Fraunhofer USA

REPORT ON THE IMPACT OF THE

Fraunhofer Center for Sustainable Energy Systems

2008 to 2012

A STUDY BY

Millville Partners, Inc.

strategic marketing to grow the clean economy

Acknowledgements

This report was commissioned by the Fraunhofer Center for Sustainable Energy Systems (CSE) as they reach the conclusion of the initial investment grant from the Massachusetts Clean Energy Center, originally through the Massachusetts Technology Collaborative. This grant enabled the establishment of Fraunhofer CSE in Massachusetts in 2008 and, as a result, has led to significant additional progress in the field of sustainability in the Commonwealth.

Before entering into the substance of the report, it is important to recognize those who have played a role in supporting this progress, and to thank them on behalf of Fraunhofer CSE:

- Governor Deval Patrick
- Lt. Governor Tim Murray
- Secretary Rick Sullivan
- Secretary Ian Bowles
- Secretary Greg Bialecki
- Executive Director Patrick Cloney and the rest of the Massachusetts Clean Energy Center team
- Commissioner Mark Sylvia
- Commissioner Phil Giudice
- Undersecretary of Energy Barbara Kates-Garnick
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- Jim Hunt, Chief of Environment and Energy, City of Boston
- Brenda McKenzie, Director of Economic Development, City of Boston
- Assistant US Secretary of Commerce John Fernandez
- Senator John Kerry (D) – Commonwealth of Massachusetts
- Senator Jeff Bingaman (D) – State of New Mexico
- Karl Weiss, Massachusetts Technology Collaborative Board Chairman
- Mark Ferri, Karl Jessen & the rest of the Massachusetts Technology Collaborative (MTC) staff

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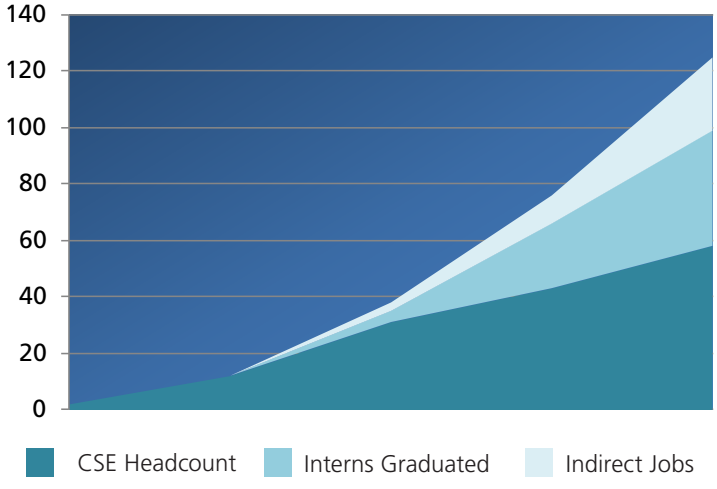
1 Progress Overview

The purpose of this report is to demonstrate the overall and long-term benefits that Fraunhofer CSE brings to the Commonwealth of Massachusetts. However, it does not seek to replicate the information provided in the semi-annual reports that have been submitted throughout the course of the MassCEC grant supporting the establishment of CSE. Instead, the goal is to provide a narrative of the work of Fraunhofer CSE and the manner in which it is completed in order to demonstrate its value and effectiveness.

That said, as a start, it is important to briefly highlight the key achievements of CSE since July 2008, each of which is covered in greater detail in their semi-annual reports:

CREATION OF HIGH-TECH, HIGH-IMPACT JOBS. As of June 1st, 2011, Fraunhofer CSE had established 58 full-time positions (with several additional open positions). This reflects a 28% increase since the end of December 2010. In addition, they anticipate expansion to 62 full-time employees by end of 2012.

Employment & Workforce Development
2008 - 2012



ESTABLISHMENT OF A GLOBALLY RECOGNIZED RESEARCH CENTER WITHIN 4 YEARS OF FOUNDING. In just a short period of time, Fraunhofer CSE has assembled a highly integrated team of globally recognized technologists acknowledged as leading figures in the areas of building energy efficiency and PV module technology. In addition to nearly 100 keynotes and invited presentations at leading conferences in their field, CSE has been able to establish itself by winning a number of high profile federal grants as well as Fortune 500 commercial clients.

