

UMASS CLEAN ENERGY EXTENSION

Quarterly Progress Report to MA Department of Energy Resources

Period ending September 30, 2017

Contacts: Dwayne Breger, Director, dbreger@umass.edu 413-545-8512
Prashant Shenoy, shenoy@cs.umass.edu, 413-577-0850

This Progress Report provides a summary of work accomplished by the UMass Clean Energy Extension (CEE) during the period July 1, 2017 to September 30, 2017.

During this reporting period, the Clean Energy Extension has made significant progress in its support of the Mohawk Trail Woodlands Partnership, established a strategic plan to support clean heating and cooling markets, and completed a successful summer with the Clean Energy Corps students working on a range of research and outreach activities. Some key highlights, further discussed in the report, this reporting period include:

- In support of MTWP towns, CEE completed 8 *Municipal Energy Assessment Reports* and has 7 in progress.
- CEE is engaged with five communities to support their application to be designated as a Green Community.
- Supported summer internships for two graduate student and four undergraduate students to assist on MassEnergyInsights data analysis, report writing, and independent research projects.
- Detailed a strategic plan to support market development for clean heating and cooling technologies in central and western MA, and engaged with DOER and MassCEC to plan a course of collaboration in this work.

1. Extension Administration and Management

CAFE Board of Public Overseers – CEE Reporting

The Center for Agriculture, Food and the Environment, CEE's parent unit, meets quarterly with a Board of Public Overseers. BOPO was created in 1997 to give stakeholders in UMass Extension areas a formal advisory role. The Board, a majority of whose members are appointed by the Governor, advises the UMass Chancellor and the Extension staff on goals, budget, and program. CEE joins CAFE senior staff at these quarterly meetings and provides highlights and updates on activities and progress, including at the July 6 meeting this period. Information,

membership, and minutes on the board is available at <https://ag.umass.edu/advisory-groups/umass-extension-board-public-overseers>.

2. Public Events and Outreach Activities

CEE (Breger) attended the international Offshore Energy and Storage Conference at the Woods Hole Oceanographic Institute, Woods Hole on July 12-13. Also attending for CEE was graduate student Prasanna Srinivasan and undergraduate Nicholas Cutrone who are working on modeling the value of energy storage to offshore wind. Nick’s cost was covered by the CAFE Summers Scholar program. We joined Professors Jim Manwell and Jon McGowan in Mechanical Engineering and the UMass Wind Energy Center, and Jim presented a paper on our collaborative work on energy storage for offshore wind.

River and Dwayne hosted a two half-day program with teenage girls as part of the UMass engagement with the Eureka Girls Inc. of Holyoke program, July 17 and 18. On the first day the girls were provided a mini lesson on energy matters and the construction of solar “pizza box” ovens. The second day was a field trip to the Holyoke Dam generation station with HG&E and of the anaerobic digester at Barstow Farm in Hadley.

During this reporting period, CEE staff and affiliates also have engaged in the following public events.

Event	Date and Location	Extension Presenter	Presentation Title	Audience	Estimated Attendance
NSF Research Experiences for Undergraduates (REU) program – Career Panel	July 19, College of Engineering, UMass	Breger	Panel presentation and discussion on career option in the wind and clean energy industry	REU summer student researchers, and IGERT graduate students	30
Pioneer Valley Renewable Energy Forum – Planning Meeting	August 4; host committee meeting at offices of Coop Power, Northampton	Breger	Meeting to discuss planning of Pioneer Valley Renewable Energy Forum, and invitation to CEE to join host committee. CEE has joined (Forum scheduled for November 17).	Climate Action Now, Coop Power, Pioneer Valley Mothers Out Front, Environment Massachusetts Research & Policy Center	4 Host Committee members
USDA/National Institute of Food and Agriculture (NIFA), Regional NIFA Director Sonny Ramaswamy	University of Connecticut, Storrs, CT	Breger, with CAFE Senior Staff	Presented overview of CEE to NIFA Director.	NIFA Director and CT and RI faculty and extension staff colleagues	40 plenary meeting and NIFA Director presentation, 6 MA meeting with Director
Green Your Bottom Line workshop for food and beverage businesses	September 27, UMass Lowell	Mattison	<i>Energy Assessments and Savings Opportunities</i>	Food/beverage processors and related businesses,	30

			<i>in Food and Beverage Businesses</i>	utilities, government agencies	
Planning Committee, Western MA Economic Development Council/UMass Conference (scheduled for October 17)	Planning meetings and calls (weekly throughout September)	Breger	EDC/UMass Conference theme <i>Innovations and Opportunities in Green Technologies</i>	Planning Committee leads, Rick Sullivan EDC; Mike Malone UMass	

3. Green Communities and other State/Municipal Assistance

Mohawk Trail Woodlands Partnership

CEE (Breger and Strong) provided an update to the MTWP Advisory Committee meeting on July 11.

