



The Northeast and Mid-Atlantic Energy Efficiency  
Research and Development (R&D) Connector:  
Findings and Recommendations

July 2018



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## About U.S. DOE's Office of Energy Efficiency and Renewable Energy (EERE)

The mission of EERE is to create and sustain American leadership in the transition to a global clean energy economy. Its vision is a strong and prosperous America powered by clean, affordable, and secure energy.<sup>1</sup>

The Office of Energy Efficiency and Renewable Energy (EERE) leads a robust community of researchers and other partners to continually develop innovative, cost-effective energy-saving solutions through increased efficiency—better plants, advanced materials and manufacturing processes, products, new homes and ways to improve older homes and buildings.<sup>2</sup>

## About Pacific Northwest National Laboratory (PNNL)

Since their inception in 1965, PNNL has advanced the frontiers of science and engineering in the service of America and the world. They make fundamental scientific discoveries that illuminate the mysteries of our planet and the universe. They apply scientific expertise to tackle some of the most challenging problems in energy, the environment, and national security.

In the field of Energy and Environment, PNNL's core areas of research include Clean Fossil Energy, Electricity Infrastructure, Energy Efficiency and Renewable Energy, Environmental Health and Remediation and Nuclear. Some of their projects in this field specifically focus on grid modernization, building controls, providing scientifically-defensible solutions for legacy waste, and the delivery of secure, sustainable energy.<sup>3</sup>

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<sup>1</sup> <https://www.energy.gov/eere/efficiency>

<sup>2</sup> <https://www.energy.gov/eere/efficiency>



## About NEEP

NEEP was founded more than 20 years ago as a non-profit to accelerate energy efficiency in the Northeast and Mid-Atlantic states. Today, it is one of six Regional Energy Efficiency Organizations (REEOs) funded, in part by the U.S. Department of Energy to support state efficiency policies and programs. Our long-term shared goal is to assist the Northeast and Mid-Atlantic region to reduce building sector energy consumption three percent and carbon emissions 40 percent by 2030 (relative to 2001). For more about our NEEP strategies and projects, visit our [website](#).

**Disclaimer:** NEEP verified the data used for this white paper to the best of our ability. This paper reflects the opinion and judgments of the NEEP staff and does not necessarily reflect those of NEEP Board members, NEEP Sponsors, or project participants and funders.

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## Introduction

At least half of America's economic growth can be attributed to scientific and technological innovation. However, as government and businesses continue to plant the seeds for tomorrow's technologies by making investments in basic and applied research and development (R&D), it becomes increasingly evident that the process is complex. Moving discoveries from their nascent stages to the later stages of product development and commercialization creates innumerable challenges for researchers and innovators.

NEEP's Northeast Regional R&D Connector Project is a first step to better understand the research activities and priorities for energy efficiency in the region, and the challenges for bringing promising technology through the 'valley of death' to market. The following objectives framed the project:

- 1. Assess the energy efficiency R&D landscape of local research organizations and states in the Northeast and Mid-Atlantic region**
- 2. Identify the major challenges associated with technology commercialization in the Northeast and Mid-Atlantic region**
- 3. Understanding research activities and priorities for energy efficiency in the region**
- 4. Gain insight into current collaborations amongst energy efficiency research institutions in the Northeast and Mid-Atlantic**
- 5. Recommend an effective ongoing framework for the advancement of promising energy efficiency technologies in the Northeast and Mid-Atlantic**

This report takes you through NEEP's journey towards achieving these objectives. It represents the ground work for a more thorough exploration into what can be done to bridge the commercialization gaps in the Northeast and Mid-Atlantic regions. This report is based on the information gathered from three specific tasks: 1) NEEP's interviews with the R&D organizations in the Northeast and Mid-Atlantic, 2) the Northeast Regional Energy Efficiency R&D Connector Workshop that was hosted by NEEP, and 3) secondary research on the topic that was gathered and synthesized by NEEP.

## Key Stages of R&D Connector Project

To meet the above-identified objectives, NEEP: 1) conducted interviews with R&D organizations in the Northeast and Mid-Atlantic to understand their research activities, priorities, and challenges in bringing new technology to market, 2) hosted a workshop to bring together R&D organizations to discuss NEEP's stage-one findings and further explore opportunities to increase the success of energy efficiency R&D commercialization efforts, and 3) compile findings into a report.

### *Interviewing energy efficiency R&D organizations in the Northeast*

During January 2018, NEEP interviewed 10 R&D organizations in the Northeast and Mid-Atlantic regions. They were asked questions regarding their current energy efficiency research and development efforts at their respective institutions. The following organizations were interviewed:



- University of Connecticut
- University of Maryland
- Boston University
- Worcester Polytechnic Institute
- Princeton University
- Columbia University
- Rochester Institute of Technology
- Fraunhofer Center for Sustainable Energy Systems
- Carnegie Mellon University
- George Washington University

### ***Hosting the Northeast Regional Energy Efficiency R&D Connector Workshop***

The Northeast Regional Energy Efficiency R&D Connector Workshop took place on March 1, 2018 at the New York State Energy & Research Development Authority (NYSERDA) offices in Albany, NY. This day-long event was attended by 10 participants and seven researcher and funder organizations of energy efficiency R&D programs in the Northeast and Mid-Atlantic. The aim of the event was to discuss energy efficiency research priorities in the region, explore opportunities to drive greater awareness and collaboration among R&D organizations, and to help advance the commercialization of energy efficiency technologies in the Northeast and Mid-Atlantic. The questions posed at the workshop along with the key responses are listed in Appendix B.