DEVELOPMENT OF A COMPETITIVE, HIGHLY SOUGHT-AFTER INTERNSHIP PROGRAM that has graduated nearly 40 participants to date, many of whom stay and work in Massachusetts. One of CSE's former interns is now a Technology to Market advisor at the US Department of Energy's Advanced

Intern Caroline Duvier of Fraunhofer CSE's Residential Energy Management Group conducts an on-site survey for a US Department of Energy-funded project. Interns such as Caroline benefit from hands-on research experience while actively working with CSE clients and collaborators on a variety of projects.

Research Projects Agency - Energy (ARPA-E), two others work for venture capital funds, and many others are researching at world-leading academic and industrial institutions. It is also noteworthy that several former CSE interns now work for the same industrial partners they initially supported during their internship period.

SUPPORTING THE COMMONWEALTH'S CLEAN ENERGY AND CLIMATE PLAN FOR 2020. Since its inception, Fraunhofer CSE has been an active participant in the Commonwealth's nation-leading greenhouse gas reduction strategy, particularly in the area of building efficiency. From 2008 to 2009, CSE acted as a technical advisor on Governor Deval Patrick's Zero Net Energy Building (ZNEB) Task Force, providing insights and recommendations towards establishing a statewide energy-efficient building strategy.

Over the past four years, CSE has also conducted extensive research into strategies for reducing energy waste in buildings, ranging from the evaluation and monitoring of high-performance homes in Massachusetts to field studies of the energy-saving potential

Building America

In July 2010, a Fraunhofer CSE-led research team was selected as one of only fifteen groups to join the US Department of Energy (DOE) Building America program, a government initiative to increase the scale and depth of home energy efficiency retrofits in the United States. In 2011, CSE received funding for eight Building America research projects addressing a variety of priority areas identified by the DOE; two of these have the potential to result in annual household electricity savings of $21 billion and annual household HVAC energy savings of $15 billion, respectively.

Backed by a building research team of 30+ members, CSE's research projects included a number of deployments to evaluate the energy savings and national adoption potential of advanced residential retrofit technologies. Among these deployments was a project addressing energy savings from programmable thermostats and home energy displays, covering approximately 240 Massachusetts households.

"We are delighted that Fraunhofer CSE's research will be implemented in Boston. We were the first city in the nation to require green building, and Fraunhofer CSE's research partnerships mean we can continue to push ahead here with even more cost-effective and advanced building energy technologies—while fostering the growth of our clean energy workforce."

THOMAS M. MENINO, MAYOR OF BOSTON

of home energy management devices such as programmable thermostats and home energy displays. Several of these projects were carried out with support from the US Department of Energy's Building America Program, which funds research into methods for reducing home energy consumption while simultaneously improving building quality.

CSE Managing Director Nolan Browne currently serves as a member of the Massachusetts Global Warming Solutions Act (GWSA) Implementation Advisory Committee (IAC), which works with the Commonwealth's Executive Office of Energy and Environmental Affairs to develop strategies for deep, impactful reductions in greenhouse gas emissions.

CSE's Building Technology Showcase (BTS) will be an important proof of concept for energy-saving retrofits and renovations, transforming a 100-year-old structure into a state-of-the-art, energy-efficient office and laboratory space. In addition to serving as a potential template for similar renovations of Boston's historic building stock, the BTS is also an important testbed for energy-saving technologies and materials that could be widely deployed in the Commonwealth in years to come. A separate educational showcase is intended to raise public awareness of building energy efficiency.

FOSTERING THE GROWTH OF THE NEW ENGLAND CLEAN ENERGY CLUSTER

by building successful industrial research alliances between private industry, universities and Fraunhofer CSE around projects like the Building Technology Showcase, and by supporting objectives of MassCEC and other notable members of the New England clean energy community via TechBridge and the U-Launch initiatives.

