptions and how-to advice, making it difficult for many project proponents to secure stakeholder support and provide required, relevant data on grant applications. Many Exchange participants found it difficult to determine project feasibility without information on other projects. Small communities noted that the lack of examples – specifically those with similar scale and scope – negatively impacted the chance of success of their own projects. However, participants did note the various beneficial resources available that they did use, such as the DOER Green Communities regional coordinators and other DOER staff, the Green Communities newsletter, technical assistance provided through DOER grants, the Massachusetts Municipal Association, Massachusetts Department of Environmental Protection, the U.S. EPA for water and wastewater plan energy audits, and MassEnergyInsight.

In some cases, without centralized resources, communities and other organizations in the project planning and implementation process often relied on local expertise, the quality of which was a key determining factor in how grant applications and projects were designed. An example of high quality expertise was a community that was able to work with a local engineering professor to obtain technical guidance for its clean energy projects. On the other hand, project proponents who lacked access to such experts *were limited in their ability to design good projects,* according to one roundtable participant. Where volunteer expertise was unavailable,

grant proposers often had to invest in engineering feasibility studies prior to applying for ARRA grants. Unfortunately, these studies cost money and did not guarantee the success of an application.

Timing was also identified as a significant factor in the success of a project during the design and construction phases. Incentive program timelines with project due dates can drive design and implementation, sometimes altering the optimal sequence of project events. One roundtable participant suggested that education about expected *stress points – bidding, scope and slack (in revising and adjusting project designs to meet real-world conditions), and construction oversight* – in a project, and how to manage them, would have been useful.



Exchange participants discuss best practices, lessons learned, and recommendations in roundtable sessions at Greenfield.

Other information, challenges, and resource related issues discussed in the roundtables included:

- Participants identified a common challenge in determining what project data to collect, and identifying who would be able to *interpret the data in a meaningful way that would enable stakeholders and project proponents to use and cite it to support future endeavors.*
- In rural areas, the number of contractors bidding on jobs was lower than expected due to lack of knowledge and experience with clean energy technologies.
- One participant said it would have been better to have a single contact at the state level to help with all aspects of the project, rather than having to coordinate with a number of state agencies to gather the information needed.

But in terms of available resources, participants again noted that they utilized a number of available resources, such as the DOER Green Communities regional coordinators and other DOER staff, the Green Communities newsletter, technical assistance provided through DOER grants, the Massachusetts Municipal Association, Massachusetts Department of Environmental Protection, the U.S. EPA for water and wastewater plan energy audits, and MassEnergyInsight. In some cases, regionally-focused ARRA education and outreach programs were also cited as helpful, by providing contractor education and information at a local level to project proponents.

Best Practices

Exchange participants outlined the following steps that enabled them to leverage existing information and resources to their advantage.

1. Identify completed projects with similar attributes to the project envisioned. Contact the project manager and others involved in the project, including state and local officials and the contractor, to learn as much about the process as possible. When possible, obtain copies of benefit/cost calculations and assumptions, feasibility studies, requests for proposals, bids and construction documents. This information will help to determine project feasibility and convince stakeholders to move forward.

2. Identify local experts, including engineers and those with clean energy project experience, and recruit them to help with the project. This expertise can help to define the scope of the project, assess technical and financial feasibility, educate stakeholders, review bids, and provide project oversight.

3. Before project implementation, identify the stress points in the project, such as construction start or completion date requirements from incentive programs and potential delays due to permitting processes. Without proper management, these stress points can create unforeseen delays, resulting in an increase in cost, or risk losing access to important financial resources.

4. Understand the data needed to establish a baseline for energy use and energy savings potential for a project, and engage in ongoing analysis of energy data using tools such as MassEnergyInsight and/or real-time energy metering information, such as that provided by EnerNOC's Enterprise Energy Management System. This can help establish the rationale for a clean energy project and demonstrate the process by which a project proponent plans to monitor and evaluate project performance.

5. For projects in areas that lack local expertise, reach out to potential project contractors and determine if they have enough clean energy or other experience to work on the project. Consider linking the contractors to educational resources provided by the state or other organizations to build a more qualified base of clean energy contractors in the area.

B. Clean Energy Financing and Financial Analysis

During this roundtable, participants reviewed the importance of financing and financial analysis to the success of clean energy projects. One key question addressed was *once ARRA funding is no longer available, what do we do next?*

Challenges and Lessons Learned

Exchange participants new to clean energy projects found the financing landscape - with its numerous options for incentives, bonding opportunities, ownership models and other considerations - difficult to navigate. For example, several municipalities found it hard to compare the relative financial benefits of direct ownership of solar PV projects versus a Power Purchase Agreement (PPA) approach. A number of participants noted that the lack of centralized information on funding sources and financing options made it harder to begin new projects with confidence.

Roundtable participants also discussed how clean energy projects are likely to be financed now that ARRA funding is no longer available. One participant suggested that while ARRA-based grants covered as much as 100 percent of the costs of a project, many projects would still make financial sense with grants that cover only half the total cost. For projects targeting savings that go beyond the low hanging fruit of numerous efficiency opportunities, however, higher grants levels will likely be needed to bring down simple payback periods. In an example provided during the Exchanges, a municipality obtained an engineering analysis addressing multiple sites. The analysis identified projects with paybacks ranging from seven to 40 years. Participants noted that those projects with a longer payback term would be less feasible after ARRA funds expired.

Conveying the financial feasibility of proposed projects to end-users of energy efficiency improvements also proved challenging for Exchange participants, especially for residential projects. In these cases, participants found utility bills difficult to understand and were challenged to find simple ways to communicate cost savings and quality-of-life benefits. Participants identified the importance of analyses or audits that document energy use inefficiencies to convince decision makers of the need to invest in energy improvements.

Performance contracts with guaranteed savings were suggested as another approach to ensure that projects make financial sense in the post-ARRA era. With no money down, project implementers can get immediate savings and pay for the project through savings. A Power Purchase Agreement with a third-party owner was also noted as an effective means to capture federal tax incentives that are otherwise not available to public entities. Also, one participant reminded the roundtable that significant levels of Mass Save incentives for energy efficiency projects are still available.

Best Practices

Exchange participants took a variety of steps during the implementation of their projects that proved valuable in evaluating and establishing the financial viability of their projects.

1. If in-house resources are not available to evaluate various potential financing options for a project, hiring consultants or engineers can help with evaluations. Technical assistance is available through some state and regional agencies such as DOER and regional planning commissions. This assistance may be especially useful to help push projects from proposed to *shovel-ready* if required by grant or other financial assistance programs.
2. In some cases, a third party ownership approach for a project may make financial sense. Three key benefits of the third party ownership model for a public organization include not having to raise capital, being able to benefit from tax incentives, and not having to pay for ongoing maintenance and operations.
3. Determine if regional performance contracts are available through a regional planning commission or other organization in your area. A regional contract with pre-negotiated pricing may offer good value, without burdening individual communities and businesses with identifying the best financial approach and performing due diligence on bids and offered prices.
4. Negotiate with vendors, contractors or other sources of materials for discounts for residential program participants. Buying locally and in bulk was one way to reduce project costs. One participant described how bundling houses together when requesting bids from insulation contractors resulted in negotiated discounts for insulation materials with a local hardware store.
5. Evaluate any extra costs associated with unique materials and construction approaches needed to meet historical preservation requirements.
6. Reach out to, and network with experienced project implementers and stakeholders. Successful projects may provide insight into financing methods and sources available for clean energy projects – including bonds, loans and state and federal funding sources.

