

UMASS CLEAN ENERGY EXTENSION

Quarterly Progress Report to MA Department of Energy Resources

Period ending June 30, 2017

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

During this reporting period, the Clean Energy Extension held a progress meeting and review of its 2017-2019 Strategic Plan with DOER on April 14th, has continued to support the Mohawk Trail Woodlands Partnership, and completed a successful spring semester with the Clean Energy Corps students with work to support Green Communities and the MTWP activities. The CEE has a robust summer work agenda including student interns to support on-going efforts and begin new research activities. Some key highlights, further discussed in the report, this reporting period include:

- Information Requests for municipal building heating loads submitted to 21 MTWP towns, and completion of analytical methodologies and a template report to provide each participant town with a *Phase I Energy Report: Municipal Building Heating Load Analysis and Recommendations*.
- Initiated discussions with DOER and MassCEC on strategic efforts that CEE might undertake to support renewable thermal market development and enrich the success of the state policies and program offerings.
- Successful engagement with UMass Physical Plant to assist in the submission of a proposal to state ACES program for an energy storage demonstration project on campus, with CEE taking the lead on a research agenda.
- Engagement with MA Representative Solomon Goldstein-Rose, in coordination with the UMass Office of Research and Engagement, on the prospects for an energy storage innovation manufacturing facility and a clean energy testing and demonstration facility.
- Engagement with City of Pittsfield and The Microgrid Institute in submission of a proposal to Mass Clean Energy Center's Community Microgrids Program.
- Launch of a research project with a graduate student from Mechanical and Industrial Engineering to develop a system dynamic model to explore the value of bulk energy storage to offshore wind development in New England over the 2025-2030 timeframe.

1. Extension Administration and Management

Strategic Planning and Staff Retreat

CEE has completed its Strategic Plan including a review with DOER in April. The Strategic Plan and 2017 Work Plan has been used by CEE to review work progress, identify and develop performance metrics, and planning for 2018. CEE still needs to finalize a public version of the Plan for posting on our website.

CEE held a half-day staff retreat on June 12th to review the Strategic Plan, review roles and decision making procedures, and discuss additional resource needs.

Project Management

CEE has established project management procedure using Excel spreadsheets and shared file space to track progress on our growing engagements with municipalities as part of the Green Communities program, and the 21 towns of the MTWP.

2. Public Events and Outreach Activities

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

Event	Date and Location	Extension Presenter	Presentation Title	Audience	Estimated Attendance
Green Your Bottom Line workshop	April 4, Stop & Shop Distribution Center, Assonet	Mattison	<i>Energy Assessments and Savings Opportunities in Food and Beverage Businesses</i>	Food/beverage processors and related businesses, utilities, government agencies	35
Public Launch of the UMass School of Earth and Sustainability	April 19, UMass Design Building	n/a; networked with University and external colleagues and potential collaborators		University leadership and external dignitaries	300
Integrated Concentration in Science (iCons) class	Spring semester	Breger, Weil – participated as judges in student class project development and competition on energy/sustainability projects. Follow up support of several student groups and individuals.		Prof. Auerbach and undergraduate class	30

The Northeast Biomass Heating Conference & Expo 2017	April 25-27, Burlington, VT	Breger, Strong, Peltier, Rizzo	Session on <i>Air Quality and Emissions</i> (Rizzo moderated session, Peltier presented on MTWP efforts)	Biomass thermal industry, consultants, and government officials	200 (conference); 30 (session)
Green Your Bottom Line workshop	May 3, Gorton's Seafood, Gloucester	Mattison	Led a series of small group discussions about energy opportunities in food businesses	Food/beverage processors and related businesses, utilities, government agencies	45
Meeting with Rep. Goldstein-Rose	May 16, State House, Boston, MA	Loren Walker (Office of Research and Engagement), Breger		Discussion meeting organized by Rep., with WPI and MIT	6
MA Forest Forum	Harvard Forest, Petersham, MA	Breger, Price (grad student)	Short update on MTWP	Bob O'Connor (EEA) and forest stakeholders	40
MA Food Policy Council Meeting	May 19, MA DFW, Westborough, MA	Breger, with Madeline Snow (UMass Lowell)	Summary presentation of EPA-funded efforts to assist MA Food and Beverage industry	MA Food Policy Council members and stakeholders	30
EBC Energy Resources Committee Program Planning Meeting	June 6, Brown Rudnick, Boston, MA	Breger	Discussion and planning of EBC program events	Planning Committee	10
MA Research Partnership (MRP) Offshore Wind Energy Workshop	June 20, Tufts University, Medford, MA	Breger (also UMass colleagues Manwell, Lackner, Baker, Griffin)		MassCEC funded MRP members, DOE, MassCEC, others	40