Fraunhofer CSE initiated major technical conferences in Boston in 2010, 2011 and 2012, and has supported MassCEC's Global Clean Energy Week event by hosting meetings with international companies to discuss clean energy opportunities in Massachusetts. Beyond this, the Center regularly hosts foreign delegations eager to learn about the Commonwealth's clean energy cluster, including delegations from Belgium, Chile and Switzerland.

Dr. Peter Engelmann conducts an on-site assessment of an experimental zero net energy home in Stow, Massachusetts. CSE's research monitored a variety of factors: indoor and outdoor temperature, relative humidity, CO^2 levels, sunlight exposure, and electricity consumption at the circuit level to determine the effectiveness of specific energy-saving measures.

Building Technology Showcase

FRAUNHOFER CSE'S FUTURE HEADQUARTERS in Boston's Innovation District is a 50,000 ft^2 "living laboratory", a venue for cutting-edge technology validation and industry R&D partnerships.

Fraunhofer CSE has partnered with leading industry manufacturers who are contributing innovative products, technologies and systems to the new building. These contributions range from building-integrated solar photovoltaics to radiant heating and cooling, high-efficiency roof membranes and advanced LED lighting. 40 partners have already committed donations, including Siemens, Philips, and DuPont.

The BTS does not only give partnering companies the opportunity to evaluate their systems' effectiveness with real-world data, but also helps accelerate adoption and acceptance of cutting-edge solar and building energy technologies throughout Massachusetts and the United States.

http://cse.fraunhofer.org/bts

"Dow Corning Corporation has collaborated with [Fraunhofer CSE] for two years. This interaction has significantly strengthened our understanding of the material requirements in PV modules, especially in areas of overall module durability and performance."

ANDY GOODWIN, GLOBAL SCIENCE & TECHNOLOGY MANAGER, DOW CORNING SOLAR SOLUTIONS

Over the past four years, Fraunhofer CSE has directly contributed to the development of solar and building energy efficiency expertise in Massachusetts, as demonstrated by the numerous publications and patents filed since their establishment, as well as the foreign firms they have attracted to do business in the Commonwealth. In addition, CSE plays an advisory role in the Commonwealth's other clean energy development efforts, offering free and independent technical assessments of programs and related issues such as solar panel toxicity.

The Building Technology Symposium

In June 2012, CSE collaborated with MIT, UMass, and the German-American Chamber of Commerce to establish the Building Technology Symposium, a cross-disciplinary dialogue between building scientists and industry representatives intended to define and address real-world market challenges for building technology in the US today.

The Symposium was held in conjunction with the opening of DasHAUS, a pavilion showcase of German innovations in energy-efficient home building and technology, on MIT's campus.

AN AVERAGE ANNUAL REVENUE GROWTH OF 175% from 2008 to 2011, reflecting CSE's success in attracting clients and creating a research program aligned with industry needs. Notable clients include national laboratories and Fortune 500 companies such as Dow Corning, with significant repeat business and high levels of customer satisfaction.

9:1 LEVERAGE OF THE COMMONWEALTH'S INITIAL INVESTMENT OF $5 MILLION in support for CSE's programs, including:

- Matching funds for the establishment of Fraunhofer CSE and expertise development, including **$16.75 million** from industrial partners like National Grid, donations from foundations, private donors, and the Fraunhofer Society.
- Financing for construction of CSE's **$23.5 million** living laboratory facility, the Building Technology Showcase, currently under development in Boston's Innovation District.
- **$3 million+** in BTS technology contributions from industry and **$1.5 million** in BTS-related research contracts.
- Applied clean energy R&D contracts and grants with industry and government totalling more than **$5 million**.
- In addition, Fraunhofer CSE's TechBridge program helped Massachusetts early-stage companies raise more than **$20 million** in follow-on venture funding.

The U-Launch Program

A grant program that provides financial and technical support to promising clean technology companies in the New England area. U-Launch reduces the risk of early stage investments, identifies strategic partnerships and sources of follow-on funding, and includes R&D services, experienced entrepreneurs, capital resources and incubation space.