C. Building Consensus

Participants discussed what did and did not work with regard to building consensus among stakeholders. They also discussed how best to identify key stakeholders for proposed clean energy projects, which should be drawn from a varied group of individuals and organizations, based on the scope and impact of a proposed project. While some projects require buy-in and support from a wide array of stakeholders to move forward, others required support from decision-makers only. Frequently, exchange participants noted that not all stakeholder groups were initially identifiable at project commencement, reducing their ability to build a consensus for their proposed project.

Challenges and Lessons Learned

Exchange participants reported a variety of outcomes and experiences from their stakeholder consensus building efforts. The challenges faced varied significantly depending on the type of clean energy technology

employed. Relatively simple and straightforward projects, such as installing new windows or LED lighting, required only authorization from business or municipality decision-makers to proceed, with wider stakeholder involvement unnecessary.

For projects such as efficient renovations at low-income housing, however, realizing the maximum benefit can require the support of end-users.

Project proponents needed to convey the difference energy-efficient improvements offered, such as energy and cost savings and improved occupant comfort, to ensure end-users adopt the new technology. One participant suggested that it was *important to turn energy savings into something that makes sense to the target audience; cater messaging to a particular audience and emphasize information for the receiving audience based on what they care about, and what it does for them.*

Other types of clean energy projects received substantial scrutiny from stakeholders throughout the implementation process and required a dedicated outreach effort. For example, a community-scale wind project may raise broad concerns that require a significant level of outreach, communication and consensus building.

A number of Exchange participants found it difficult to effectively communicate project benefits and impacts to stakeholders. A significant challenge faced by proponents was identifying all key stakeholders and understanding the specific project benefits and impacts perceived by each group. Exchange participants identified working in partnership with persons or groups established within a community or organization as essential. Community organizers and advocates are an important group to identify and engage, as they can enhance the reach of education and outreach efforts. One participant indicated it was important to *get as local as possible when identifying sponsors and communicators for a project in order to gain support and demonstrate ongoing savings data - identify leaders who are trusted by citizens.*

DOER was recognized for the help it provided in identifying stakeholders and aiding project proponents in making contact. One participant reported that rural communities can face special challenges in building consensus for projects, as households in some areas are not served by local media and/or don't have internet access. Other suggestions for identifying stakeholders and seeking public participation included posting project updates on a community list serve or website, or in local newspapers.

Communicating with stakeholders early in the project planning phase was also seen as essential by Exchange participants. Being the first to bring up the project with stakeholders and discuss potential issues with them allows all parties to consider alternatives and impacts within the context of the proposed project. Also, participants advised that having the means to counter negative comments, such as in a newspaper editorial, with factual information is critical.

Best Practices

Exchange participants recommended the following approaches to initiate outreach efforts and build consensus.

1. Evaluate the level of stakeholder outreach needed to complete the project successfully. Projects that are more visible to the public, entail more risk, or involve new technologies, will likely benefit from sustained outreach with stakeholders. For more straight-forward projects such as normal building upgrades and maintenance, minimal outreach may be required. Educating decision makers on the benefits and costs of the projects may be sufficient as long as the financial case for the project is clear.

2. If a significant outreach effort is needed to educate stakeholders and plan on developing a stakeholder outreach plan. The plan should identify all stakeholders that can help the project proceed, as well as those that may oppose the project. This list should include state and local decision -makers, permitting officials, committees and boards, non-profit groups, and local information sources such as newspapers, websites, and libraries. Known or anticipated stakeholder views on the project should be noted, as well as strategies to inform those who may be skeptical about the project. The plan should be continuously updated with new information and resources.

3. Identify and recruit local and respected community leaders who can deliver messages, raising awareness and support for a clean energy project among constituents and peers.

4. Engage decision-makers, community leaders, and stakeholders early in the process to raise awareness and support and improve dissemination of information, preempting incorrect or incomplete information. Where possible, use peer-to-peer outreach: advocacy group-to-advocacy group, neighbor-to-neighbor, business-to-business, community-to-community.

5. Focus outreach on tangible and intangible benefits, including non-energy results such as more comfortable buildings during cold or hot weather. Active engagement with stakeholders can have an important role in refining a project to meet a community's or organization's needs, contributing to the projects ultimate success. This outreach should also convey the important role that stakeholders can play in the project's success. Maximize outreach impact by displaying information on billboards, signs, real-time TV monitors or other areas accessible by a wide audience.

6. When possible, work with schools to educate students on the project. Student engagement can result in enthusiasm for projects and potentially lead to broader community support.

D. Navigating Permitting

Navigating permitting requirements, and complying with ARRA-specific requirements at times proved challenging for some Exchange participants. In particular, those installing renewable energy systems also found obtaining interconnection permits and agreements from utilities difficult. Exchange participants identified challenges, lessons learned, and best practices, compiled below.

Challenges and Lessons Learned

Exchange participants, especially those new to clean energy project implementation, found it difficult at times to navigate project permitting and electrical grid interconnection processes and to work within ARRA-related requirements. Participants reported that, in some cases, they had difficulty finding regulatory and permitting guidance. In one example, a state agency installing PV modules on buildings established its own policy for minimum roof edge setbacks ensuring safety of rooftop activities.

Utility grid interconnection authorization was viewed as one of the largest challenges by many participants who installed renewable energy projects. One participant called the application experience "*difficult*," based on the need to respond to frequent requests for more information. Many projects were delayed by the slow pace of utility review and authorization. Another roundtable participant said the process seemed *almost like the utility was educating itself* on grid integration of clean energy technologies. Since the holding of both Forums, the Commonwealth completed a stakeholder process with involvement from the electric utilities to improve the interconnection process. As a result, utility interconnection applications and relevant guidance documents are in the midst of being revised.

Participants discussed how local building and electrical inspectors often lack prior experience with new clean energy technologies. In such cases, the inspector may *not know what to inspect* on a project. These professionals typically work only part-time as inspectors, while maintaining other jobs. One participant reported that the permitting process went smoother in cases where the inspector was knowledgeable about the project.

Best Practices

Exchange participants suggested a number of efforts project implementers can undertake to effectively manage compliance with regulations and meet permitting requirements. Best practices they identified included:

1. Invest time in the beginning of a project to understand the regulatory and permitting requirements fully. This is the best way to reduce costs and mitigate any possible slow-downs in the implementation of a clean energy project.
2. Talk with state and local officials and utility representatives early in the planning process to identify any potential issues that might delay or jeopardize the project. Officials may include local building and electrical inspectors, fire marshals, planning and zoning boards, historical commissions, and those who oversee environmental permitting. Maintain contact with these officials throughout the project to stay up-to-date on changes to permitting and regulatory requirements.
3. View the permitting process as an opportunity to educate officials who are not knowledgeable about the clean energy technology to be employed. Compile case studies, statistics, operations manuals, and other relevant information to make the education process easier for officials.
4. Consider hiring additional staff to help manage the project. A dedicated staff person can help make sure paperwork is completed on time, and all regulatory requirements are being met.