Three key questions were discussed at the event:

- 1. What are the main factors that contribute to R&D commercialization success?**
- 2. What resources or structures do you think should be put into place to enable a more successful pathway towards R&D commercialization in the region?**
- 3. Is there a role for a regional organization like to NEEP to help strengthen the R&D pipeline? Are there other organizations well-positioned to play greater roles?**

### ***Producing the Northeast Regional R&D Connector Report***

This report is the final stage of the R&D Connector Project. It captures and summarizes the information gathered in the interviews and the workshop, and provides recommended next steps from the compiled research.

## **The Energy Efficiency R&D Ecosystem in the Northeast and Mid-Atlantic**

### ***Energy Efficiency Research Institutions in the Northeast and Mid-Atlantic***

The Northeast and Mid-Atlantic region has a wealth of universities and research institutions that focus on energy efficiency research. Table 1 below lists the most prominent energy efficiency research institutions in the region. Ten R&D institutions from this list (those highlighted in green) were interviewed by NEEP based on response and relevancy. The institutions were chosen based on the relevancy of work in energy efficiency and willingness to take part in the interview.

**Table 1: Energy Efficiency Research Institutions in the Northeast and Mid-Atlantic (highlighted institutions were interviewed by NEEP)**

State	Energy Efficiency Program Center	Affiliated University
Connecticut	<b>Center for Clean Energy Engineering</b>	University of Connecticut
Connecticut	<b>Center for Green Energy and Green Engineering</b>	Yale
Delaware	<b>The Energy Institute</b>	University of Delaware
<b>Maryland</b>	<b>University of Maryland Energy Research Center</b>	<b>University of Maryland</b>
Maryland	<b>Environment, Energy, Sustainability &amp; Health Institute</b>	John Hopkins University
Massachusetts	<b>MIT Energy Initiative</b>	Massachusetts Institute of Technology
Massachusetts	<b>Clean Energy and Environmental Sustainable Initiative</b>	Boston University
Massachusetts	<b>Center for Energy Efficiency &amp; Renewable energy</b>	University of Massachusetts, Amherst
Massachusetts	<b>Fraunhofer Center for Sustainable Energy Systems</b>	N/A
Massachusetts	<b>WPI Energy Research Group</b>	Worcester Polytechnic Institute
New Hampshire	<b>The Arthur L. Irving Institute for Energy and Society</b>	Dartmouth College
New Jersey	<b>Andlinger Center for Energy and the Environment</b>	Princeton University
New York	<b>Lenfest Center for Sustainable Energy</b>	Columbia University
New York	<b>Energy Efficiency in the College of Engineering</b>	Cornell University
New York	<b>Center for Energy and Environment</b>	University of Rochester
New York	<b>Golisano Institute for Sustainability</b>	Rochester Institute of Technology
Pennsylvania	<b>PENNERGY- The Penn Center for Energy Innovation</b>	University of Pennsylvania
Pennsylvania	<b>The Wilton E. Scott Institute for Energy Innovation</b>	Carnegie Mellon University
Washington D.C.	<b>Environmental and Energy Management Institute</b>	George Washington University

The interviews with each respective researcher or institution program director were phone interviews approximately 20 minutes in length. The goals of these interviews were to understand funding sources, with whom researchers currently collaborate, and perceived gaps in commercialization in the region. The interview questions that were answered by the research institutions are included in Appendix A.

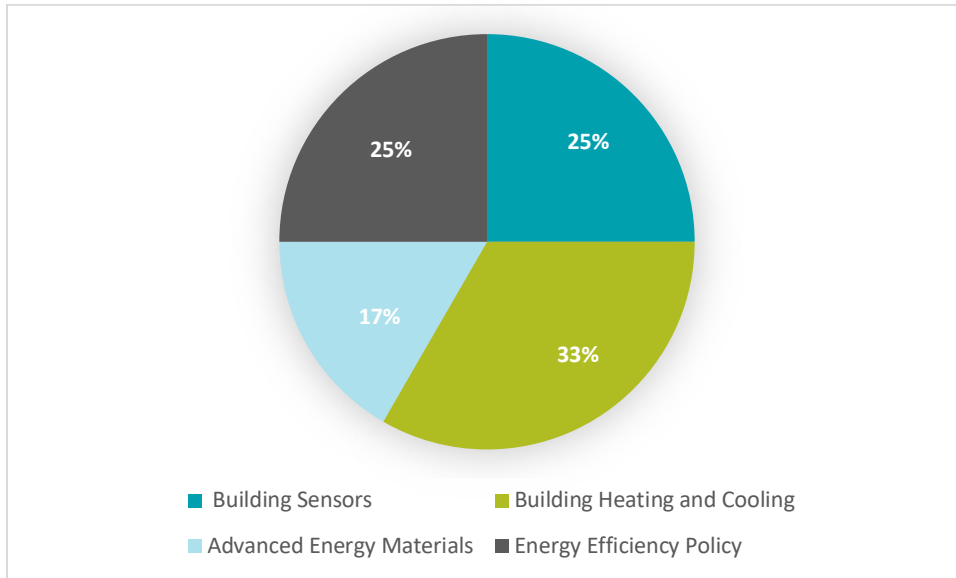
The results from the interviews are discussed below.



### Types of Energy Efficiency Research Conducted in the Northeast and Mid-Atlantic

The chart below shows the major energy efficiency research areas that the 10 interviewed institutions focus on. Here, we see that over 50 percent of the institutions focus on building-related energy efficiency research while fewer focus on energy efficiency policy (25 percent) and advanced energy materials (17 percent).