U-Launch is partially funded by a three-year award from the U.S. Department of Energy's Innovation Ecosystem Development Initiative and operated by Fraunhofer TechBridge in collaboration with three partner organizations—the Massachusetts Clean Energy Center, the ACTIONetwork, and the New England Clean Energy Foundation (NECEF).

"Number 9: MIT Clean Energy Prize and Fraunhofer Institute. *The Fraunhofer Center for Sustainable Energy Systems [...] is the next step in Massachusetts' Cleantech Eco-system."*

SHAWN LESSER, SUSTAINABLE WORLD CAPITAL: "TOP TEN REASON MASSACHUSETTS IS A CLEANTECH LEADER"

Selected CSE Highlights

GENERAL

- Leveraged Commonwealth investment 9:1
- 60+ employees, plus dozens of indirect jobs
- Internship program has graduated 50+ to date; many stay and work in MA
- Co-founder of multiple technology conferences hosted in Boston
- Ongoing partnerships with local universities, including Babson, Harvard, UMass, MIT, and Boston University

BUILDING ENERGY EFFICIENCY

- Pilot testing residential energy technologies in 250 Massachusetts homes
- Research Team Leader for US Department of Energy's Building America research program
- Advisory support for Commonwealth's Clean Energy and Climate Plan 2012

SOLAR PV TECHNOLOGIES

- New outdoor solar test facility in Revere attracting solar business for Massachusetts
- Launched a Photovoltaic Module Durability Initiative in partnership with Fraunhofer Institute for Solar Energy Systems (ISE)
- Patented, licensed new technique that should create tens of millions in value for PV industry

TECHBRIDGE AND U-LAUNCH

- Leveraged US DOE funds to assist more than 20 Massachusetts early-stage cleantech companies with R&D and grant writing
- These companies have gone on to secure more than $20 million in follow-on funding within the first 18 months of the program
- Collaborated with the Cleantech Open to perform judging, workshop sessions, and operations support; provided awards for select companies
- Organized the CTSI Utility Technology Challenge, a national solicitation in partnership with utilities to help entrepreneurs find pilot opportunities

BUILDING TECHNOLOGY SHOWCASE

- Building a living laboratory for building energy efficiency in Boston's Innovation District to develop and deploy solutions and create jobs in Massachusetts; move-in date is December 2012.
- BTS will provide hands-on training, learning opportunities for high school and college students, encourage construction industry to adopt advanced building energy technologies
- Showcase will validate and develop technology to support growth of the building technology manufacturing industry in Massachusetts

2 The Fraunhofer Model

The Fraunhofer model is a unique, cost-effective, and powerful way to commercialize technologies for national economic development. Chief among them is the idea that leveraging public funding to attract private investment in applied research will not only accelerate technological progress, but will foster economic and manufacturing development as well. This model is well proven in Germany and is now taking hold globally, particularly here in the United States.

The Obama administration's Fiscal Year 2013 budget submission to Congress included "a proposal to create a new $1 billion private-public partnership program aimed at commercializing and manufacturing U.S. developed technologies. The National Network for Manufacturing Innovation (NNMI), which takes its inspiration from the Fraunhofer model, is a joint effort between the Departments of Defense and Energy, the National Science Foundation the Commerce Department's National Institute of Standards and Technology. Its goal would be to 'revitalize U.S. manufacturing… through a network of institutes where researchers, companies and entrepreneurs can come together to develop new manufacturing technologies with broad applications,' according to the budget submission."

The Fraunhofer Society now includes 81 research centers around the world. In the US, each of the 7 Fraunhofer USA Centers is co-located with a major university. In all cases, the funding model requires two-thirds of operating revenue to be competitively earned through contract research for commercial clients and research funding agencies, reducing the government's cost of supporting it. This balance of private and public funding helps to ensure that the applied research is purpose-

"Fraunhofer CSE is a model of international collaboration for economic development in a partnership that creates jobs and clean-energy economic development opportunities for both economies."