E. Quality Assurance and Long Term Operations and Maintenance

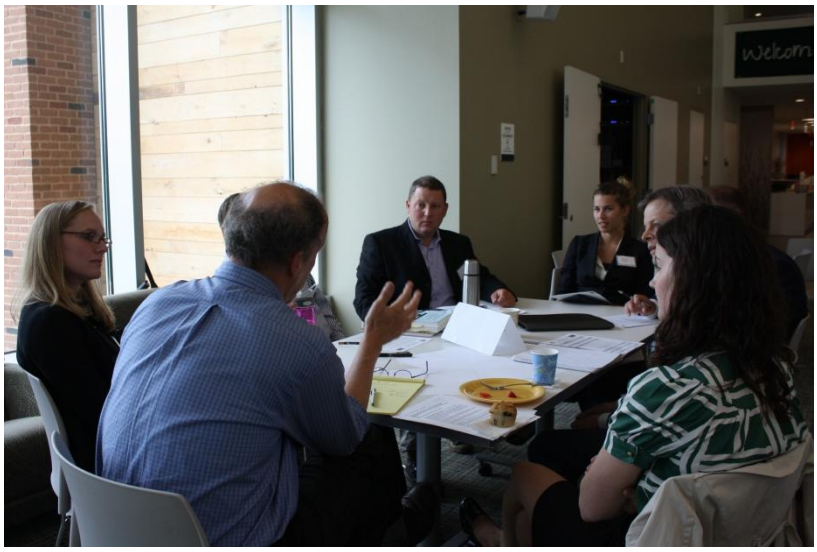
During the roundtable discussions, participants reviewed how to integrate operations and maintenance (O&M) into project planning and financial analyses. Much of the discussion centered on measurement and verification (M&V): efforts to measure a project's impact in terms of energy saved or generated and verify that it meets performance expectations.

Challenges and Lessons Learned

Some participants reported that they had not considered O&M needs during project feasibility reviews, or during negotiations with contractors. As such, no funding for O&M was available when needed. Further, because no O&M plans were in place, responses to operational problems were made largely on the fly. Participants indicated that clean energy projects can underperform when adequate controls are not incorporated in the design of a project.

Exchange participants found it easy to underestimate the degree to which the lack of adequate control systems can impact performance, noting that controls and data tracking enabled them to evaluate observed *peaks and valleys to determine when machinery is or isn't working well; and how a building is performing compared to other similar facilities.* Attendees also indicated that the upfront costs of controls may seem excessive and the controls themselves might seem difficult to integrate, but that they are often worth the investment due to improved operations.

Questions raised pertaining to M&V included how to measure and track data, and whether staff with specialized training is needed to interpret the data. Participants found it difficult to establish an energy use baseline and determine the amount of energy savings without a tracking system or plan incorporated into the project, *especially projects in which retrofits or clean energy systems were multifaceted and integrated; integration is a major issue with multiple project components.*



Exchange participants share ideas during roundtable discussions.

The usefulness of energy management and performance tracking systems (such as data acquisition systems [DAS]) was also discussed by participants. Common tools used to measure performance of clean energy projects, DAS allow for easy review of performance data against benchmarks for energy efficiency and renewable energy systems. One participant explained that these systems can aid in the identification of non-optimal equipment operation, and gave an example of a facility manager who accesses the energy management system (EMS) every morning and reviews equipment performance logs and any warning messages. Participants also cited the importance of *data that can be easily accessible to a wide range of stakeholders, not just those that have a vested interest in the particular project*, to maintain continued support for clean energy projects.

Best Practices

Exchange participants identified best practices to address and integrate quality assurance and operation and maintenance into the design of a project.

1. During project feasibility make sure to consider operations and maintenance costs in any financial feasibility assessment. If you do not have access to information on typical costs, contact project managers or contractors involved with similar projects. When requesting bids from contractors, ask for quotes for ongoing maintenance over the life of the project.
2. Before selecting contractors, make sure they will remain accessible after project completion. If something breaks or functions with diminished capacity, the original system installer will be most capable of providing assistance.
3. Make sure the contractor supplies an operating manual that covers all aspects of system operation, and procedures for resolving performance issues.
4. Develop a monitoring and verification plan, and consider the data resources needed to implement the plan. The contractor selected to construct the system should be able to assist in plan development. If a DAS or EMS will be used, make sure staff or other responsible persons receive the training necessary to use these systems.
5. Consider using systems such as MassEnergyInsight or, if available, EnerNoc's Enterprise Energy Management System as a key component in an M&V plan. By continuously monitoring energy use data impacted by the clean energy project, implementers can determine energy savings achieved by their effort.
6. Put information into the proper context by collecting data related to past performance (before the system was operational), current performance (during the operation phase), and relative performance information from other similar clean energy projects.

Best Practice Workshops

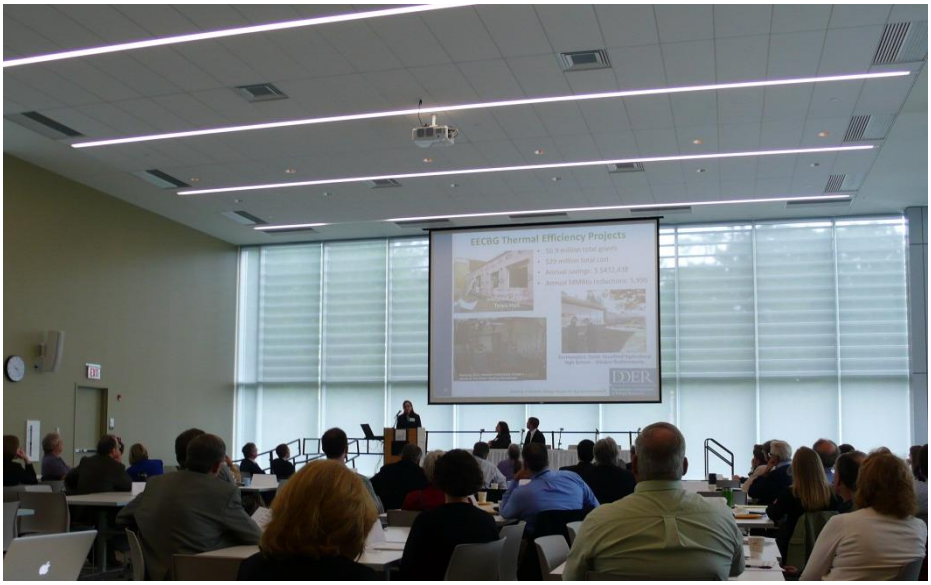
Afternoon workshops featured presentations by clean energy experts and successful ARRA-funded clean energy project teams from across Massachusetts, moderated by DOER staff. The workshops also provided additional opportunities to delve into topical issues raised by Exchange participants, with more than half the time devoted to questions and answer sessions and open dialogue.

Included below is a summary of presentations and dialogue from each workshop, including the presenter and moderator information.

A. Building Efficiency and Deep Energy Retrofits

Moderated by Diane Gray (building efficiency) and Alex Sherman (deep energy retrofits), Massachusetts DOER

Presenters shared their experiences implementing building efficiency projects during afternoon workshop sessions. They stressed that each project presented unique challenges, and familiarity with building efficiency technologies and practices was critical to successful projects, especially for deep energy retrofits or projects located in historical buildings. Several speakers noted that identifying and resolving inefficiencies in building performance could deliver energy savings at lower cost than energy generation projects, while increasing the feasibility of those projects in the long run.



DOER staff share thermal efficiency projects funded through the Energy Efficiency Conservation Block Grant program.

