

UMASS CLEAN ENERGY EXTENSION

Creating Opportunity: Building a Massachusetts Battery Energy Storage Innovation Ecosystem

Massachusetts Statehouse Presentation

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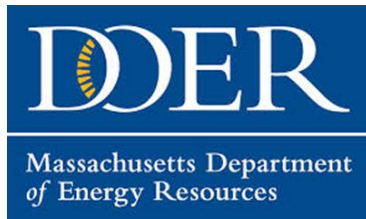
**River Strong
Associate Director, Clean Energy Extension**

October 29, 2019



UMassAmherst

UMass Clean Energy Extension



Established in 2015, with support from MA Department of Energy Resources, to help meet the state's energy and climate goals.

Expanded UMass extension services under the Center for Agriculture, Food and the Environment (CAFE).



Our Activity Areas

- Technical Assistance & Advisory Services
- Market Analysis & Outreach
- Collaborative Applied Research
- Education & Workforce Development



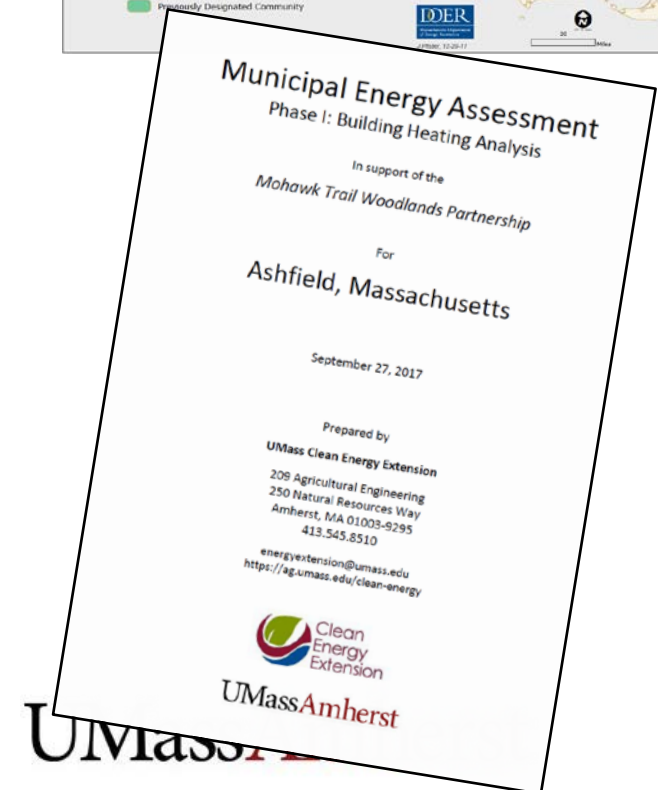
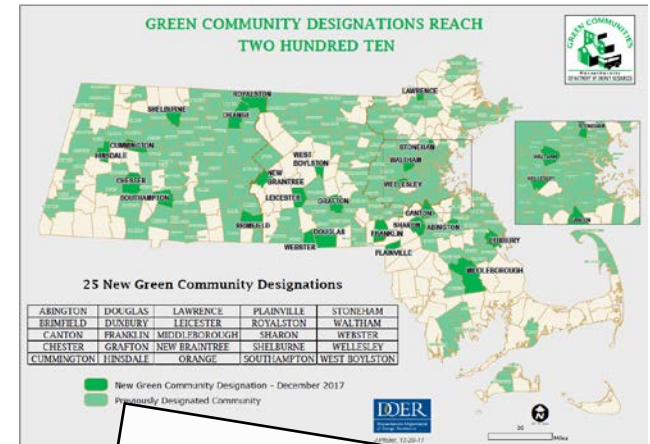
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Supporting DOER's Green Communities Program

- Working with **prospective** Green Communities to enter the program
- Supporting 50+ **existing** Green Communities toward their 20% energy reduction goals

Provide towns with

- MassEnergyInsight (MEI) support
- Municipal Energy Assessment Reports
 - Desktop MEI-based analysis and recommendations
- Clean Energy Site Assessment Reports
 - Building walkthrough and detailed building diagnostics and recommendations



Supporting DOER SMART Program

Facilitating Farm/Solar Land-Use Education and Outreach and Developed Pollinator-Friendly Solar Certification Program

Pollinator-Friendly Solar PV Certification



In consultation with a range of experts and stakeholders, developed statewide voluntary **Pollinator-Friendly Solar PV Certification** Program – to help solar developers implement, maintain, and promote native meadow habitats under and around solar panels

Fact Sheets and Outreach



SMART Program Dual-Use Application Tools and Reporting

Working with UMass Extension colleagues and MDAR to provide program support to farm sector on solar adoption generally, and for **dual-use solar arrays** specifically per state regulations.