3. Green Communities and other State/Municipal Assistance

CEE expended significant efforts this reporting period in support of the Mohawk Trail Woodlands Partnership as detailed in the Work Plan progress summary in Section 6. Based largely on strategies and methods adopted for using GIS and business databases to identify market opportunities and approximate heating loads, CEE shared its strategic thinking on its potential role to support DOER and MassCEC in developing renewable thermal markets.

Advancements of these ideas and collaboration with DOER and MassCEC will be provided in the next reporting period.

CEE continues to provide technical assistance to Massachusetts towns in support of Green Communities or for activities apart from this program. CEE has utilized its staff engineers, Chris Beebe and Lauren Mattison, for this purpose, along with the efforts directly by Principal Investigator Ben Weil and the student Clean Energy Corps. River Strong maintains management of the activities and interactions with the towns. During this reporting period, CEE staff and affiliates have engaged with the following communities.

City or Town	Status	Technical Assistance
Conway	Annual GC reporting support.	CEE staff met with the Conway energy committee to discuss assistance in preparing the town's annual Green Communities report and scheduling walk-through at three key buildings.
Erving	Consulting and support for project identification and implementation	Dr. Weil, Lauren Mattison and the Clean Energy Corps visited several town facilities and reviewed energy billing data, then provided a memo with findings and recommendations.
Gill	Consulting and support for project identification and implementation.	CEE met with Gill's energy committee to analyze energy usage and advice on clean energy and cost-saving strategies for town hall, including ground-source heat pumps and building envelope strategies.
Goshen	Annual GC reporting support.	CEE communicated with PVPC staff regarding annual GC reporting support. Clean Energy Corps reviewed MEI data and identified data gaps.
Greenfield	Consulting and support for project identification and implementation	CEE provided billing data to the UMass Center for Energy Efficiency and Renewable Energy (CEERE) to do a screening of the feasibility of combined heat and power in the high school.
Huntington	Consulting and support for project identification and implementation.	CEE met with Huntington's energy committee, water/sewer commissioner, and Green Communities officials, and PVPC staff to discuss recommendations and next steps regarding energy upgrade work at the wastewater treatment facility.
Montague	Consulting and support for project identification and implementation.	CEE met with Montague town administrator and staff members to scope work related to supporting the Montague in its energy capital planning process as it seeks to identify, organize, prioritize, and implement clean energy projects throughout the town.
Orange	GC designation application support.	Dr. Weil and the Clean Energy Corps compiled additional data and identified strategies to enable the town to reduce total energy use by more than 20% at an annual savings. Some recommendations offer savings of about \$14k/year with a simple payback of less than two months.
Pelham	Consulting and support for project identification and implementation.	Dr. Weil and the Clean Energy Corps produces and delivered a Community Center Retrofit Analysis for Pelham. The analysis looked at three