Steps presenters recommended for project proponents seeking to begin building efficiency projects included:

- Begin clean energy projects by conducting comprehensive audits to identify existing inefficiencies and projects with the highest potential energy savings. The Massachusetts Bay Transportation Authority's (MBTA) Mike Donaghy noted that comprehensive audits enabled the MBTA to hit the ground running. He explained that the authority *never had to go back and re-do plans.* He also noted that *using audits to calculate and communicate paybacks was effective.* Audits can help identify and prioritize energy savings measures to undertake, enabling proponents to formalize long-term energy savings plans.
- Define the decision making process. Bernard Kubiak of the Town of Deerfield explained that it was helpful to have a small group responsible for implementing the project. Having a small group of project proponents streamlined the decision-making process.
- Engage end-users, residents, and other stakeholders early in the decision-making process, incorporating their recommendations and needs in the project design process. Ricardo Conde of the New Salem Energy

Committee found it challenging to effectively communicate project benefits, especially when related to historical buildings and community landmarks. Emphasizing the potential savings the town would realize as a result of the project, and framing the benefits in a way that residents could appreciate, however, convinced them the project was worth the investment and changes. Speakers also noted that building efficiency projects at historical sites presented a challenge, as they required a *balance between historic accuracy and energy efficiency*, noting that historical accuracy is highly valued by residents but should be balanced with energy-efficiency goals to ensure the best use of limited project resources.

- Bundling building efficiency projects within a community or by region or facility type was a way to improve project feasibility and financing options available to project proponents. The Division of Capital Asset Management (DCAM) bundled state facilities by region and facility type (i.e., education, correctional institutions, courts) in order to realize economies of scale. Bundling projects encouraged additional competition by making projects larger and more attractive to contractors, streamlining procurement processes and reducing administrative costs; and made it possible to schedule projects to optimize the utilization of limited DCAM staffing resources within the ARRA timeframe. A defined decision-making process and schedule were also key components of successful joint projects.
- Planning for ongoing operations and continued tracking of performance metrics, were cited by presenters as crucial for improving the success of building efficiency. Presenters also strongly recommended adopting standard methods and practices to quantify realized benefits in terms of energy and cost savings, and to identify qualitative benefits, such as increased comfort or fewer maintenance calls. Tracking standardized and documented metrics can help safeguard long-term project performance and savings.

Presentations: Building Efficiency

Hudson Public Library Window Project, Kerin Shea, Town of Hudson

The Benefits of Regional Performance Contracting to Achieve Energy Savings, Bernard Kubiak, Town of Deerfield

Implementation of Thermal Efficiency Improvements in Historic Town Buildings, Ricardo Conde, New Salem Energy Committee

Small Scale Utility Programs at Public Transportation Locations, Mike Donaghy, Massachusetts Bay Transportation Authority

Navigating the Performance Contract Process by Streamlining Resources, Tony Ransom, Massachusetts Division of Capital Asset Management

Targeting Public Safety Structures for Energy Efficiency, Craig Kleman, Town of Becket

Presentations: Building Energy - Deep Energy Retrofits

Pioneering Deep Energy Retrofits in Large Residential Buildings, Mike Marotta of Elton Hampton Architects

Reducing Energy Use through Passive Conditioning, Gregg Crotea of UTEC

Historic Preservation and Energy Retrofits, Colleen Chapin of Historic New England

Energy Efficiency in Adaptive Re-use, Maggie Super Church of Lawrence CommunityWorks

Addressing Historic Concerns in a Deep Energy Retrofit, Mary Quigley of Quigley Builders

Mission-Driven Commercial-Scale Deep Energy Retrofits, John Majercak of the Center for EcoTechnology

Deep Energy Reductions in Greenhouses, DeWitt Thompson of Full Bloom Market Garden

B. Clean Energy Financing

Moderated by Eric Friedman, Massachusetts DOER

Securing funds for clean energy projects is a necessary step for all successful projects, but the variety of available financing mechanisms can prove difficult to navigate. Presentations given during the Best Practice Workshops focused on existing financing mechanisms for renewable energy and energy efficiency projects, which will continue to be available after ARRA funds are exhausted.

Determining the relative advantages offered by competing financing options can also prove challenging. Organizations seeking to develop a solar PV installation can select between public and private ownership options and a variety of financing sources, each with their own benefits and drawbacks. Financing options available for energy efficiency projects can be stand-alone, or bundled together with other projects at similar facilities, communities, or businesses to create a competitive advantage. It may be difficult to identify which projects will meet the energy savings and economic goals for both the investor and organization. Technical feasibility and the uncertainty of energy savings and return on investment must be included in any financial analysis. One presenter noted, *a multidisciplinary team should be assembled, including financial, operational, administrative and legal standpoints* to evaluate the feasibility and "finance-ability" of a proposed project.

Energy Efficiency Financing

Performance contracting is a common approach for financing energy efficiency projects. It allows municipalities to leverage their existing operating budgets to invest in infrastructure upgrades that improve the energy efficiency of a facility or invest in renewable energy. Some benefits of pursuing a performance contract include:

- Upgrades to building infrastructure
- Reduced operations and maintenance costs
- Enhanced operating staff productivity
- Flexibility to implement renewable energy strategies
- Improved indoor air quality
- Qualitative benefits such as enhancing curricula in local schools by integrating innovative technologies with educational objectives.

As Beth Greenblatt of Beacon Integrated Solutions noted, however, *performance contracting isn't a one-size-fits-all program, and it is not well understood by stakeholders. There are challenges to defining comprehensive projects that meet the economic goals of communities*. Determining the feasibility was critical to moving forward with energy efficiency projects, by first identifying proposed projects through a *preliminary audit*, and then determining the financial viability through an *investment grade audit*.

Key steps recommended for organizations or communities implementing energy efficiency projects include:

- Assemble a multidisciplinary team that includes financial, operational, administrative, and legal standpoints.
- Identify a project champion, or manager, who will take ownership of the project and see it through to completion.

- Develop stakeholder goals for energy and costs savings, and define the risk tolerance for the project (i.e. how much the town is willing to borrow, or if the project must be budget-neutral every year, or over the term of any loans, etc.), and set project expectations that balance risk with cost.
- Educate stakeholders on the benefits, process, and procurement statutes early in the process, and build consensus amongst end-users.
- Seek guidance from DOER and town counsel on contracting language and vehicles. Contract language provided by Energy Services Companies can introduce additional legal complications and should not be relied on.
- Consider engaging an owner's agent with expertise in performance contracting.
- Research available third party funding options, including grants and incentives offered by state and utility programs.

Renewable Energy Financing

Project managers invited to present during the best practice presentations shared their experiences evaluating the feasibility of and implementing solar PV installations. The presentations reviewed the two financial models commonly used for solar PV - design-build and power purchase agreements - and how to evaluate the benefits and drawback of each model. Presenters also reviewed additional funding sources available, including solar renewable energy credits (SRECs) and net metering.

Outright ownership by an organization or community commonly follows the design-build model, or design-bid-build model of procurement. Advantages of outright ownership include greater control over the installation and operation of the system. Costs savings, in dollars per *kilowatt hour*, can also be realized if the owner has access to capital at a lower borrowing cost (interest rate). Tax-exempt organizations, such as municipalities and nonprofits, are unable to take advantage of some incentives when pursuing outright ownership, including the 30 percent federal income tax credit, which may be a strong disadvantage.