Offshore Wind Professional Graduate Certificate Program

Up-Skilling the Professional Workforce to Meet the Needs Across the Offshore Wind Development Process

Built for professionals:

- Wind energy engineers
- Project developers and financiers
- Supply chain managers
- Energy marketers and consultants
- Environmental scientists & monitors
- Legal & policy professionals

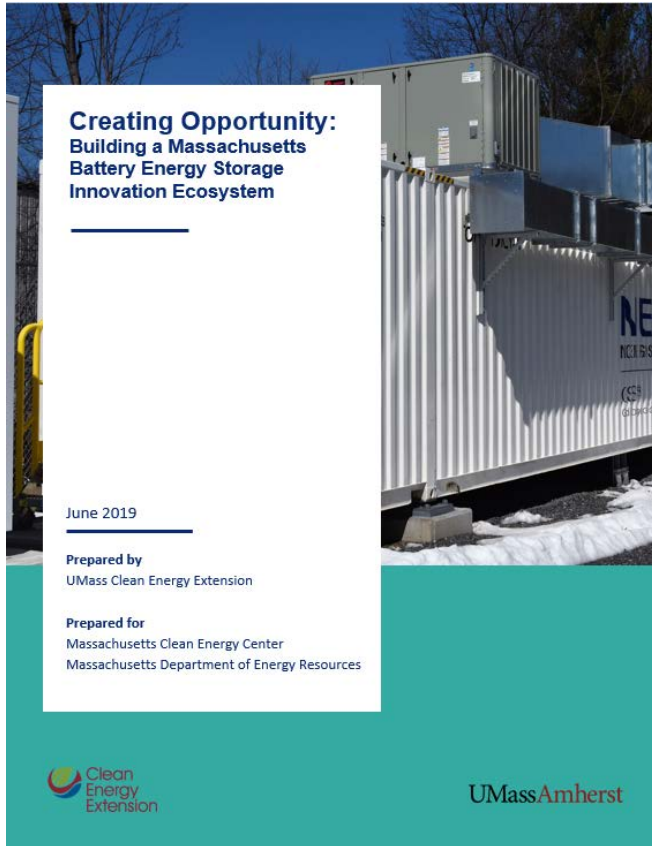


Program design and delivery:

- Online courses
- Program completion within one year
- Interactive engagement with instructor
- Scheduled events: speakers, career development, field trips available from UMass Mt. Ida campus in Newton

Planned Launch: Fall 2020. Funding provided by **Massachusetts Clean Energy Center** as part of its *Offshore Wind Workforce Training and Development Program*.