CEE has drafted a scope of work for a consultant to execute a feasibility study for a pellet and dry chip manufacturing facility to serve a regional demand for clean wood energy development. Scope is in review with MTWP leads from FRCOG and BRPC.

CEE with Professor Rick Peltier has screened and prioritized existing wood heating systems for air emissions monitoring during the coming heating season. CEE is in communications with system owners and facilities managers to reach agreements on the monitoring effort.

Green Communities

CEE continues to provide technical assistance to Massachusetts towns in support of Green Communities. During this reporting period, CEE has supported five municipalities as provided below.

CEE (Strong and Beebe) and graduate student Jeremy Price are working with the Green Community of Montague to examine building energy loads and strategic opportunities to reduce energy use and adopt clean energy.

As part of Green Communities or outside this program, CEE staff and affiliates have engaged with the following communities.

City or Town	Topic	Technical Assistance
Pioneer Valley Planning Commission, Catherine Ratte	RFP to DOER/MassCEC Affordable Clean Residential Energy (ACRE)	CEE joined PVPC as non-budgeted team member in proposal to ACRE program. CEE committed to play role of a technical advisor to PVPC and local low-income housing organizations.
Franklin Regional Council of	Opportunities for regional electric aggregation	CEE provided technical and policy review of electric aggregation

Governments, Bob Dean		
Conway	Green Communities Annual Report support.	CEE provided Green Communities Annual Report support to Conway.
Gill	Clean Energy Site Assessment and Green Communities Annual Report support.	CEE developed a comprehensive Gill Municipal Energy Assessment in support of the town's Green Communities goals. Professor Ben Weil provided a focused look at energy usage in the Gill Elementary School.
Goshen	Clean Energy Site Assessment and Green Communities Annual Report support.	CEE and the Clean Energy Corps developed a Goshen Clean Energy Site Assessment and provided Green Communities Annual Report support to Goshen.
Greenfield	Opportunity for solar + storage and resiliency.	Ben McDaniel (CEERE staff) provided feasibility studies of CHP and solar plus storage for Greenfield High School and helped to review past proposals for solar and storage.
Heath	Green Communities designation application support.	CEE developed a Municipal Energy Assessment in support of both Heath's participation in the MTWP and the town's Green Communities designation application.
Huntington	Green Communities Annual Report support.	CEE provided Green Communities Annual Report support to Huntington.
Northampton	HeatSmart Northampton renewable thermal program.	CEE engaged in Northampton's HeatSmart Northampton program design and vendor selection process.
Orange	Green Communities designation application support.	CEE developed a Municipal Energy Assessment in support of the town's Green Communities designation application.
Pioneer Valley Regional School District	Green Communities designation application support.	CEE and the Clean Energy Corps developed a PVRSD Clean Energy Site Assessment and worked with the PVRSD's constituent Green Communities (Warwick, Bernardston, Northfield) to include PVRSD schools in the MassEnergyInsight energy accounting platform.
Salem	General support	CEE is reviewing Salem's energy consumption data and providing guidance on identifying future projects in support of the city's Green Communities program goal.
Shelburne	Green Communities designation application support.	CEE developed a Municipal Energy Assessment in support of both Shelburne's participation in the MTWP and the town's Green Communities designation application.
Southampton	Green Communities designation application support.	CEE drafted a Municipal Energy Assessment in support of the town's Green Communities designation application.

4. Business Outreach and Support

The Clean Energy Extension staff held substantive direct interactions with the following businesses, state entities, and other organizations.