Figure 1: Major energy efficiency research areas by percentage



### Funding for energy efficiency R&D in the Northeast and Mid-Atlantic<sup>4</sup>

Interviews with researchers from institutions revealed that funding for energy efficiency R&D in the Northeast and Mid-Atlantic comes from the following sources:

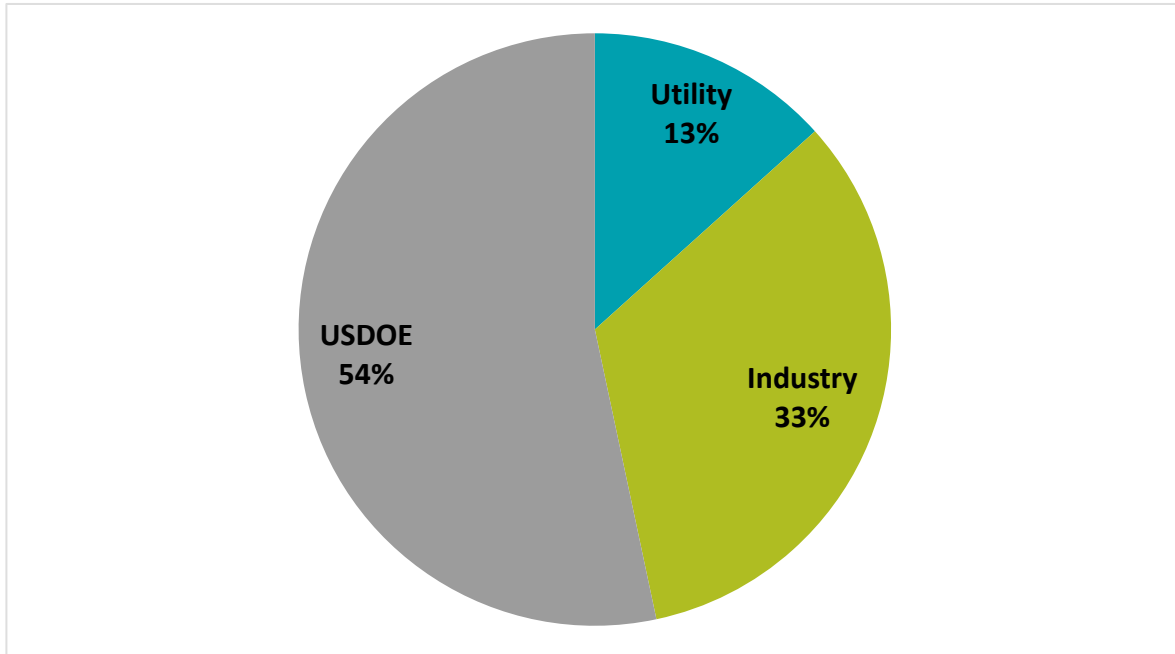
- Internal Seed
- Local Government
- State Government
- Utility
- Federal Government
- Industry

<sup>4</sup> Specific funding data for energy efficiency R&D in Northeast and Mid-Atlantic states was unavailable when this report was being compiled. However, data for all R&D funding by state, funding source and year was available at this link:

<https://www.researchamerica.org/advocacy-action/research/research-funding-and-economic-impact-of-funding-by-state>

It was reported, however, that three primary funders were: federal government, utilities, and industry. The following table shows the percentage of institutions that identified the respective funding sources as being their major source of funding.<sup>5</sup>

**Figure 2: Major funding sources by institutional percentage**



### ***Types of Research Collaborations at R&D Organizations in the Northeast and Mid-Atlantic***

R&D collaborations can have many benefits, including improved access to funding, shared research costs, broader knowledge pools, stronger and more widespread relationships and networking, and increased productivity.

Most of the R&D institutions surveyed reported that they currently participate in internal (to their respective organizations) and external research collaborations as listed below:

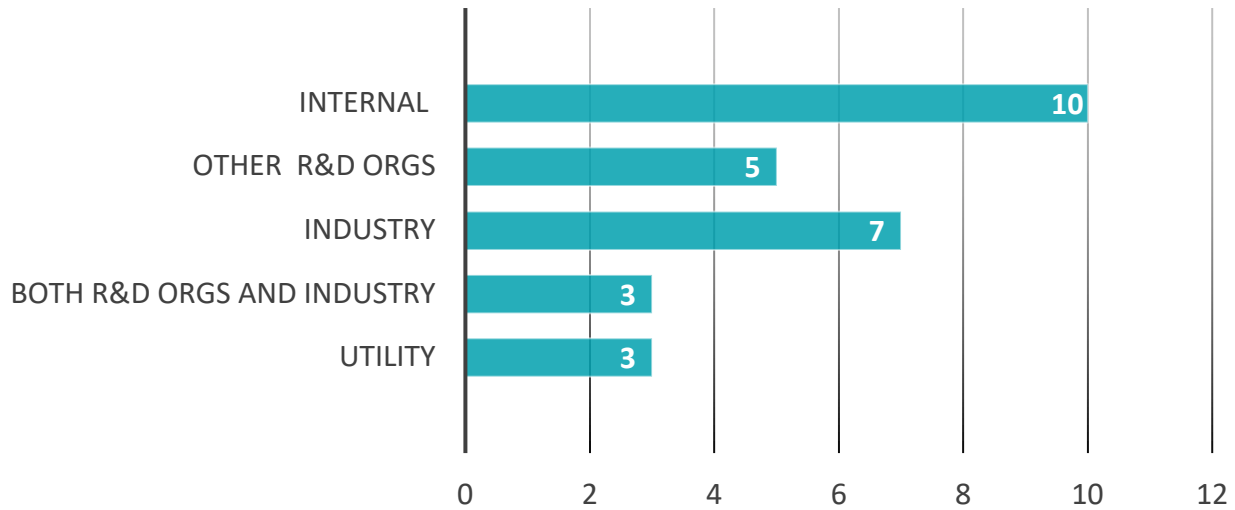
- **Internal collaborations**
- **Collaborations between R&D organizations**
- **Collaborations with Industry**
- **Collaborations that involve multiple R&D organizations and industry**
- **Collaborations with Utilities**