		key areas of opportunity for energy savings. Including: 1. Reduced heat loss through the building envelope, particularly the walls. 2. Improved operational efficiency of the existing boiler, chiller and associated hydronic system. 3. Improved bulk water management.
Pioneer Valley Regional School District	Consulting and support for project identification and implementation.	CEE met with PVRSD and GC officials to discuss supporting PVRSD in establishing an MEI account for the District, entering and organizing data, and establishing a path for identifying and implementing clean energy projects across the district. Dr. Weil and Clean Energy Corps members conducted walk-throughs at each of the district's five schools.
Rowe	Preliminary feasibility study for possible district energy system.	CEE communicated with Rowe regarding updating cost estimates for integrating the town hall and police and fire station into a district heating loop connected to the wood pellet boiler system at the DPW.
Salem	Consulting and support for project identification and implementation	CEE is reviewing billing data and discussing opportunities for efficiency or renewable energy projects, and we provided billing data to our CEERE to do a screening of the feasibility of combined heat and power in city facilities.
Southampton	GC designation application support.	CEE and Clean Energy Corps members met to plan a process for assisting Southampton toward a GC designation application in the fall of 2017.
Ware	Preliminary study assessing the applicability of a water source heat pump using wastewater effluent	CEE staff visited the Ware Waste Water Treatment Plant to assess the viability of recovering thermal energy from the waste water effluent to provide space heating and space cooling.

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
Appalachian Trail Conservancy	April 13, email	Beebe, Strong	Adam Brown communicated with ATC staff regarding replacing ATC's oil-fired boiler with a pellet-fired boiler.
FiveFork Farms, Upton, MA	May 1 site visit, and follow up	Beebe, Strong, Breger	CEE Staff performed a site visit and follow up support as FiveFork Farms sought to apply for MDAR grant funding (among others). Among the projects identified were biomass heating, solar PV, improved cooling capacity, and improved insulation in the greenhouses.
New Energy Corp., Calgary, Canada (installation at Turners Falls, MA and	June 8 phone call	Breger, Strong	Reviewed hydrokinetic power device and introduced company to MassCEC and Holyoke Gas and Electric.

principal is student at UMass)	and follow up		
Stump Sprouts, Hawley, MA	June 23, phone call	Beebe, Strong, Breger	CEE staff met with Stump Sprouts' owner to discuss assisting the business as it considered moving toward modern wood heating and district energy system at its multi-building, rural facility.

5. UMass Clean Energy Corps and other Research Activities

The Clean Energy Corps spring 2017 semester course led by Ben Weil led to detailed building energy assessments and diagnostics in coordination with town officials in Pelham, Greenfield, and Erving. The site visits and analyses led to detailed reports customized to the interests of the towns delivered at or near the end of the semester. Further, the Clean Energy Corps provided support to other towns engaged in Green Communities program (Orange, Hawley, Rowe, Adams), and provided support for CEE staff with the MTWP information request and data analysis. Two students from the class were hired by CEE as summer interns to continue this support work.

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

- Two undergraduate students completed in May an evaluation of wood energy policy and strategic economic development in Upper Austria and transferability to western MA. A technical report is drafted and will be posted on the CEE website.
- One undergraduate student completed an evaluation and ChargePoint data analysis of the use of electric vehicle recharging stations at UMass Amherst and recommendations for expanded stations and EV adoption. This research was presented to Bill Watts, Director of Transportation Services at UMass and a technical report was completed in May and is posted to the CEE website.
- Under the supervision of CEE staff, one undergraduate student, worked with the City of Northampton on a Geographic Information Systems (GIS) project in support of the city's efforts focused on developing an outreach campaign aimed at informing citizens about the benefits of air source heat pumps (ASHPs) as a renewable heating and cooling technology and eventually making ASHPs available at a reduced cost. The project involved an effort to visualize, segment and analyze Northampton's residential building sector based on several factors (e.g., building location, building type and age, current heating fuel type, building owner demographic information) so that outreach efforts can be effectively targeted.
- CEE Director is a member of a PhD dissertation committee for Zara Dowling who is researching the impacts of offshore wind turbines on bats. Specific assistance is being provided 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.