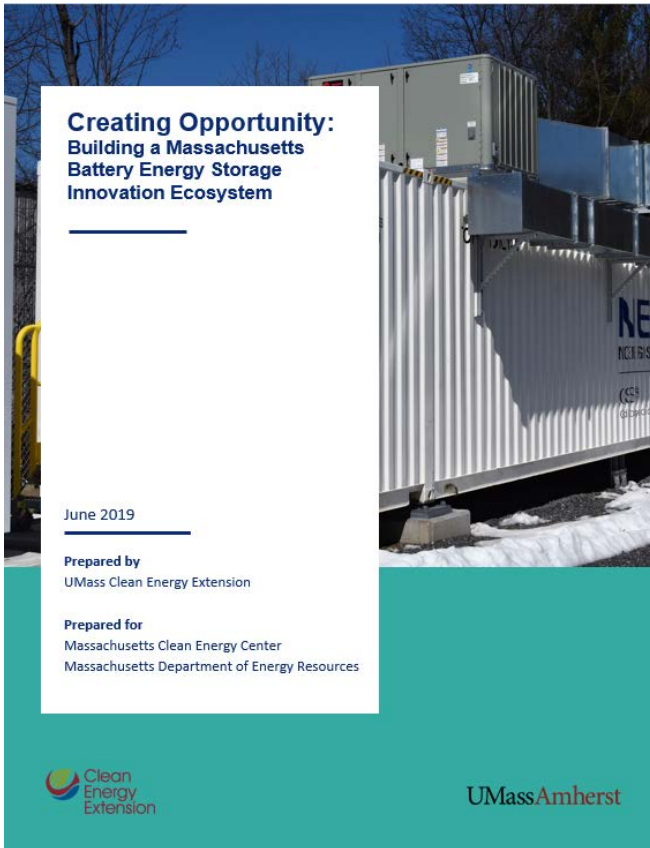




Building a MA Battery Energy Storage (BES) Innovation Ecosystem



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Study Origin and Timeline:

- Project instigated by the Massachusetts State Legislature and the Special Legislative Commission on battery energy storage as established in Section 134 of Chapter 47 of the Acts of 2017
- 2018 CEE report *Energy Storage and Battery Test Facilities: National Benchmarking Report* surveyed national battery testing facilities,. Key finding: “access to technology testing equipment could greatly benefit battery entrepreneurs and emerging energy storage companies...”
- Present study was commissioned in 2018 by the MA DOER and MassCEC
- Report released in June 2019



Building a Massachusetts Battery Energy Storage Innovation Ecosystem

Study Goals

1. Document BES R&D Resources in a *representative sample* of MA Academic Institutions
2. Engage with a *representative sample* of MA battery Companies to identify BES Industry Needs
3. Provide findings and recommendations to Match up Academic Resources and Industry Needs to enhance BES innovation ecosystem



Credit: <https://www.3blmedia.com> - Tesla Lithium-Ion battery storage system being installed at the National Grid solar site in Shirley, Mass.

- The U.S. energy storage market is expected to be worth \$4.5 billion in 2023
- *State of Charge* report suggested MA optimally should deploy 1766 MW of storage to reduce peaks and integrate renewables
- MA is already beginning to reap the benefits of this expanding industry through both storage deployment and significant research, development, entrepreneurial, and commercial activities

Study Design

- 20 hours of commercial and academic interviews and site visits
- 11 academic research participants across 6 institutions
- 13 commercial ventures
- Collaborations with MassCEC, DOER, and Greentown Labs
- Research sources: industry reports, patent filings, technical journal publications, trade publications, market research resources



Credit: <https://spectrum.mit.edu> - Pilot manufacturing plant at 24M's headquarters in Cambridge

Academic Sector Participants

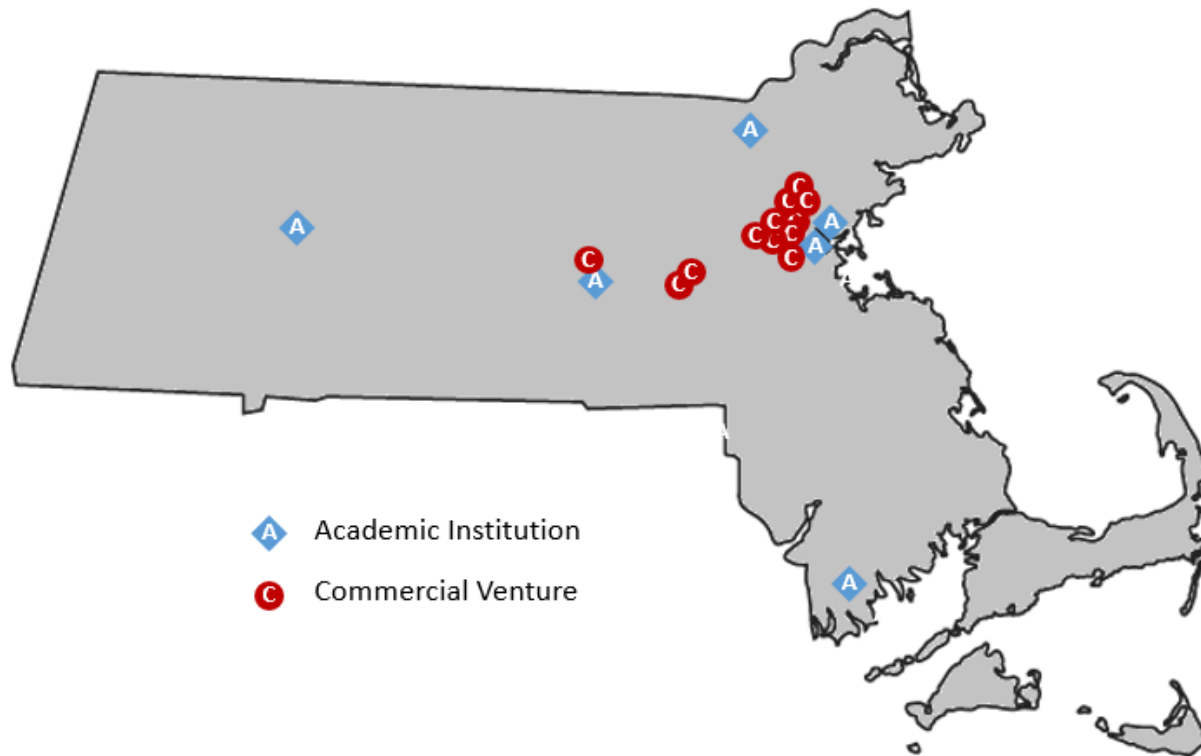
Institution	Study Participant(s)
Massachusetts Institute of Technology	Dr. Fikile Brushett Dr. Yet-Ming Chiang
UMass Boston	Dr. Niya Sa
UMass Amherst	Dr. Wei Fan Dr. D. Venkataraman Dr. Wei Fan Dr. James Watkins
UMass Lowell	Dr. Ertan Agar Dr. Fuqiang Liu
UMass Dartmouth	Dr. Patrick Cappillino
Worcester Polytechnic Institute	Dr. Yan Wang