CONSUL GENERAL FRIEDRICH LÖHR, GERMAN CONSULATE OF BOSTON

driven toward commercialization, while ensuring that each center continues to function as an impartial non-profit organization.

In Germany, where the model is more deeply established, Fraunhofer institutes have demonstrated a ripple effect on the local economy and manufacturing base. Because each institute is focused on one area of applied research, they attract student interns who are interested in that subject matter. In turn, the companies sponsoring the research tend to move to the area and hire the students who have worked in the institutes' labs because they have received sophisticated training. One good example is Freiburg's Fraunhofer Institute for Solar Energy Systems (ISE), which was founded 27 years ago in an area where there was no renewable energy manufacturing or research. At the present time, Fraunhofer ISE is one of the world's leading solar labs. **10% of the surrounding workforce now works in photovoltaics and renewables** – a clear demonstration of how industry builds up around the Fraunhofer centers as they grow forming strong clusters.

By leveraging the power of the Fraunhofer model, CSE has already created its own share of success stories. One such story is that of former student intern John Lloyd, who joined the CSE team with a Master's Degree in Materials Engineering from Drexel University in Philadelphia. As an intern with CSE's PV Modules Group, John played a key role in the development of a non-destructive in-line testing tool to improve the quality and manufacturing cost of photovoltaic solar

Employee Profile

Dr. Kurt Roth

DIRECTOR, BUILDING ENERGY EFFICIENCY

Dr. Roth has headed the CSE's building technology research program since January 2009. Under his direction, CSE's Building Energy Efficiency Group has become a respected industry presence, attracting millions of dollars in government funding and project work as well as top talents from renowned institutions such as Oak Ridge National Laboratory (ORNL) to live and work in Massachusetts.

An experienced researcher, Dr. Roth has authored more than sixty "Emerging Technology" articles for the ASHRAE Journal to date. He received his BS, MS, and PhD degrees from MIT.

Former Fraunhofer CSE intern John Lloyd works on a prototype of a mechanical indentation tester. This technology, developed by John and the CSE Solar PV Team, was recently licensed by a German industrial partner for commercialization, and is expected to yield tens of millions of dollars in revenue opportunities.

modules. The research funding invested in this project was just $172,000, but it is expected to provide **tens of millions of dollars in revenue opportunities for the industry** through better, more consistent quality of module lamination. In and of itself, this is already a success, but John's experiences as an intern ultimately motivated him to pursue further research as a PhD candidate at Caltech, which will undoubtedly lead to future achievements. It is worth noting that regardless of where John's future career path leads, his research is already contributing to economic growth. Most importantly, John left Fraunhofer CSE with commercially viable skills in applied research. A key advantage of the Fraunhofer Model is the fact that the future expense of job training is borne by Fraunhofer's research institutes rather than by the private sector.

Because highly skilled workforce training is a natural result of Fraunhofer's applied research process, interns and graduate student fellows graduate CSE with the skills they need to

enter a complex manufacturing or commercial research environment. To maximize this advantage, CSE focuses on finding students who are as passionate about commercialization and business as they are about science. Training these students creates a new wave of future employees who arrive on the job ready to work. Corporations who sponsor research can look to Fraunhofer graduates as **trained workers who are already familiar with their technology fields,** significantly decreasing the cost of bringing them on board.

At CSE, the goal is to replicate the model exemplified by Fraunhofer ISE in Freiburg – to grow in such a manner as to attract industry and further research to Massachusetts. They are well on track to do so. In the Fraunhofer Society's 2010 Annual Report, CSE was referenced as the **second best-performing Fraunhofer center in the US.** It should be noted that the leading center, the Center for Molecular Biotechnology in Delaware, has been operating for more than a decade. Even as the youngest research center out of six in the US, CSE is already demonstrating rapid growth within the Fraunhofer model.

In Massachusetts, CSE acts as a **focal point for the entire Fraunhofer organization,** attracting funding, talent and know-how from its German labs and assisting these labs in setting up and coordinating operations in the United States. In 2010, Fraunhofer's Heinrich Hertz Institute, a global leader in high-speed communications and data visualization systems, opened an office at Fraunhofer CSE. This collaboration will open new areas of applied research at the intersection of high speed communications and energy systems.