The following figure shows the types of existing collaborations amongst the interviewed research organizations.

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<sup>5</sup> The research institutions that were interviewed did not provide actual funding figures, but indicated which funding sources were considerably greater than the others. For the 10 institutions, the major funders were identified as follows: DOE only- 3 institutions; both DOE and Industry- 4 institutions; both DOE and Utility- 1 institution; Utility only- 1 institution; Industry only- 1 institution.

**Figure 3: Types of collaborations identified by interviewed R&D institutions**



Appendix C provides a detailed compilation of energy efficiency research and development efforts by state for the the Northeast and Mid-Atlantic region compiled by the American Council for an Energy-Efficient Economy’s (ACEEE)<sup>6</sup>. This listing highlights the energy efficiency centers in each respective state, their core areas of focus, and in some cases, their sources of funding. According to this compilation, the main areas of energy efficiency research conducted at the energy efficiency centers include: advanced manufacturing technologies and strategies, energy efficiency policy and practices, building energy efficiency, and smart grid efficiency.

### Existing Commercialization Gaps in the Northeast

Based on the interviews with R&D institutions and discussions at the Northeast Regional Energy Efficiency R&D Connector Workshop, three key gaps in the R&D commercialization process have been identified as follows:

- **Knowledge gaps**
- **Funding gaps**
- **Support gaps**

#### *Funding gaps*

In the Northeast and Mid-Atlantic, funding for early-stage technology development in the field of energy efficiency is available from university seed funding, state and local governments, state programs, utilities, and corporations. However, many researchers have expressed that financing is often unavailable for the next stage of research --product concept feasibility--that is needed to develop proof of concepts, prototypes, or patents. Habitually, these activities are neither eligible for standard research grants nor attractive options for investors.

<sup>6</sup> <https://database.aceee.org/state/research-development>



At this stage, a technology is at too early a stage of development to pull in venture capitalists and too risky and lacking tangible assets to receive traditional bank loans. Ultimately, the existence of this gap is a huge cause of frustration for many researchers and aspiring entrepreneurs as it limits the possibility to turn research results into commercially viable products and services.

### *Knowledge gaps*

During the R&D Connector Workshop, researchers shared that there is a general lack of knowledge of the factors that contribute to a successful path towards R&D commercialization. This includes information on industry needs, market trends, application prioritization, new energy efficiency technologies, and best practices of successful R&D ecosystems. Having access to this type of information could help to ensure better planning and management of the various steps towards commercialization.

### *Support gaps*

Beyond the funding and knowledge gaps just mentioned, researchers suggested that support structures that could assist in bridging both gaps are just as important. Support mechanisms that were suggested at the workshop included: accelerator programs that could connect innovators to funders and industry partners; crowdfunding platforms that could help connect fledgling technologies to the early money and attention they need; public events that could give innovators the opportunity to make pitches to investors; and workshops and seminars that could educate researchers on market trends, intellectual property, and ways to identify and secure funding sources.

## **Bridging Commercialization Gaps in the Northeast and Mid-Atlantic: Identified Needs and Suggested Actions**

Based on the interviews with researchers in the Northeast and Mid-Atlantic and feedback from the Northeast Regional R&D Connector Workshop, NEEP identified two key areas where sustainable and concrete actions could be taken to overcome the existing obstacles within the commercialization pipeline in the region:

- 1. VISIBILITY - Providing information on key energy efficiency R&D commercialization practices, insights, and technologies within the Northeast and Mid-Atlantic region**
- 2. COLLABORATION - Providing platforms that would promote collaborations within the energy efficiency R&D ecosystem in the Northeast and Mid-Atlantic**

For each of these key areas, this section also itemizes what needs should be met to bridge the commercialization gaps (through the lenses of the interviewed researchers) in the Northeast and Mid-Atlantic regions; and for each need, suggests actions that could be taken towards closing the associated commercialization gap.

(Please see Appendix B for a complete list of feedback from questions that were asked at the Northeast Regional R&D Connector Workshop)

## Visibility

### Industry technology needs

Most researchers NEEP spoke with expressed the need for more information on trends that currently shape the energy efficiency industry, and how the industry positions itself with respect to changing market conditions and competition. One specific question that was raised is: “Do companies seek new energy efficiency business based on technical breakthroughs, or is it sufficient for R&D to support existing businesses in upgrading, modifying or extending current products and services?”

***Suggested action:** By conducting further research and analysis of the industrial energy efficiency R&D landscape in the Northeast and Mid-Atlantic, a more comprehensive assessment of how market conditions, technical breakthroughs, and energy efficiency trends and indicators are currently impacting energy efficiency industries in the Northeast can be done. This assessment could be made available to researchers via different platforms including reports, webinars, and blogs.*

### Best practices

Many of the researchers NEEP spoke with expressed frustration in not having sufficient knowledge to successfully move innovations from the discovery stage through to product commercialization. It was suggested that having access to “best practices” of successful R&D programs could provide insight to tailoring their own practices towards commercialization success.