Commercial Sector Participants

Company	Study Participant(s)
24M, Inc.	Dr. Yet-Ming Chiang
Ambri, Inc.	Phil Giudice
Battery Resourcers, Inc.	Dr. Yan Wang
Battrion, Inc.	(Katie MacDonald)* (Victor Marttin)*
Form, Inc.	Dr. Yet-Ming Chiang Mateo Jaramillo
Greentown Labs	Katie MacDonald Victor Marttin
Lionano, Inc.	Dr. Siyu Huang
Lithio Storage, Inc.	Dr. Anthony D'Angelo
NEC Energy Solutions, Inc.	Michael Hoff
Sparkplug Power, Inc.	Sean Becker
Titan Advanced Energy Solutions	Dr. Steven Africk, Ashish Sreedhar
Toyota Research Institute	Dr. Brian Storey
Vionx Energy Corp.	Dr. Shazad Butt

*Greentown Labs on behalf of Battrion, Inc.

Study Participant Locations



Location of each **commercial-** and **academic-sector** BES entity engaged in the course of this research

Finding #1: MA Has a Wealth of BES Academic Resources and Expertise

The Commonwealth's colleges and universities have substantial technical, intellectual, and developmental BES resources that are of current and potential value to Massachusetts BES commercial ventures:

- MA academic technical resources are largely concentrated at the level of bench-scale (up to 100 V) technologies.
- There is limited equipment suitable for developing and testing medium-scale (>100V) systems, and little or no equipment suitable for large- or grid-scale systems.
- Companies cited many non-equipment needs such as access to capital, workforce development, and manufacturing capacity.
- No single institution has the core set of resources that an emerging commercial venture might need. Even if available, these academic resources may not be readily accessible to the commercial sector.
- Massachusetts academic sector is providing considerable technical expertise to state BES ventures at a broad range of system scales and developmental stages – and that the potential to foster and strengthen these working relationships is significant.

Finding #2: MA is Both Generating and Attracting BES Businesses

Massachusetts is both generating BES companies and attracting them from outside of the state:

- MA is functioning as a BES market engine and is arguably on the cusp of becoming a global locus of BES research and commercialization.
- 70% of the MA BES companies surveyed were primarily **direct spin-outs of Massachusetts academic institutions**.
- Several BES companies surveyed have relocated to **Massachusetts** because of the recognized value of the Massachusetts technology ecosystem
- Major multi-national corporations are establishing BES labs in Massachusetts, and are **actively hiring technical talent from within the state's skilled workforce**.