Outdoor Testing Facilities

CSE's advanced test center in Revere, Massachusetts, co-located at a 750kW solar power plant operated by National Grid, has been recognized as one of the leading facilities of its kind in the northeastern US. Its capabilities include peak power tracking of individual modules, intermittent IV curve tracing, comprehensive meteorological data tracking, hot spot testing, temperature coefficient determination, and thermal imaging under operating conditions.

Capabilities such as these not only allow CSE to attract a broader range of research projects, but give student interns the opportunity to work with an active PV installation and gain hands-on experience in field testing and monitoring.

3 Measuring Effectiveness

As an organization, Fraunhofer CSE has been very effective — a metric determined not only by jobs created and funding leveraged, but functionally by the value of the work they have performed for their partners and clients.

To measure this, two surveys were administered by Millville Partners: one for large companies (17 participants) and one for smaller TechBridge companies (11 participants).

HIGH-QUALITY PROJECT WORK

In aggregate, clients' feedback on their experiences working with Fraunhofer CSE was highly positive. Respondents regularly said that they were impressed with CSE, and several called out particularly helpful team members.

The quality of CSE's project work underlines the Center's commitment to engaging workers who can support their mission: to foster economic development through the commercialization of clean energy technologies for the benefit of society. Because their success hinges on creating ongoing relationships with clients, Fraunhofer CSE focuses on hiring employees who can serve as thoughtful, engaging, and even inspirational partners for client projects.CSE's ability to deliver on — and exceed — clients' expectations is also reflected in the number of follow-on contracts obtained from major clients such as Dow Corning over the past four years.

CREATING PROJECT OPPORTUNITIES

CSE creates value not only by addressing client needs, but by creating opportunities for research and product development. Many large companies we surveyed looked forward

"As a U-Launch awardee, we were able to show potential investors that our [technology] had been technically validated and that the results showed the promise of the technology. [U-Launch] helped us receive the venture funding that will take our technology to the next stage of commercialization."

SWAPNIL SHAH, CEO AND FOUNDER, FIRSTFUEL SOFTWARE

to the opportunities presented by the Building Technology Showcase project. Others recognized the significant value of being able to connect to the Fraunhofer network through Fraunhofer CSE, allowing them leverage the substantial expertise and capabilities of the Fraunhofer Society.

DRIVING JOB CREATION WITHIN CLIENT COMPANIES

Companies were surveyed on the number of jobs they expected to create as a result of successful projects with Fraunhofer CSE. 35% of survey respondents anticipated adding jobs; collectively, they expected that as many as 40 jobs could potentially be created, a significant portion of which would be located in Massachusetts. This will accelerate over time, and CSE ultimately expects to produce 4 jobs for every full-time CSE staff member.

U-Launch awards have also proven to be an important tool for clean energy job growth, drawing the funding needed to build out start-up teams and create new positions. Many existing U-Launch awardees have already substantially expanded their headcount as a result of investment and grants, a trend we expect to continue as further grants are awarded.

ASSISTING EARLY-STAGE COMPANIES

Clean energy start-ups and spin-outs are an essential element in creating a dynamic clean energy economy in Massachusetts, and the key focus of CSE's TechBridge Program.

Building Value For Early-Stage Start-Ups

U-Launch awards connect Massachusetts-based companies with R&D services, experienced entrepreneurs, and incubator services to help them expand and raise funds. Successes include:

Ubiquitous Energy

Ubiquitous is developing solar technologies for deployment in everyday products and surfaces, and received a combination of technical, executive-in-residence (EIR), and incubation services. Following their U-Launch award, Ubiquitous successfully raised $1M from private investors.

Dynamo Micropower

Dynamo is creating a low-cost, fuel-flexible micro-turbine for distributed generation, and received EIR and incubation services. Despite its small size — just three employees — Dynamo subsequently won a $150,000 grant from the National Science Foundation to build an initial prototype.