A power purchase agreement (PPA) offers an alternative to outright ownership. Using a PPA, the host of solar PV system agrees to purchase energy generated by the PV system from the project owner at a predetermined rate. Unlike outright ownership, PPAs offer organizations a turn-key process with little or no upfront cost. PPA hosts pay for the performance of the system, and owners have an incentive to ensure the system continues to operate efficiently. PPA owners, however, may have reduced access to low-cost capital for financing, negatively impacting the dollar per kW price they can offer.

Determining the appropriateness of a design-build model versus a PPA model should be done by evaluating the organization's ability to secure financing, and the real cost/benefits posed by the scheme. Organizations should:

- Evaluate the suitability of the property and proposed project;
- Evaluate your financial options based on the cost of capital versus third party financing, and how much debt an organization is willing to undertake;
- Evaluate all available financial incentives and structures, including buy-out options for a PPA system;
- Work with experienced owner's agent advisors, vendors, and counselors to develop a contract that meets your terms.

SRECs also offer an additional financial resource for organizations pursuing solar PV projects. Energy generators and utilities selling into the Massachusetts market are required by law to supply a portion of the electricity supplied from renewable sources, with a specific carve out dedicated to solar PV generation. Funds obtained by the sale of an SREC, which is equivalent to the "green" attributes of 1 *megawatt hour* of energy produced by a solar PV system, could help reduce outstanding debt used to finance the construction of a system, or be used for the continued operation and maintenance of the system.

Presentations

Lessons Learned from Developing a PPA, Thomas Durkin, Massachusetts Water Resources Authority

The Cost Analysis of a PPA versus Design Build, Andrew Kinross, Navigant

Taking Advantage of Utility Incentives for Public and Private Entities, Robert Coates, Western Massachusetts Electrical Company and Carld Auguste, NSTAR

Insights into Performance Contracting: Tips and Tricks for Developing Successful Performance Contracts, Beth Greenblatt, Beacon Integrated Solutions

How to Successfully Sell RECs from On-Site Renewable Energy Projects, Dave Lewis, Massachusetts Division of Capital Management

Buying and Selling RECs for Public Entities, Kevin Bedford, Nexant, Inc.

C. Clean Energy Communications

Moderated by Tom Witkin and Susan Kaplan, Massachusetts DOER

Presenters identified proactive communication throughout each stage of a clean energy project as a key contributor to a project's success. Presenters noted the importance of identifying messaging that resonates with target audiences based on their interests and concerns, as well as on their level of knowledge of clean energy issues.

Workshop presenters found it difficult to demonstrate the benefits obtained from clean energy projects as local residents are likely to assume the benefits are limited to a small subset of the community. Presenters also noted that some *educational events focused on energy efficiency were not well attended unless the topic was controversial, meaning that project materials may have merely reached stakeholders already supporting the effort*. The best practice presentations reviewed a variety of methods to engage stakeholders, and recommendations that clean energy project proponents initiating an outreach effort should consider.

- Making assumptions about individual or stakeholder familiarity with clean energy concepts and issues can be counterproductive. Brian Adams of Greenfield Community College (GCC) noted that *while those educated on efficiency may perceive particular solutions as obvious, a lack of understanding on the full range of benefits of clean energy projects is often times the greatest barrier to support for such projects*. Stakeholders unfamiliar with the benefits of clean energy projects may be apprehensive about the upfront costs or impacts of a proposed project, especially if they are not informed of short and long term benefits the project may provide. Outreach and education should relate to stakeholder interests, values, and understanding of environmental and energy issues.
- Working with established partners in the community or regional organizations can improve the dissemination of messages. Local champions can connect with and tailor messages to their own communities more effectively.

- Engaging local residents and businesses in project planning and decision making results in better planned projects and more involved communities, even where clean energy projects are unsuccessful. *Designing feedback loops into outreach efforts can help hone programs and education efforts to a community's needs, and bring programs to a wider audience*, according to Brian Adams of GCC. Outreach efforts, targeted to low-income or underrepresented communities, on the advantages and cost savings presented by clean energy projects were important components to obtaining community support.

- Helping residents and community members to understand utilities' role in clean energy investment was recommended by Nancy Nylen of the Mass Energy Consumers Alliance. Most community members do not understand that utilities must choose between investing in new power sources and power plants or in energy efficiency and renewable energy projects to meet future demand. Energy efficiency projects are frequently more cost-competitive, as it's less expensive to save energy than build new power plants. By educating energy consumers, it also helps to reduce skepticism surrounding Mass Save/ utility incentive programs.

- Providing training and education to end users is recommended to ensure that energy savings meet expectations, but is also an effective step to garner support and buy-in for current and future projects. Exchange participants from the Castle Square Tenants Organization noted that *when introducing new energy efficiency technologies into peoples' homes, it may be necessary to train residents on how to use them. In the case of Castle Square apartments, tenants didn't understand the programming for new thermostats and didn't initially use them in an energy efficient way. Providing resources and education on "going green" to encourage new behavior patterns was a needed step*.

- Clean energy projects located at public buildings, including schools, public works departments, and other facilities, should be used as educational and outreach opportunities. Displaying real time energy savings data via monitors or a website, and converting data to real life equivalents that are understood by a wide audience such as cost savings, or carbon reductions in terms of cars off the road or trees planted, can help make the case for future clean energy projects.

Presentations

Community-Driven Energy Efficiency – Small Communities, Deborah Backus and Gary Lee, Castle Square Tenants Organization

Communicating Clean Energy to Students and Campus, Hollyce States, Massasoit Community College

Developing Clean Energy Curriculum for Students and Campuses, Brian Adams, Greenfield Community College

Clean Energy Municipality, City or Town, Susan Worgaftik, Greening Greenfield

Communicating Clean Energy to Homeowners, Nancy Nylen, Amy Vavak and Stephan Wollenburg, Mass Energy Consumers Alliance

D. Energy Management through Data Analysis

Moderated by Maggie McCarey, Massachusetts DOER

Efforts to track energy use provide valuable data to identify where opportunities for energy savings exist or determine how an existing clean energy project is performing. Data, from an energy management or tracking system, can aid in identifying what technology, or system configuration, will offer the best energy savings

potential, but can also be used to establish a baseline and help identify equipment issues once a system has been installed.

The workshop presentations focused on various methods for Energy Management currently employed in Massachusetts by a variety of organizations, and efforts to analyze and utilize the data collected in meaningful ways. Two tracking systems, the Enterprise Energy Management System (EEMS) and Mass Energy Insight, were featured during the presentations. Each system used a different method to analyze energy use and identify energy savings potential. EEMS was designed and installed at approximately 400 Massachusetts facilities using ARRA funds, and utilizes on-site meters to track energy use. Mass Energy Insight is a web-based tool used by Massachusetts municipalities for tracking energy use through utility accounts at buildings and facilities.