Entity and Attendees	Date and Format	Extension Staff	Purpose and Outcomes
Rep. Goldstein-Rose, GE, and Eversource	July 10; meeting at UMass Physical Plant	Breger	Met with Rep. and utility to discuss energy storage project opportunities.
Rep. Goldstein-Rose	August 2; Share Coffee, Amherst	Breger	Overview of CEE and discussion on battery storage development and testing facility.
Massachusetts Clean Cities Stakeholders Meeting	July 20; UMass Transportation Services	Strong	Discussed CEE's role in clean energy and electric vehicle infrastructure analysis at UMass.
SunRaise Investments, Joe Harrison	August 3; CEE offices	Strong, Breger	Discussion on SunRaise solar development interests and activities in preparation of SMART program. Harrison a 2003 UMass alum.
Pioneer Valley Renewable Energy Forum – Planning Meeting; Climate Action Now, Coop Power, Pioneer Valley Mothers Out Front, Environment Massachusetts Research & Policy Center	August 4 and 11; Forum host committee meetings	Breger	Meeting to discuss planning of Pioneer Valley Renewable Energy Forum, and invitation to CEE to join host committee. CEE has joined (Forum scheduled for November 17).
Springfield Mason Sq. Development and PVPC	August 7, conference phone	Strong, Breger, McDaniel	Discussed potential microgrid project to provide clean energy and resiliency to Springfield MA neighborhood. CEE provided technical information and support.
Hyperion LLC, Michael Lehan	August 22; CEE offices	Strong, Breger	Update on NREL grant effort on dual-use agriculture solar arrays, and preparations for SMART program.

5. UMass Clean Energy Corps and other Research Activities

CEE is funding a Seed Grant to support Professor Ezra Markowitz in Environmental Conservation to conduct research in energy efficiency decision making in the low income sector. Work will include survey and experimentation using university-owned graduate student housing which has been instrumented with real time electric usage monitoring and remote data collection.

CEE (Breger) participated in meet and greet of incoming graduate students in the Environmental Conservation department Masters of Science in Sustainability Sciences (MS3) program. MS3 has a track on renewable energy and interests of students has been growing.

Other graduate and undergraduate student research projects underway with CEE during this reporting period include the following.

- Undergraduate student, Rebecca Howard, is working in collaboration with UMass Physical Plant to investigate the opportunity for distributed renewable thermal systems for target campus buildings, or clusters of buildings, as an alternative approach to eliminate or

defer the need to expand the capacity of the central Campus Heating Plant to meet growing steam needs.

- Undergraduate student, Juan Toro-Killion, is utilizing advanced GIS analysis to examine municipal parcel level data across the MTWP region and western MA to identify clusters of buildings appropriate for community/micro scale district heating systems.
- Nicholas Cutrone, supported as a CAFE Undergraduate Summer Scholar, presented a poster on his research at the annual CAFE Undergraduate Summer Scholar poster session on September 13. Poster was titled *Evaluating Energy Storage to Enhance the Value of Offshore Wind to the ISO-NE Grid – A System Dynamic Modeling Approach*.
- CEE Dwayne Breger is a member of a PhD dissertation committee for Zara Dowling who is researching the impacts of offshore wind turbines on bats. Zara has completed her dissertation chapter on the development of a model to consider the performance and economic impact of curtailment strategies to limit wind turbine operations during conditions of high bat presence. She has drafted a journal paper with Dwayne on the topic and will submitting it for publication.
- CEE Dwayne Breger has joined Prof. Eve Vogel as an adviser in her proposal to the NSF Geography and Spatial Sciences (GSS) Program. The proposal is *How Sustainable is Deregulated Electricity? An Investigation of Market Restructuring, Hydropower, Rivers and Communities*, will investigate the interdisciplinary issues regarding hydropower in Massachusetts.

6. Progress on 2017 Work Plan Activities

Progress on the activities outlined in the 2017 Work Plan are reported below.

UMass Clean Energy Extension Work Plan 2017	2017 Q2 Progress Report
--	-------------------------

Activities	Timeframe	Summary of Progress
------------	-----------	---------------------