***Suggested action:** Targeted research focused on energy efficiency R&D programs that have successfully commercialized technologies could provide a roadmap for success. Further research could aim to answer questions such as:*

- *What are some of the key resources needed to develop energy efficiency R&D programs to the stage where industry or investors can recognize their commercial potential?*
- *How have collaborations and other engagement activities affected R&D success in the Northeast and Mid-Atlantic?*
- *How are current energy efficiency R&D programs providing benefits to the users of resulting energy-saving and energy producing innovations?*

*Answers to these questions could be shared with research organizations in the Northeast and Mid-Atlantic via best practice exemplars accompanied by a webinar series.*



## Funding sources

A hindrance in the commercialization process that was shared with NEEP was that it is more difficult to access funding for the developmental stages (e.g. prototype development) of energy efficiency R&D than it is to obtain funding for the earlier stage R&D. This may leave a gap between product concept funding and the development work that is an essential stage in the continuum to bring a product to commercialization.

***Suggestion action:** Tracking energy efficiency R&D funding and programs in the Northeast and Mid-Atlantic by major categories of research (e.g. basic research, applied research, and developmental research) could help provide transparency to funding sources that support product development.*

## Success stories

Everyone likes a good success story, and energy efficiency researchers in the Northeast and Mid-Atlantic are no exception. One commonality that was noted among energy efficiency researchers that NEEP interviewed is that they are interested in the impacts of their energy efficiency innovations. Many expressed that success stories with similar focus would be of value to them.

***Suggested action:** Further research and analysis could lead to a better understanding of energy efficiency R&D success, the major contributing factors, and how success could be measured. Highlighting success stories in the Northeast and Mid-Atlantic via web postings, reports, blogs, webinars, and conferences could provide examples of how success is achieved and measured.*

## Energy Efficient technologies

Researchers mentioned that it is difficult to know what research is currently being funded in the Northeast and Mid-Atlantic. Up-to-date information on what technologies are currently being funded would result in less duplication of research and more problem solving.

***Suggested action:** The ultimate objective of energy efficiency R&D is to develop new energy efficient technologies that can be used in the marketplace. Considering that it is very costly to fund technologies to the stage where they can be implemented at a commercial scale, it is important to keep track of the technology research that already exists. Both energy efficiency researchers and businesses in the Northeast would benefit from up-to-date tracking or clearing house of information on existing technologies via accessible database platforms.*

## Intellectual property

Practical intellectual property (IP) issues are of relevance to all the distinct stages of technical innovation; from the idea/concept stage to the successful launching of a product in the marketplace. NEEP's research revealed that energy efficiency researchers and funders in the Northeast and Mid-Atlantic need more information on IP

systems, especially information that highlights how to effectively use the tools of IP systems to better manage innovation.

***Suggested action:** Since intellectual property is an important management resource that follows different decision-making paths in different technology sectors, it is important to understand how it is positioned to help reduce risks and expand business opportunities in energy efficiency R&D within the region. Further research could be conducted to understand how best to educate researchers in the Northeast and Mid-Atlantic on this topic to assist them in formulating more effective R&D strategies.*

## **Collaboration**

### **Connect R&D organizations with industry**

A number of R&D organizations have increased their engagement with industry partners. Most of the energy efficiency researchers that were interviewed by NEEP believe that there is room for more collaborations with industry, and that more platforms for “match-making” could be put in place.

***Suggestion action:** Explore and highlight existing collaboration opportunities between R&D organizations and industry, and assess whether other approaches would be beneficial.*

### **Facilitate multi-state projects**

Of the 10 R&D organizations that participated in the Northeast Regional R&D Connector project, only one is currently part of a multi-state research effort. Researchers from most of the other organizations thought that participating in multi-state projects could potentially grow their knowledge pool, increase their productivity, develop important relationships, and improve access to funding.

***Suggested action:** Multi-state energy efficiency R&D projects in the Northeast and Mid-Atlantic could be facilitated via webinars, interactive discussions, in-person workshops, and blogs.*

### **Cost-sharing**

Just as profits and losses are shared among partners, so too can research and developmental costs and risks associated with the investment of time, money, and other resources. Setting up platforms to promote cost-sharing partnerships could potentially help R&D organizations to take on more ambitious and perhaps more valuable R&D projects.

***Suggested action:** To facilitate cost-sharing arrangements, it could be helpful to identify sources qualified to educate R&D professionals on this complex topic. This could demystify:*

- The collective sharing of profits and losses
- The central management and decision making processes that will need to be followed
- The joint ownership of materials, equipment etc. that would be needed to carry out projects

### **Research crowdsourcing**

Crowdsourcing is the use of internet services to host research opportunities that draw from a large and diverse population of participants. It is a rapidly growing R&D trend, and one that energy efficiency researchers in the Northeast and Mid-Atlantic expressed interest in increased participation.

***Suggested action:** The facilitation of a crowdsourcing platform would require relevant research to answer the question “what makes crowdsourcing work best?” Providing guidance or a primer on how crowdsourcing works could help educate the research community in the Northeast and Mid-Atlantic on how to potentially make use of this new resource.*

### **Conclusion**

Based on limited research - the interviews with 10 research institutions in the Northeast and Mid-Atlantic and feedback from the Northeast Regional R&D Connector Workshop - NEEP identified three key barriers that face many researchers and inventors in the energy efficiency field. These include a shortage of available funding for the critical stages of technology transfer, a need for information on market trends and industry needs, and limited support structures to sustain energy efficiency R&D projects.