Credit: Clean Energy Group – Sterling, MA Solar + Storage Project

Finding #3: MA Has the Elements to Become a Global BES Innovation Center

Massachusetts has the critical BES innovation ecosystem elements necessary for the state to become a global center of BES innovation and commercialization:

- A robust and **engaged academic sector** and **graduate-level workforce**;
- A **thriving commercial BES industry** and broader technology sector;
- An **active investment community**;
- **Progressive clean energy and energy storage policies** and programs; and
- Expanding **state, national and global BES market demands** that drive the ecosystem.



<https://news.harvard.edu/gazette/>

Recommendation #1: Create a Leadership Consortium/Steering Group

Potential Steering Group Representation

- **Academic:** Researchers and relevant administrators from public and private institutions
- **Commercial:** Corporate representatives from across a range of applications, technologies, and corporate spectrum (both scale and maturity)
- **Finance Sector:** Private capital, equity and debt
- **Public Sector:** Greentown Labs, NGOs, MassCEC, DOER, Executive Office of Housing and Economic Development, Legislators, etc.



Credit: <https://www.borregosolar.com> – Braintree, MA Electric Light Dept.

Primary Functions of Steering Group

- Serve as a steering committee for **strategic decision-making** and related initiatives
- Increase the **profile and visibility of the Massachusetts BES industry**

Recommendation #2: Convene and Facilitate BES Industry Events, Symposia, and Networking Opportunities



Credit: <https://www.invisionapp.com>.

- Face-to-face events and symposia to facilitate **networking** among Massachusetts BES academic, private- and public-sector ecosystem stakeholders
- Facilitated forums for discussion of key issues and questions
- Highlighting **successful collaborations**
- **Networking opportunities** to build and strengthen connections between stakeholders
- Forums for how **industry can plug into academic resources** and stimulate collaborations
- Identification of business development resources
- Opportunities for emerging **ventures and investors** to meet

Recommendation #3: Develop and Disseminate a Massachusetts BES Innovation Ecosystem Brand

- Develop a MA BES “brand” identity that clearly illustrates the Commonwealth’s role as a global opportunity center for BES innovation and commercialization.
- Effectively identifying, unifying, and communicating about the MA BES ecosystem represents an opportunity for the Commonwealth, and represents an attractive value proposition to BES researchers and ventures



Credit: <https://www.designevo.com>

Recommendation #4: Develop a Multi-functional Web-based Platform to Connect Ecosystem Resources and Activities

Online “virtual platform” to host a range of functions related to the Massachusetts BES ecosystem:

- Searchable Database Tool of Ecosystem Resources
- Descriptive Outreach Pages for Energy Storage Ecosystem Stakeholders
- Recruiting / Employment tools
- BES Industry News / Announcements / Calendar
- BES Policy and Programmatic News and Announcements



Credit: <https://itechcraft.com>

Next Steps

1. Establish Energy Storage Leadership Consortium / Steering Group

- Identify relevant entity to host and administrate
- Recruit and convene Leadership Consortium and develop key issues and work plan

2. Host Face-to-Face Forum for Massachusetts Energy Storage Community

- Utilize Leadership Consortium and others to identify key topics for forum
- Identify entity or entities to plan, organize, and sponsor forum

3. Establish and Broadcast a Branding for the Massachusetts Energy Storage Ecosystem

- Utilize Leadership Consortium and others to define and articulate brand
- Utilize the branding to identify and broadcast Massachusetts energy storage innovation within the Commonwealth, nationally, and globally

Next Steps (continued)

4. Develop and Launch Massachusetts Energy Storage Web-based Platform

- Create a **scope of work to create and launch platform**
- **Identify relevant entity or entities to host and administrate**
- Identify capital needs and funding for both development and ongoing operations (e.g. GreenWorks H 3987 and/or Climate Adaptation Infrastructure S 10)

5. Evaluate Industry Need and Funding for Public-Access BES Testing and Validation Facility

- Utilize Leadership Consortium and Face-to-Face Forum to **investigate industry needs**, facility specifications, and potential use and revenues of a facility

6. Convene Academic Sector and Explore Common Challenges and Opportunities to Sustain Robust BES Technology Development

- **Discuss role of MassCEC and others to create programs** to support/motivate BES entrepreneurship and address university barriers to applied research and commercialization
- Explore means to **support more graduate students** to support academic research and the technical workforce needed for spin-out companies

Thank You. Questions?

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