- Municipalities, school districts, colleges, hospitals, and correctional facilities and similar institutions can benefit from the use of Energy Management System (EMS) controls equipment by identifying potential energy efficiency projects, but also by identifying simple behavioral changes that can reduce energy consumption. By monitoring peak usage periods and where energy-intensive practices occur, EMS users can identify opportunities for savings in their institution's energy consumption, and reset controls to reschedule processes for off-peak periods, or turn off lights or equipment when not in use. These simple changes can result in real cost savings, further aiding institutions with limited resources for capital expenditures.
- Goals and expected outputs should be considered when deciding upon an EMS or data tracking tool. Maciej Konieczny, the sustainability project manager for the city of Newton, noted that Mass Energy Insight was useful to managers assessing building performance on a monthly, quarterly or yearly basis, but it was less helpful for troubleshooting operations as the data was only available a month or more after it was used, and the data was only specific to account-level information, not particular building equipment.
- Deploying a data tracking system requires foresight and organization. Utility accounts and billing data need to be aligned with physical meters and facilities. To gain the most insight from tracking data, electrical loads and equipment should be tied to meters during site surveys, and analyzed along with tracking data. Karthik Rao of EnerNOC noted that *site surveys and upfront work are important parts of successful meter deployment. Access to billing information and site configuration ensure the accuracy of the system*.
- Presenters also noted that training is a necessary step to effective use of systems such as EEMS and Mass Energy Insight. Again, Karthik Rao noted that *engaged personnel were key to successful projects – organizations needed to have an interested point person for using EEMS*. Paul Wolff of Bunker Hill Community College noted that use of the dashboard and energy data analyses were not necessarily intuitive. Training, available through the state, or how-to guides proved useful to EEMS users.

Presentations

Analyzing and Communicating Real Time Energy Savings in Curriculum, Paul Wolff, Bunker Hill Community College

Lessons Learned Through Large Scale Metering Installation, Karthik Roa and Micah Remley, EnerNoc, Inc.

Installing and Maintaining Real Time Energy Equipment, Micah Remley and Karthik Rao, EnerNoc, Inc.

How Effective is MassEnergyInsight Data for Towns? Aimee Powelka, Massachusetts DOER

Integrating Real-Time Meter Data into Building Management, Scott Richards, Berkshire Community College

MassEnergyInsight: Energy Data Gathering Significance and Challenges, Paul Gromer, Peregrine Energy Group

E. Solar Photovoltaics

Moderated by Michael Judge, Massachusetts DOER

Especially for newcomers to the technology, solar PV projects are sometimes challenging to implement due to issues pertaining to technical details, scheduling, and project financing. Presentations focused on technology, engineering and installation issues, and sharing best practices and guidance on avoiding pitfalls common to solar PV installations.

As is the case with many other clean energy projects, pre-design research and analysis is an important step. Since structural, shading, and interconnection issues can delay or halt the progress of proposed systems, site feasibility evaluations can identify potential issues and prevent costly delays.

- A formal structural review should be conducted prior to system design. Detailed structural analysis may reveal potential issues, including:
    - Insufficient roof support for the added load PV panels create (ballasted systems, which do not puncture the roof commonly add eight to ten pounds per square foot);
    - Snow loading on panels (Massachusetts Building Code, 8th Edition made significant changes);
    - Lateral loads, including wind and earthquake resistance.
- A roof exposure analysis – evaluating the proposed site for its total solar resource factor and shading – is another component of a complete site feasibility evaluation. The analysis will show how light will track across the proposed system, and the location of obstructions exist that will negatively impact the system's energy production. Plans to trim tall trees and relocate heating and air conditioning equipment installed on a rooftop can be developed using this information.
- An interconnection study – another component of a complete site feasibility study – evaluates possible locations for connection to the electrical grid, including the distance between the proposed solar PV array and proposed interconnection sites and the capacity of the existing infrastructure. Large distances and insufficient capacity at substations may present added costs and barriers for proposed PV systems.
- Since utility companies can provide essential information regarding service configuration and capacity, participants recommended engaging them early in the planning stages. Early application for interconnection authorization and net metering allocation was highly recommended. Tim Roughan of

National Grid recommended working with an engineer familiar with grid interconnection standards and protection issues.

- Project budgets should also be developed during the pre-design phase, as unforeseen costs can frequently impede the financial feasibility of an installation. Budgets for site feasibility, permitting, interconnection, system equipment and materials, installation, and the continued maintenance and operation should all be considered, as should the maximum cost at which the system is still financially feasible.
- Participants recommended defining a final project scope and installation schedule once the feasibility of a proposed solar PV installation is determined. The scope should include provisions for system design, installation and quality assurance, and provide direction for the operation and maintenance of the system after installation is complete.
- Develop a detailed three-line electrical diagram, taking into account all issues identified in the site feasibility study and decisions made during the pre-design phase. The design should be compliant with Massachusetts Electrical Code, utility, and other applicable requirements. Equipment should be listed by a Nationally Recognized Testing Laboratory, such as UL, and rated for the appropriate current, which can exceed 600 amperes before conversion to alternating convert current.
- Quality assurance and peer review should be included in the design of the three-line diagram and physical installation. Review by licensed electricians and professional engineers can help identify issues early.
- Plan for continued operations and maintenance of the system, such as routine inspections to ensure the system wiring remains intact and that vegetation growth does not adversely impact energy generation.

Presentations

Structural Review of a Solar PV Site, Jim Walker, Ameresco

Highlighting the Effectiveness of Solar Tracking Systems, Andy Bakinowski, Massachusetts Department of Correction

How to make the Interconnection Process Seamless with your Utility Provider, Tim Roughan, National Grid

Structural Review of a Solar PV Site and an Overview of Racking Options and Installations Issues in Solar PV, Al Weisz, Massachusetts Division of Capital Asset Management

The Do's and Don'ts of Wiring Solar Installations, Matt Piantedosi, The Cadmus Group, Inc.

The Advantage of a Pole Mounted Solar PV System, Juliette Haas, Town of Egremont

Preparing for the Utility Interconnection Process, Erik Morgan, Western Massachusetts Electrical Company

F. High Performance Buildings: Biomass

Moderated by Alexander Sherman: Massachusetts DOER

At the Greenfield Exchange, stakeholders reviewed a variety of biomass projects installed through ARRA funds in western Massachusetts, including systems located at the Massachusetts Museum of Contemporary Art (Mass MoCA), Greenfield Fire Department, local schools and businesses. Participants engaged in a conversation on how best to promote biomass investment in the future rather than just the best practices for existing technology.

The goal of these grants was to demonstrate the effectiveness of high-efficiency ultra-low emissions biomass boilers at both residential and commercial scales, as a way to offset the use of fossil fuels for space heating. Additionally, these grants were designed to seed the biomass pellet market and support a pellet storage and distribution infrastructure that would be available for a mature biomass market in the region.

Participants reviewed existing installations and identified infrastructure and market needs specific to the biomass industry. Participants noted there still remain key opportunities to expand demand for biomass technologies and products and develop a mature infrastructure.