Identifying these barriers was an important step towards the acceleration of energy efficiency commercialization in the Northeast and Mid- Atlantic – not only for the sake of bringing attention to these barriers in an effort to assist researchers, innovators and funders; but due to the broader implications that arise when technologies do not mature to the stage where they could be made available, and be of benefit to potential end-users.

With a long history of facilitating partnerships and using the power of collaboration in the Northeast and Mid-Atlantic, NEEP is well positioned to help bridge many of the identified gaps in the energy efficiency commercialization pipeline in this region. While several valuable action items towards achieving this were identified in the previous section, NEEP is aware that these were based on feedback from only 10 research institutions and that the inclusion of a broader set of research institutions would lead to a more comprehensive approach.

To accomplish this, NEEP would take a two- step approach to developing an action plan for this work. First, NEEP proposes to conduct additional research to gain a deeper, more thorough understanding of the energy efficiency





R&D landscape in the Northeast and Mid-Atlantic to validate and prioritize the knowledge, funding, and support needs identified. Secondly, NEEP proposes to develop a strategic roadmap that would address the top ranking priorities for bridging the R&D commercialization gaps in the Northeast and Mid-Atlantic states.

## Appendix A- List of questions that were answered by participating research institutions during phone interviews

1. What is the nature of your energy efficiency research?
2. What is the stage of your research?
3. What is your current source of funding?
4. Is your research being done in partnership with another research institution?
5. Have you partnered with other research institutions in the past?
6. What are some of the biggest obstacles you face while executing energy efficiency research?
7. Do you think that visibility of what other institutions are researching can be of benefit to you in the future? Consider the following:
  - Partnering to take advantage of grants
  - Ensuring that there are no redundancies in research being done

## Appendix B- Answers for questions asked at the R&D Connector Workshop

What are the main factors that contribute to R&D commercialization success?

- **Continuous funding through the several lab-to-market steps**
- **The ability to transfer from public to private funding**
- **Producing a product that has a clear competitive advantage**
- **Awareness and use of support programs**
- **Identification of who would be good commercialization partners**
- **Identification of a clear market paths**
- **Having well rounded teams working on the commercialization project**
- **Having IP (Intellectual Property) policies that are reasonable and workable**

What resources or structures do you think should be put in place to enable a more successful pathway towards R&D commercialization in the region?

- **Prototype testing facilities- third-party evaluation**
- **Vetting process (pre-pilot)**
- **Start-up training**
- **Public-private incubators**
- **Match-making events**
- **Commercialization centers**
- **Facilitation of deeper connections between researchers and funders**
- **Simplified contracting**
- **Curated deal flows**
- **Funders who are invested in the process from inception to commercialization (responsive to challenges, needs etc. of the researchers)**



- **Access to manufacturing capacity**
- **Access to information on new resources- EE programs etc.**

Is there a role for a regional organization like to NEEP to help strengthen the R&D pipeline?

- **Collect, clarify regional priorities**
- **Maintain ongoing intelligence related to Energy Efficiency R&D**
- **Advocate for energy efficiency program funding**
- **Facilitate multi-state projects**
- **Highlight the best practices of a successful R&D ecosystem**
- **Facilitate platforms for cost sharing**
- **Highlight ways to crowdsource research**
- **Provide information on new energy efficient technologies**
- **Provide information on industry technology needs via for example, a regional technical forum**
- **Provide platforms to connect R&D organizations with industry**

## Appendix C- Detailed Information on Energy Efficiency R&D by State<sup>7</sup>

This information in this Appendix has been added to give a broader understanding of energy efficiency research in the Northeast and Mid-Atlantic states.

### *Connecticut*

The University of Connecticut's Center for Clean Energy Engineering (C2E2), founded in 2009, serves as a nexus for activities involving fundamental and applied research in clean and efficient energy systems as well as training of 21st century scientists and engineers. Advanced energy conversion technologies, fuels and fuel processing, energy storage, power management and smart grid, and conservation of natural resources with a focus on water are all part of the Center's larger research and educational portfolio. The center's efforts are geared toward catalyzing the transformation of science-to-systems for a global "Sustainable Energy Economy" through academic research and industrial development, systems engineering, prototype development and demonstration. C2E2 also provides cost-effective solutions to current and emerging technologies. The center employs a portfolio of multidisciplinary faculty through the Sustainable Energy Initiative.

The Connecticut Center for Advanced Technology (CCAT) focuses on initiatives in several areas of energy efficiency, including advanced manufacturing technologies and strategies for improving efficiency. CCAT assists DEEP with several programs, including the Energy-Efficient Business Program, the Zero Emission Vehicle (ZEV) program, the Rural Energy Assurance Program, and several others.

The Test Bed Program is administered by the Department of Energy and Environmental Protection's Bureau of Energy and Technology Policy, as required by Connecticut law (C.G.S. 16a-4d). The Energy Efficiency & Renewable Energy Test Bed Program (Test Bed Program) provides an opportunity for a technology, product or

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<sup>7</sup> (Except from American Council for an Energy-Efficient Economy (ACEEE) <https://database.aceee.org/state/research-development>)



process that promotes energy conservation, energy efficiency or renewable energy technology, to be used on a limited trial basis in the operations of a State agency or facility. Since May 2015, the Test Bed Program has received applications for two products: a reflector lens by Energy Savings Lights, LLC and an intelligent boiler control unit by Fireye Inc.