Arctic Sand

An MIT spinoff commercializing a power conversion technology that consolidates several board-level power components onto one chip. Arctic Sand was awarded U-Launch incubation services in late 2011, and was able to raise $6.6M in equity by mid-2012. Fraunhofer CSE also manufactured initial prototypes of solar modules using Arctic Sand power conversion chips.

Employee Profile

Jeff McAulay

PROGRAM MANAGER, FRAUNHOFER TECHBRIDGE

As Program Manager of Fraunhofer's TechBridge Program, Jeff coordinates reviews of potential U-Launch award recipients on both technical and business merits, and connects early-stage companies with relevant investors and government grant opportunities.

Additionally, he works to link Fraunhofer spinouts with business opportunities in the US. Jeff has worked on a variety of alternative energy technologies, with experience in biofuels and optimized flex fuel vehicles, catalytic fuel reforming, fuel cells, and battery electric vehicles. Recently, he led a Fraunhofer effort to identify new entrepreneurial opportunities for addressing business challenges facing electric utilities today.

"The U-Launch award is a great success story proving how impactful policy and federal funding can be to cleantech entrepreneurship."

JASON MATLOF, BATTERY VENTURES

Survey participants collectively praised the effectiveness of the overall blend of services TechBridge made available to them. Many respondents called out the ability to leverage TechBridge technical services to attract follow-on funding as a particular asset; to date, TechBridge-assisted companies have raised more than $20M in follow-on funding.

In addition, TechBridge participants recognized the value and strength of the connections they are able to make with U-Launch program partners. A respondent from U-Launch awardee Keystone Tower Systems described their experience as follows: "The EIR program within U-Launch has been very valuable to us. It has enabled us to establish strong connections within industry and brought in advisers who have given us great commercialization advice. It has been a very valuable complement to SBIR funding, enabling us to develop our business in addition to developing our technology."

Selected Survey Results

Please describe progress made since you began working with us (or since receiving a U-Launch award):

Follow-On Funding Events

80%
of respondents

Increase in # of Employees

70%
of respondents

New Achievements

60%
of respondents

"Subcontracting to Fraunhofer was relatively easy. That's often not the case with larger firms."

"The 5CC Project will become a benchmark for the sustainable design of audiovisual and other building-centric communications systems. We are very pleased to be engaged with Fraunhofer CSE!"

"As a client of the firm, I would emphasize the importance to us of the research work that Fraunhofer CSE has performed. It's not R&D, but rather analysis, and it is tremendously helpful to our organization, our members and third-parties such as policy makers and stakeholders in the energy efficiency community."

"Fraunhofer CSE had a unique talent base that allowed us to proceed with our work where others did not."

Respondent Comments

4 Looking Ahead

As they move forward, CSE has exciting new initiatives on the horizon – not least of which is their Building Technology Showcase in the Boston Innovation District. This center of excellence will become the centerpiece of a Fraunhofer-led regional effort to even better integrate research, development and manufacturing introduction for wide-scale deployment of energy efficient buildings across North America.

Over the next eight years, energy use reduction through building energy efficiency will account for over 40% of the energy savings called for in the Commonwealth's Clean Energy and Climate Plan for 2020. Fraunhofer and its partners will take an active role in the realization of this goal by 1) conducting field and technology assessment studies to prove out the next generation of energy-saving technologies and help develop them at scale, 2) working with UMass, MIT and other local universities to develop energy technology leaders and a workforce that will power the clean energy transition in the Commonwealth, and 3) working closely with leading building technology companies in the Commonwealth to develop novel energy-saving technologies and practices.

The Building Technology Showcase provides an important focal point for these efforts, underlined by the ongoing partnerships fostered by the project. With nearly 40 industry partners already in place, the majority from the Commonwealth, the Showcase demonstrates Fraunhofer's central role in building the local clean energy sector and will become an important research hub for energy efficient retrofits of Boston's historic building stock, saving both our heritage and energy.