- Bob Latour of A.R. Sandri, an energy service company specializing in biomass systems, noted that the biomass market is still maturing in Massachusetts. In order to continue to mature, from the consumer's perspective, additional vendors and a more competitive market needs to take shape.
- Providing outreach and incentives to potential end users and suppliers, including commercial facility managers, home owners, energy providers, and fuel distributors, can increase awareness of the under-developed biomass market in Massachusetts. For many of the early adopters participating in the exchange, high fuel costs in 2008 prompted them to look for an alternative to fuel sources. ***Sandri responded to customer frustration by identifying biomass pellets as an alternative to fuel oil and natural gas costs; enabling their existing customers to convert to biomass heat***. Likewise, end users such as Mass MoCA invested in biomass heat to limit their exposure to fuel prices fluctuations, fixing the percent of their annual operating budget that was allocated to energy costs. In the absence fuel price spikes, the benefits offered by biomass may not be easily recognized. Outreach, focusing on the sustainability, cost-competitiveness, and reliability of biomass fuel sources is necessary.
- Support and training to area contractors to enter into the biomass industry is also needed. Blair Benjamin noted that while Mass MoCA was pleased with the completed project; the competitive bidding process was limited in the area. He noted that ***the biomass market is still maturing, and opportunities to assist biomass contractors enter the market are needed.***

Presentations

Reducing Energy at Mass Museum of Modern Art, Blair Benjamin, the Museum of Contemporary Arts
Biomass Boiler System Owners, Bob Latour, The Sandri Companies
Expanding the Energy Portfolio of Western Massachusetts, Jake Goodyear, The Sandri Companies
Feedback from Biomass Systems Representatives Present, Group Discussion

Recommendations for Statewide Support by Clean Energy Stakeholders

Roundtable and workshop discussions highlighted the important role ARRA has played in moving Massachusetts forward on clean energy goals. Several participants noted that the effort *opened up a huge line of communication between people, agencies, and energy efficiency programs that inspired action and energy savings*. Exchange participants praised DOER staff for helping participants navigate the process of developing clean energy projects and maintain *positive and productive working relationships*. Participants also cited non-energy benefits realized through the ARRA programs, including building the capacity of both professional and volunteer clean energy proponents to successfully plan and manage projects, as well as reducing skepticism surrounding clean energy projects and utility incentive programs.

One of the primary goals DOER identified for the Exchanges was soliciting advice and recommendations for the state and its agencies to improve existing processes and continue the momentum in clean energy investment that began under ARRA. Feedback received from participants is grouped below in three broad categories: *Technical Assistance and Financial Guidance*, *Consolidated and Streamlined Processes*, and *Information Clearing House*.

A. Technical Assistance and Financial Guidance

While ARRA funds are no longer available, participants noted that a number of clean energy funding sources remain that can be tapped as resources to help finance clean energy projects. Resources include incentives from utility efficiency programs, renewable project rebates from the Massachusetts Clean Energy Center, DOER Green Communities grants, and Renewable Energy Credits, as well as other state and federal tax benefits. One participant reported that *leveraging funds obtained from utility incentives to secure additional financing worked well and could cover between 10 and 50 percent of a project's cost, and sometimes more*.

The third-party ownership model, especially for solar PV projects, was seen by participants as a pathway to pursuing financially viable projects in the post-ARRA era. This model enables tax-exempt organizations, such as municipalities, to obtain the benefits of a solar PV installation and leverage all available funding sources to reduce project costs, including federal tax credits that are frequently unavailable to tax-exempt organizations. In addition, attendees discussed the value of technical assistance in reviewing Power Purchase Agreements (PPAs), identifying risks within a contract, and helping negotiate the best value for a buyer.

To maintain the momentum established under ARRA and improve on the processes, participants recommended the following:

1. Create and provide access to a financial *roadmap* demonstrating how the various incentives and financing approaches can be packaged and the steps needed to apply for and access incentives. The roadmap should be easy to follow and provide links to necessary forms and processes essential to securing the incentives. (Also see Information Clearing House below).

2. Provide technical support in conjunction with state-level financial incentives, including those offered by utilities. Participants suggested an energy coach approach where region-based technical assistance could be obtained as needed by organizations, businesses and communities. Energy coaches could help identify financial resources at both the community and individual residence level, and assist

communities applying for incentives. Give special consideration to small and rural communities, which may need more assistance or have unique assistance needs.

3. Provide access to existing contracts, requests for proposals and responses for clean energy projects executed in the state to make due diligence efforts easier and more fruitful. (Also see Information Clearinghouse below).

4. Develop incentive-based approaches and specialized technical assistance for historic buildings to help address the unique, more costly challenges they face.

5. For purposes of calculating greenhouse gas reductions, allow developers of clean energy projects in historic buildings to consider the embedded carbon in older existing materials, and the net carbon increase associated with replacing them with new materials.

6. Develop tools to enable project proponents to easily compare the benefits and disadvantages of various financing approaches, such as third party ownership vs. direct ownership models. The tools should help purchasers perform due diligence on proposals and quotes received, and provide confidence to project proponents that proposed financing is appropriate. Also provide technical assistance to help review financial details and contract language.

7. Provide tools and technical assistance to help municipal utilities establish on-bill financing programs for energy customers in their service territory.

B. Consolidated and Streamlined Processes

During roundtable and workshop sessions, Exchange participants frequently referred to the complexity of the business side of clean energy projects. Some participants perceived navigating the multitude of options and requirements, ranging from permitting to financial models, as seemingly insurmountable challenges. A common suggestion was for the state to consolidate and streamline its requirements and processes.

To maintain the momentum established under the ARRA initiatives and improve on existing processes participants recommended the following:

1. Work with state and local organizations to consolidate and streamline regulatory and approval processes, reduce redundant information required of clean energy projects, and detail the procedures that must be followed. For example, a single application that links all state incentives, serves as an application for grid interconnection and net metering with the regional utility, and provides the opportunity to submit information required by state and local government permitting bodies was identified as the ideal. The system could track and inform project proponents of application approval status for the various components. Examples of consolidated processes mentioned at the Exchanges included those from the state of Hawaii (permitting packet, guidebook technology, online wizard) and the province of Ontario, Canada. Streamlined processes could also make project reporting requirements easier to fulfill.

2. Work with state, federal, and local governments to develop and implement standard regulatory and permitting requirements and processes for clean energy projects across the Commonwealth. This will help project proponents and developers meet permitting requirements of the various entities, without added research or effort, reducing costs to determine project feasibility.

3. Establish a prescribed resolution process, for instances where interpretations are inconsistent. A standard process will aid project proponents to identify next steps for projects that become stalled due to complex or confusing permitting requirements.

4. Educate and train local inspectors on building and electrical codes, particularly in relation to clean energy technologies. Promote best practices and consistency in establishing local technical requirements such as setbacks from roof edges for rooftop solar installations. Consider promoting, or requiring, the use of third party engineers as technical reviewers during the commissioning process to assure projects deliver expected savings.

5. Consider accommodations for small communities and small businesses. For example, consider exemptions to program requirements that are especially burdensome for small contractors. Provide upfront guidance on the administrative requirements for a clean energy project so project managers have a better understanding of the level of effort needed to meet the requirements. Provide education outreach efforts directed to small communities, which have limited resources and expertise with clean energy technologies and project identification and management.

6. Standardize engineering documentation guidelines for projects located at historic sites across the state. Several participants found engineering documentation related to historical building projects difficult to interpret. They pointed out that it would be helpful if statewide directives were propagated out to local historic commissions to standardize engineering documentation guidelines.

7. Provide guidance and assistance to project proponents applying for utility incentives and interconnection authorization. Document and pass on lessons learned and best practices for completing utility applications and meeting requirements. Identify bottlenecks and work with utilities to revise processes to avoid delays and unexpected costs.

C. Information Clearinghouse

Many Exchange participants requested that the state work to *improve access to information, resources and data by developing an on-line site to share documents developed by project proponents, best practices and lessons learned, and project data and results*. In conjunction with consolidated and streamlined processes, participants felt a *one-stop shop* source of information would reduce the time burden and lead to better outcomes for clean energy projects. They also voiced frustration at the time required to identify information sources and availability, and were concerned that they lacked the ability to identify all relevant sources that might improve the project or the development process.