### *Delaware*

University of Delaware's Center for Energy and Environmental Policy: The Center is composed of an internationally diverse faculty and research staff with backgrounds in a variety of disciplines including economics, sociology, geography, political science, philosophy, engineering, urban planning and environmental studies. As part of the Center's energy sustainability theme, researchers explore sustainable energy utilities and clean energy futures.

University of Delaware's Mid-Atlantic Industrial Assessment Center (IAC) is one of 24 in the country that provides energy, waste and productivity assessments to small and mid-sized manufacturers with a concentration in energy efficiency. The Energy Savings Assessments are conducted at no cost and offer the next generation of engineer's valuable hands-on training while producing energy efficiency recommendations resulting in reduced energy consumption. Since its creation the IAC has yielded over 100+ clients 10-30 percent energy bill reductions. In 2012, the U.S. Department of Energy awarded the Mid-Atlantic IAC the "Center of Excellence" award.

Delaware Technical and Community College was awarded \$4,297,800 in grants in 2009-2010 by the Economic Development Administration (EDA) to build energy facilities at three of their campuses. The construction of these buildings marks the region's first comprehensive workforce development centers in the field of energy efficiency. Delaware Tech's Energy House and Center for Energy Education and Training were both awarded LEED Platinum certifications. The Sustainable Energy Training Center was awarded LEED Gold. Delaware Technical & Community College partnered with Trane and the National Coalition of Certification Centers (NC3) to create the Trane Center of Excellence. The center is the fourth of its kind across the country and has the ability to run simulations on energy efficiency opportunities at a system level, as opposed to the unitary level approach which allows for maximum energy efficiency gains. This center is key for preparing Delaware's energy efficiency workforce through real-life applications of commercial air handling units, boilers, and chillers.

### *Maine*

The Maine Technology Institute (MTI) invests in research and development. MTI defines its areas of focus as clusters and one of those is energy and the environment and explicitly includes energy efficiency technologies.

### *Maryland*

The University of Maryland's Energy Research Center (UMERC) is a campus-wide research center dedicated to the development of energy-efficient and environmentally sustainable technologies and practices. UMERC also educates the public on matters of energy efficiency and sustainability, and the global impact of energy policy and practices, and is engaged in promoting policies that encourage sustainability and energy efficiency. In terms of energy efficiency, it focuses specifically on HVAC, CHP, lighting and building efficiency, and waste heat recovery. UMERC and its affiliated faculty receive funding from the University of Maryland, the U.S. DOE, and a variety of other sources based on research topic.



The Maryland Clean Energy Center (MCEC) serves as a hub and key information resource for businesses in the energy efficiency and conservation sectors. MCEC holds its annual Clean Energy Summit and features a series of educational sessions about emerging technologies and practices such as smart grid and advanced metering infrastructure and innovative financing. MCEC sponsors the Maryland Clean Energy Technology Incubator (CETI). CETI supports entrepreneurs and early stage energy efficiency and conservation businesses seeking to transition from research and development into demonstration and ultimately commercialization. CETI provides services specifically tailored to the needs of companies working with renewable energy, as well as energy management and storage technologies. University of Maryland, Baltimore County (UMBC) faculty and students in the clean energy sector also provide tenant companies with assistance.

### **Massachusetts**

The Massachusetts Energy Efficiency Partnership (MAEEP) supports demonstration of energy efficiency technology and tools to the industrial, commercial, and institutional sectors. The MAEEP program leverages resources from U.S. DOE, the University of Massachusetts and Massachusetts electric utilities.

The Center for Energy Efficiency and Renewable Energy (CEERE) at the University of Massachusetts at Amherst provides technological and economic solutions to environmental problems resulting from energy production, industrial, manufacturing, and commercial activities, and land use practices. The university-based research program is built upon four subgroups of Renewable energy resources, building energy efficiency, industrial energy efficiency, and environmental technologies with unique abilities to service energy and environmental problems. The center has 43 faculty and staff and is funded in part through U.S. DOE grants.

Massachusetts is also leveraging \$4.5 million in grants to pilot programs to demonstrate energy-efficient technologies in the building sector.

In 2014, the Massachusetts Clean Energy Center (CEC) in collaboration with DOER, launched the Mass. as First Customer Program, which aims to help young, innovative clean energy firms develop market and customers at public entities for their products, technologies and services. Working with DOER and DCAMM, the program has held two innovative technology vendor fairs, one targeted at all public agencies and one at public colleges and universities. Additionally, the program is identifying a small subset of companies that have products ready to go to market and will work closely with state partners to identify potential host sites for both pilots and installations.

Massachusetts also supports an extensive system of clean energy R&D and market development centers and incubators, including Institute of Energy and Sustainability, North Shore Innoventures, and other entrepreneurship incubators that do not focus on clean energy specifically but do support some energy efficiency businesses. In 2015, DOER worked with UMass again to expand services to residents and businesses through the Clean Energy Extension (CEE) program. The CEE works to reduce market barriers and accelerate the adoption of clean energy for Massachusetts cities and towns, businesses, institutions, farms, low income and multi-unit housing, and others. The CEE's mission is to provide outreach, technical assistance, and research to the market.