Beyond offering an opportunity for CSE and its research partners to work with government and industry on an entirely new level, the BTS will also create a virtuous cycle, fostering the creation of a leading workforce and attracting companies who in turn create more opportunities in the Commonwealth. Its location in the Innovation District increases public visibility of the Commonwealth's clean energy efforts while promoting the commercial adoption of building energy efficiency technology in one of New England's densest clusters of architecture, general contracting and design.

The BTS "living laboratory" will not only test integrated building systems and concepts, but will also be a "living classroom" providing workforce training for promising young researchers and students throughout the region. Kurt Roth, Director of CSE's Building

Energy Efficiency Group, describes the symbiotic relationship between Fraunhofer and Massachusetts, noting: "Because of where we are, we have access to strong ecosystem of relevant, innovative companies, agencies, and policymakers, and top-notch college students

"Part of Governor Patrick's economic development strategy is making Massachusetts a place where inventive, talented people from around the world want to be, strengthening our connection to global centers of innovation. [CSE]'s decision to grow in Boston bolsters our state's already strong innovation ecosystem and cements our ties to the pioneering work they are doing in Germany."

GREGORY BIALECKI, MA SECRETARY OF HOUSING AND ECONOMIC DEVELOPMENT

Employee Profile

Dr. Olga Sachs

GROUP LEADER, RESIDENTIAL ENERGY MANAGEMENT

Olga Sachs leads behavioral and human factors research at Fraunhofer CSE's Building Energy Efficiency Group. She has over 10 years of experience in the field of cognitive neuroscience, with published work on the topic of knowledge representation in the brain, as well as subconscious conceptual relations and their role in decision-making.

At CSE. Dr. Sachs's research focuses on user psychology and energy-use decisions and behaviors — a crucial topic of study in the future development of energy-saving building technologies, but one that is only just beginning to be explored in earnest.

The Building Technology Showcase groundbreaking ceremony in May 2011 (L to R): Fraunhofer USA Executive VP Dr. William Hartman, Commonwealth Ventures' Dick Galvin, Boston Mayor Thomas Menino, Mass. Secretary of Housing and Economic Development Gregory Bialecki, Assistant Secretary of Commerce John F. Fernandez, Fraunhofer CSE Managing DIrector Nolan Browne, Mass. Clean Energy Center Executive Director Patrick Cloney, Mass. Undersecretary for Policy (Energy & Environmental Affairs) David Cash.

has already been working with community colleges to jointly pursue federal grants, and has hosted training sessions for students interested in using IT to address real-world building construction and maintenance challenges.

Over the next four years, CSE will add substantial research capabilities to its team through university and government partnerships as well as knowledge transfer, **attracting German building and solar technologists to set up and staff the CSE's new research initiatives:** Workplace of the Future, Sustainable Historic Building Preservation, Augmented Reality for Construction and Ongoing Commissioning, and Building Technology Policy. These additions will create a well-balanced and knowledgeable organization capable of tackling the challenges of our time.

CSE's goal is to be **one of the top building energy technology research laboratories in the US within the next 4 years.** As Fraunhofer CSE looks ahead, it is committed to accelerating adoption and acceptance of cutting-edge solar and building energy technologies in Massachusetts and the United States, of supporting the growth of both early-stage and large companies through their facilities and programs, and of training the next generation of technologists and workers that will carry us into a cleaner, better tomorrow.

Credits

The report was researched and written by Millville Partners, a strategic marketing firm established to support the growth of the clean economy. The goal of report is to provide an overview of the CSE's progress, to highlight the success of their work over the past four years, and to reinforce the understanding of the economic benefit that Fraunhofer CSE brings to the Commonwealth of Massachusetts.

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IMAGE CREDITS

INTERIOR: *5 - Gerrit Strack/Fraunhofer CSE; 7 - Martin Sachs/Fraunhofer CSE; 8 - DiMella Shaffer; 9 - German America Chamber of Commerce/DasHAUS Tour; 13, 14, 18, 21 - Daniel Downs/Fraunhofer CSE; 15 - Emily Dahl/Fraunhofer CSE; 22 - Denterlein International/ Fraunhofer CSE*

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