To maintain the momentum established under ARRA and improve on the processes, participants specifically recommended DOER develop and provide access to a centralized repository of energy efficiency and renewable energy guidance and data (e.g., in a web-based bulletin board). The resources would include information on potential vendors, contractors, installers, "how to" guides (e.g., on navigating early planning steps of clean energy projects), and energy savings and benefit data, calculated using data from completed projects. Useful information to be made available includes:

1. Catalogue best practices and available resources by topic, and provide a forum for continued review and revision. Note best practices by topical category (e.g., financing, procurement, project management, stakeholder outreach, O&M) and other resources available, and post example outreach plans to help project proponents win project support.

2. Provide lists of professionals providing services in clean energy technologies, including engineers, architects, and contractors with clean energy project experience, noting specialized experience, such as historic building renovation.
3. Emphasize the importance of O&M planning and develop a prescriptive process for developing an O&M plan that identifies key requirements such as system commissioning. Provide guidance on expected O&M costs for various technologies and provide example plans for review.
4. Provide an overview of local zoning regulatory and permitting requirements and costs for each Massachusetts community.
5. Provide overviews of new technologies that have not yet been established in Massachusetts. Include benefit/cost examples, a summary of design or installation issues, and other issues to consider in due diligence reviews.
6. Discuss best practices in interfacing with state agencies. Provide contacts, links to applications, and other materials.
7. Connect with interested stakeholders to discuss new and evolving procurement and management approaches (e.g. using accrued savings to cover inverter replacement).
8. Encourage networking and inter-community cooperation through forums, newsletters, and other means. Share lessons learned between proponents of complete and proposed clean energy projects.
9. Provide documents and materials from clean energy projects as examples for review by future project proponents. Develop virtual tours and project profiles of clean energy projects, and provide access to detailed documentation, ranging from feasibility studies to cost/benefit analyses.

Conclusions and Next Steps

The Best Practice Exchanges provided insights into successful clean energy projects funded through the ARRA SEP and EECBG programs, and identified key recommendations for program managers and project implementers to improve the success of future clean energy enterprises. By connecting the collective experiences of ARRA grant recipients and using the knowledge compiled to develop and improve the next generation of projects, state implementers and clean energy stakeholders can increase the benefits achieved through their clean energy investments.

Participants recognized the importance of ARRA funding in putting people to work, cutting energy use and costs, reducing greenhouse gas emissions and helping the overall economy. And while participants acknowledged that another ARRA program is unlikely to occur in the near future, they strongly pointed out the critical nature of this type of federal support. Virtually all ARRA projects would not have occurred without ARRA funds or would have been less comprehensive and far-reaching in nature. Future investments and support from the federal government were described as important to keeping the momentum that was established under ARRA, although participants also recognized the need to continue working on clean energy programs whether or not the federal government was able to maintain its support. DOER was seen as a critical partner as well and participants encouraged DOER to maintain its leadership and coordinating role in supporting state and local projects, whether through financial assistance, technical support, research, information dissemination, to name just a few suggestions.

With regard to the Best Practices Exchanges, participant feedback indicated that the forums served as successful networking and educational events. Many participants noted the following:

1. Sharing information directly with peers was productive and roundtable discussions produced high-quality dialogue.
2. Gathering an assortment of stakeholders with varied experience and contributions to clean energy projects to help determine common needs and goals was beneficial.
3. Participants “learned a lot” and were “amazed by the amount of information and skill” represented by those in attendance.

The Exchanges provided attendees with an opportunity to share their experiences and collaborate on a formal basis. Many participants encountered new, technical information during Best Practice Workshops, roundtable discussions, and networking sessions, which could materially contribute to the success of current and future clean energy projects. Still others identified new information that could have improved their completed projects.

Numerous requests for additional opportunities to collaborate and share information were voiced during the Exchanges. Participants strongly recommended holding additional networking events on an ongoing basis. Suggestions for future events:

1. Shorten the forum length, or adapt the forum agenda to enable participants with limited availability to identify workshops and conversations of importance to them.
2. Offer breakout sessions tailored to specialized groups such as small communities, or solar PV stakeholders, especially at events where a broad variety of perspectives is represented. Conversations should be balanced to provide broad perspectives and actionable information.

3. Invite additional stakeholders – municipalities, the general public, vendors - to share information with project implementers who may pursue similar projects in the future.
4. Offer information regarding future policy goals, priorities, and resources towards successful clean energy investments.
5. Increase opportunities for networking and guided dialogue sessions with clean energy experts.

A. Next Steps

Hold additional events similar to the Best Practice Exchanges. Through future best practices exchanges, DOER and its partners may facilitate the disbursement of information, improving the success of future clean energy projects. Massachusetts clean energy stakeholders can gain access to beneficial information and resources by launching:

1. Routine best practice exchanges
2. Increased publicity for existing stakeholder networking groups
3. New efforts and networking groups to address topics identified by Exchange participants (e.g. small communities, deep energy retrofits at historic sites, energy management systems and data analysis).

Analyze and compile data and information collected through the ARRA projects. Exchange participants requested that the Massachusetts DOER and its partners analyze and make available data and information collected through the ARRA projects. The data will enable organizations seeking to begin new clean energy projects to:

1. Substantiate energy savings or generation claims
2. Enable implementers to seek advantageous clean energy financing
3. Aid implementers in promoting clean energy projects to business and community decision makers and stakeholders

The scope and organization of analyzed data resources is critical. Categorizing actual energy savings by project, based on technology type and specifications, seasonality, and characteristics of the community, business, and facilities, is an important way to ensure that the data is helpful to stakeholders with varied interests and needs.

Identify and act on opportunities to consolidate and streamline project administration. DOER and its partners can help reduce the regulatory complexity surrounding clean energy projects by consolidating incentives and streamlining permitting and other regulatory processes.

Investigate the feasibility of creating an information clearinghouse. Many Exchange participants requested guidance accessing existing data sources and assistance in utilizing data collected through the ARRA programs on a variety of technologies and topics. DOER and its partners should take the following steps to determine the feasibility and resources necessary to implement a statewide information clearinghouse:

1. Catalogue clean energy resources currently available.
2. Outline how an information clearinghouse would present these materials, and what additional information could be made available.
3. Present energy savings data and project information collected from ARRA projects for use as resources for future project proponents. Some Exchange participants noted that case studies of successful

projects would be useful, while others requested finer-resolution data to support energy savings estimates and engineering assumptions for future clean energy projects.

4. Determine what resources would be needed to establish and maintain the Information Clearinghouse.

Develop financing guidance and technical assistance tools. Provide financial roadmaps for various clean energy project types, and other assistance, as discussed in the ***Recommendations from the Clean Energy Stakeholders*** section of this report.

With the completion of ARRA projects as of November 29, 2012, the holding of two ARRA Best Practice Exchanges, and the release of this summary report, the Department of Energy Resources acknowledges the vast amount of information and knowledge that has been shared. DOER expresses its interest in working with stakeholders to review, prioritize, and respond to the many thoughtful recommendations contained in this report. As such, the agency will be initiating in 2013 an internal process to identify recommendations that can be implemented with existing resources and to discuss with stakeholders ways in which DOER and the Commonwealth can be helpful in maintaining clean energy momentum expanded under ARRA.