- CEE River Strong and Dwayne Breger have collaborated with Prof. Eve Vogel and are advisers to her internal seed grant from the Institute for Social Science Research (ISSR). Her research considers the integration of social, political, economic, and environmental issues related to hydroelectric power in New England.

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
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Activities	Timeframe	Summary of Progress
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Market Analysis & Outreach		
<i>Clean Energy in Food/Beverage Industry</i>	Q1-Q4	Lauren Mattison took a leading role in organizing workshops in April (hosted by Stop & Shop Regional Distribution Center, approximately 35 attendees) and May (hosted by Gorton's Seafood, approximately 45 attendees).
<i>Community Scale Biomass District Heating: Role of Farmers/Foresters, Outreach Materials</i>	Q1-Q3	As reported above, two undergraduate students completed a report on the model of Upper Austria in advance a biomass energy economy, and on its application to the conditions of western MA. As part of the MTWP, CEE has established a GIS parcel-level heat mapping capability, and is working on queries to target opportunities for micro/community scale district heating systems.
<i>Packaged CHP and ASHP Evaluation for Hotel Industry</i>	Q1-Q3	Began research on existing hotels in the state and their energy use and CHP potential. Began discussions with DOER and CHP/ASHP manufacturers/installers about market penetration, barriers to these technologies, and project goals.
<i>Biomass and other Renewable Thermal Heating for Greenhouses</i>	Q2-Q4	Greenhouses have the potential to support resiliency within the Commonwealth by growing food and plant products locally. CEE has been working with MDAR to support participation in their programs. In addition to improved efficiency, distribution, and control technologies, CEE has reviewed biomass heating as a potential technology to support greenhouse operations. This approach is particularly effective given the low temperature requirements of modern hydronic greenhouse heating systems.
<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.
Air Emissions Monitoring and Public Health Assessment	Q1-Q2 and 2018	Professor Peltier has completed development of a mobile air emissions monitoring laboratory and has deployed the laboratory to the Amherst College book depository for its first monitoring effort. The mobile lab was fully tested and small bugs were corrected. Monitoring data was collected for approximately 4 week in late April and May (wood pellet system works year round for dehumidification of the underground facility). Data collection demonstrated that the lab is working properly and initial results on emissions were unremarkable. Lab samples are still being analyzed.
Pellet/Dry Chip Manufacturing - Alternative Business Models	Q2-Q4 and 2018	Not yet started
Regional Economic Analysis	Q2-Q3 and 2018	In coordination with CEE, Professor Henry Renski in Regional Planning has hired a graduate student to support this work which is expected to begin in July.
<i>Analysis of Monitoring Data from Renewable Thermal Systems</i>	Q2	Not yet started / Opportunity to be reviewed with DOER
<i>Analysis of Pellet Boiler Systems and Thermal Storage</i>	Q1-Q3	No progress to report; graduate student in Mechanical Engineering is expected to report progress over the summer.
<i>Thermal Storage & Renewable Thermal to reduce UMass Campus Oil Use</i>	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 embarked on a scope of 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.
<i>UMass Faculty Seed Grants</i>	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 underway. A paper on the modeling "Design and Analysis Tool for Power Systems with Large Scale Wind Power and Energy Storage" was accepted and will be 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 the next reporting period.

Technical Assistance & Advisory Services		
<i>Green Communities/Municipal Support</i>	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.

<p><i>UMass Physical Plant - Energy Storage Proposal</i></p>	<p>Q1-Q2 and as needed</p>	<p>Joined with UMass Physical Plant on April 10 in the interview of two finalist energy storage provider candidate companies, with follow up discussions and selection.</p> <p>Completed research agenda and budget in coordination with other UMass colleagues (Center for Energy Efficiency and Renewable Energy and the College of Information and Computer Science). Co-applicant (UMass Physical Plant lead applicant) in submission of proposal to DOER/MassCEC ACES RFP.</p>
<p><i>Technical Assistance to State, Businesses, Institutions, Associations, others</i></p>	<p>as needed</p>	<p>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.</p>