## *New Jersey*

The New Jersey Commission on Science and Technology (CST) administers the Edison Innovation Clean Energy Fund through a Memorandum of Understanding with the New Jersey Board of Public Utilities (BPU). The Clean Energy Fund provides grants of \$100,000 to \$500,000 to New Jersey companies for demonstration projects and developmental and ancillary activities necessary to commercialize identified renewable energy technologies and innovative technologies that significantly increase energy efficiency. All grants are subject to a 50 percent matching funds requirement. Businesses may also apply for and receive up to 20 percent of the approved grant amount in equity-like financing from the New Jersey Economic Development Authority (EDA) for non-research and development related costs.

The Rutgers Center for Green Building promotes green building through research, advocacy and education. The center conducts applied research utilizing planned and existing green building projects, works with industry and government to promote these concepts, and develops undergraduate, graduate and professional education programs. It seeks to establish itself as the pre-eminent interdisciplinary center for green building excellence in the Northeast, while serving as a single accessible locus for fostering collaboration among green building practitioners and policy-makers.

## *New York*

The New York State Energy Research and Development Authority (NYSERDA) supports a broad range of technology research, development and commercialization activities, and exists within a deep network of other New York based organizations having similar missions. NYSERDA makes strategically significant investments in scientific research, market analysis, product development, and technology field validation. These investments are used to provide knowledge on the environmental impacts of current and emerging energy options, conduct early-stage market analysis associated with new technologies, advance clean energy innovations towards market readiness, and stimulate an innovation economy in New York. The support provided by NYSERDA to develop and test new products and technologies have and will improve the energy efficiency and expand the energy options for the buildings, industrial, transportation, power, and environmental sectors of the New York economy. In addition to the investments made to assist with technology development and validation, NYSERDA also helps to build a growing clean energy business ecosystem through investments in multi-use assets and through support for industry consortia; the aim of which is to support the environment or ecosystem within which clean technology companies are more likely to be incepted and nurtured for better growth prospects. Key components of this strategy are Proof of Concept Centers (POCC) and Incubators.

The Center for Sustainable & Renewable Energy (CSRE) at the State University of New York College of Environmental Science and Forestry is a clearinghouse for all 64 SUNY campuses' research and development in the areas of energy efficiency and sustainability. Its current efficiency focuses are the New York "Green Campus" Energy Efficiency Initiative and a water efficiency feasibility study involving Lake Ontario.

The Building Energy and Environmental Systems Laboratory (BEESL) at Syracuse University is a research lab associated with the Syracuse Center of Excellence in Environmental and Energy Systems, the New York Strategically Targeted Academic Research Center for Environmental Quality Systems, and the New York Indoor Environmental Quality Center. BEESL advances technologies for indoor environmental quality, energy efficient buildings, air conditioning and refrigeration manufacturing, and power generation and distribution. It was



established in November 1999 with funds from the U.S. Environmental Protection Agency, the New York State Assembly, National Grid, Syracuse University, and a \$2 million gift from Frances and Fritz Traugott. It has a staff of nearly 40 and is funded through research grants from a variety of US agencies, New York state agencies, NGOs, and corporations, as well as from Syracuse University.

The Institute for Urban Systems at City University of New York (CIUS) identifies innovative solutions to the problems of aging capital stock, environmental sustainability, and urban economic competitiveness in the management of transportation, energy, water, buildings, and other infrastructure systems.

The Energy and Environmental Technology Application Center (E2TAC) at Albany State University is also at the forefront of energy-related issues such as smart grid energy efficiency, thermoelectric, power electronics, sensors, and superconductors, and advanced PVs.

The Clean Energy Fund (CEF), recently approved in NYS provides a consistent funding commitment over a 10-year period (nominal R&D investment is \$70 million annually) for strategic investments in clean energy research and development. This long-term support is unique compared with other states and provides a strong signal to entrepreneurs and startup companies that NY is willing to make the sustained commitment necessary to develop and commercialize clean energy technologies that support the economy and the environment.

### *Pennsylvania*

The Energy Research Center (ERC) at Lehigh University is a multidisciplinary research group with major emphasis on research dealing with energy conversion, power generation, and environmental control. Research within the center is supported by contracts and grants from government and industry. The center has particularly close ties with industry, with a significant number of joint research projects involving Lehigh faculty, staff, and students and staff from private industry. The center also operates the Energy Liaison Program, which provides consultation and problem-solving assistance to participating companies for up to \$20,000 a year.

The Indoor Environment Center (IEC) at the Penn State Institutes of Energy and the Environment conducts interdisciplinary research, knowledge transfer, and outreach activities to support the development of indoor environments that are more safe, more thermally, visually, and acoustically comfortable, and that minimize the use of energy and other resources.

The Consortium for Building Energy Innovation (CBEI) is located at the Navy Yard in Philadelphia. CBEI is comprised of 14 organizations including major research universities, global industrial firms, and national laboratories from across the United States who collaborate to develop and demonstrate solutions for 50 percent energy reduction in existing buildings by 2030. CBEI is a research and demonstration center that works in close partnership with DOE's Building Technologies Office.

In addition, several state-funded financial incentives encourage research activities. The Pennsylvania Energy Development Authority requires a research component directly related to each project, and the Alternative Fuels Incentive Grant (AFIG) funds innovative research projects including electric vehicles and fuel cells.



### *Rhode Island*

The University of Rhode Island Cooperative Extension created the Energy Fellows Program to place students with various energy companies, agencies, and organizations throughout the state to get workforce training and learn about Rhode Island energy issues. Most of the 2017 participants conduct research and outreach on energy efficiency.

### *Vermont*

The University of Vermont's Smart Grid Research Center conducts research on the technological, human behavior, and public policy implications of smart grid technology, including its use to increase energy efficiency.

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