Market Analysis & Outreach		
<i>Clean Energy in Food/Beverage Industry</i>	Q1-Q4	Lauren Mattison took a leading role in organizing a workshop in September with approximately 30 attendees. She is currently coordinating with the US Small Business Administration on planning a webinar this winter.
<i>Community Scale Biomass District Heating: Role of Farmers/Foresters, Outreach Materials</i>	Q1-Q3	CEE has established a GIS parcel-level heat mapping capability, and has developed an analytical procedure to target opportunities for micro/community scale district heating systems. The analytical method is being tested for western MA counties.
<i>Packaged CHP and ASHP Evaluation for Hotel Industry</i>	Q1-Q3	In September, Lauren Mattison and Beka Kosanovic met with John Ballam at DOER to discuss this effort. John described another CHP project with which he would like assistance before considering the hotel industry specifically, so we are in discussion with him about moving forward with that work.
<i>Biomass and other Renewable Thermal Heating for Greenhouses</i>	Q2-Q4	CEE completed an inventory of greenhouses in western MA, though data availability has rendered the database less than complete.
<i>Energy Storage in Manufacturing Sector</i>	Q2-Q4	Not started

Collaborative Applied Research		
<i>Mohawk Trail Woodlands Partnership</i>	2017 and 2018	
Regional Inventory of Boilers / Wood Heating Demand	Q1-Q3	CEE continued collecting data and following up on the Information Request with member towns. CEE conducted energy analysis for 10 member towns and prepared a draft Municipal Heat Load Analysis report for the Town of Hawley that will serve as a template for reports to all 21 member towns. Beyond municipal building heating loads, CEE has been working with GIS and parcel data and is developing a method to approximate regional thermal loads and market adoption scenarios for wood heating to evaluate potential wood pellet and chip demand profiles. Lastly, we have used boiler reporting data from DEP to determine boilers that contribute large thermal loads. This data is in the process of being compiled during 2017Q4.

Air Emissions Monitoring and Public Health Assessment	Q1-Q2 and 2018	Rick Peltier and staff have made preparations in the mobile truck to commence air emissions monitoring in the late fall. CEE has identified and prioritized existing wood heating systems for monitoring and is reaching out to host sites to reach necessary agreements to plan and conduct monitoring.
Pellet/Dry Chip Manufacturing - Alternative Business Models	Q2-Q4 and 2018	CEE has prepared a draft scope of work for a consultant to provide technical support to CEE in this activity. FRCOG and BRPC is reviewing scope for MTWP.
Regional Economic Analysis	Q2-Q3 and 2018	CEE held a kick off meeting with Professor Henry Renski and his graduate student to begin this work. Project will need to be phased as additional data becomes available from other MTWP support activities.
Analysis of Monitoring Data from Renewable Thermal Systems	Q2	Not yet started / Opportunity to be reviewed with DOER
Analysis of Pellet Boiler Systems and Thermal Storage	Q1-Q3	No progress to report; graduate student in Mechanical Engineering is expected to report progress over the summer.
Thermal Storage & Renewable Thermal to reduce UMass Campus Oil Use	Q2-Q4 and 2018	The research agenda in the UMass proposal to the state ACES program includes an activity to evaluate the use of large-scale, low temperature, clay borehole thermal energy storage to pre-heat campus CHP steam distribution make up water. CEE has begun work with UMass Physical Plant and Sustainability Director to evaluate the opportunity for distributed renewable thermal wood heating boiler to serve campus buildings, reduce the use of fossil fuel and GHG emissions, and defer the need for expansion of the campus CHP plant.
UMass Faculty Seed Grants	as needed	Manwell/McGowan, Offshore Wind and Energy Storage: Research on large scale storage technologies and modeling has been completed, and a final report is in final draft. A paper on the work "A Design and Analysis Tool for Utility Scale Power with Large Scale Wind/Solar PV and Energy Storage" was presented at the Offshore Energy and Storage 2017 Conference at Woods Hole, Cape Cod in July. Timmons, Massachusetts Biochar Economics Study: Research has advanced and final report is expected in October.

Technical Assistance & Advisory Services		
Green Communities/Municipal Support	Q3-Q4 and continuously	As reported in Section 3 of the Progress Report, CEE has continued to serve a growing number of MA municipalities in support of the Green Communities program and other services.
UMass Physical Plant - Energy Storage Proposal	Q1-Q2 and as needed	UMass Physical Plant and CEE awaits review and decision by DOER/MassCEC on their application to the ACES program. Due to the large number of applications received, the agencies have postponed the schedule to announce awards until November.
Technical Assistance to State, Businesses, Institutions, Associations, others	as needed	As reported in Section 4 of the Progress Report, CEE has provided technical assistance and market advice to businesses, non-profits, and farms on an as needed basis.