VERMONT NRCS CONSERVATION INNOVATION GRANT
Quarterly Progress Report

Grantee Entity Name: Meach Cove Real Estate Trust	
Project Title: Fuel from the Field to the Flue: Grass pellet heating equipment combustion optimization project.	
Agreement Number: 69-1644-11-08	
Project Director: Christopher W. Davis	
Contact Information	Phone Number: (802) 985-9218 E-Mail: cdavis@meachcovefarms.org
Three Month Period Covered by Report: January 1, 2015 – March 31, 2015	
Project End Date: 9/20/2015	

A. Project Status

1. *Summary of progress, including the results to date and a comparison of actual accomplishments with proposed goals (milestones) for the period and, where project output can be quantified, a computation of the costs per unit of output.*

During this quarter the Project Director worked with the plumbing contractor to get the biomass boiler and the original oil boiler to function as intended. The oil boiler would not operate a reliable back-up source of heat until additional components were added. Once these issues were resolved, the Project Director could schedule time to run various grass species and wood/grass blended pellets through the **Evoworld** 350C (Evo) biomass boiler and record the emission data.

The Project Director was able to confirm that the emission analyzing instrument available from the Vermont Technical College did not have the ability to detect NO or SO2 gasses. These two gasses are important to test for because their presence in the emissions of biomass can be corrosive to the boiler and flue, and may increase the potential for environmental impacts from the emissions in the atmosphere. The **University of Vermont** Engineering Department was not able to confirm if they had a portable emission analyzer that could test for these four gasses, so the Project Director contacted several emission analyzer vendors regarding sales of new and reconditioned instruments, or rentals of appropriate emission analyzer instruments.

The results of this search led to the purchase of a Wohler A500 emission analyzer instrument from Wohler USA located in Danvers, MA. The unit they offered to sell the Project Director was a new unit but a model that had recently been replaced with a newer version. Because of this, and the company's interest in the research project, Wohler was willing to discount it to $2,000.00, a price below the cost of renting an instrument for one month, and less than half of the newer model. The instrument arrived in late February and the Project Director began testing two brands of 100% wood pellets as a standard for comparison with the various grass blends. The Project Director first tested the twelve different wood and grass blended pellets that were part of the January, 2011 **Biomass**

Energy Resource Center (BERC) and **Vermont Sustainable Jobs Fund**, "*Technical Assessment of Grass Pellets as Boiler Fuel in Vermont*" report.

Once the blends of wood and grass samples were tested, the Project Director ran follow up tests of the 100% grass species and the 100% wood pellets to build the emissions database.

During this reporting period Adam Dantzscher, of **Renewable Energy Resources** worked on making repairs to the BHS "slugger" densification machine and tested the recipes for making switchgrass "pucks". Once the densification machine is operating properly and the moisture ratio has been worked out Adam Dantzscher will make several tons of switchgrass and mulch hay "pucks" to test in the biomass boiler. If possible, Adam Dantzscher will also try to make some *Miscanthus Giganteus* "pucks" from the *Miscanthu*s grass harvested from the Meach Cove test plots.

The test result data obtained with the Wohler emission analyzer for each test run has been entered into an Excel spreadsheet designed to represent the data in a clear and easy to read format that is similar to the data reports created for the **BERC** "*Technical Assessment of Grass Pellets as Boiler Fuel in Vermont*" released in January, 2011.

2. *Current problems or unusual developments or delays.*

Problems were encountered with the operation of the oil boiler as an automatic back-up heat source to the Evo biomass boiler. Once those issues were resolved, in February, the work of testing the various grass species in pellet form was able to begin.

The Project Director continues to work with the boiler engineer at **Troy Boiler Works** (TBW) to understand the programming that runs the Evo biomass boiler. The input and advice from the TBW team is essential to making necessary adjustments to the air and feed rate settings on the Evo biomass boiler to optimize the combustion of the various grass species.

Some of the grass species form a molten ash that becomes a hard crust layer in the boiler following cooling after the burn cycle in the boiler has been completed. The Project Director continues to work with the engineer at TBW to come up with options for dealing with this rigid ash byproduct so that the Evo biomass boiler can operate for continuous cycles when fueled with the various species of grass.

The Evo operator's manual that was provided with the Evo biomass boiler (350C) was translated from German and some of the terminology and descriptive words are not completely clear. The Project Director has spent a great deal of time learning how to operate the boiler efficiently on wood pellets and he is using this knowledge to make changes to the boiler fuel and air mixtures to optimize the combustion performance of the various grass pellet samples that will be tested as part of this project. The Project Director intends to provide the **Evoworld** company with notes and text that they may consider adding to their operator's manual for this boiler.

3. *Reasons why goals and objectives were not met, if appropriate.*
   The goals for this project are being met.

4. *Additional pertinent information including, where appropriate, analysis and explanation of cost overruns or high unit cost.*

   The project is being completed within the budget submitted.

5. *Any funded or unfunded time extensions.*

   The project time extension was granted until September 20, 2015.

6. *Any changes to the project's original objectives, methods, or timeline with a summary of the justification for the changes.*

   As more time is spent working to improve the settings to optimize grass fuel combustion it may be possible to have the Evo boiler operate as it is designed without modifying the boiler. Based on the test burns conducted as of this date there may be a need to modify the ash cleaning feature for the ventilated portion of the grate to facilitate better cleaning when some species of grass pellets are burned.

7. *Lessons learned that inform future project activities or broader efforts in the project's topic area.*

   After only a few weeks of running test burns with the various species of grass pellets it is clear that this model **Evoworld** biomass boiler can handle the combustion of the species of grass tested to date without special modifications of the boiler as it was fabricated. Over time the efficiency and emission profile of the various grasses is expected to improve as the Project Director becomes more familiar with the capabilities of the Evo biomass boiler and the impact of the various settings. Running more tests will produce more emission data for analysis. Using the expanding database the Project Director and his collaborators should be able to make fact-based statements regarding the viability and costs of burning the grass species that Meach Cove and UVM Extension have demonstrated can be grown successfully in Vermont.

8. *Work to be performed during the next three month period.*

   - Continue to test grass species and record the data in the spreadsheets.

   - Work with Adam Dantzscher to produce quantities of "pucks" of several grass species to test in the **Evoworld** biomass boiler.

   - Hold several open houses and demonstrations of the project.

   - Work out the modifications to the Evo boiler software and operation set up to allow continuous heating cycles burning the various grass species.

- Post the preliminary data and other related information on the Meach Cove website.

B. Project Results

1. *Any preliminary results that can be used by NRCS for practice standard revisions, new practice standard adoption, policy changes, program revisions and training opportunities.*

   It is possible that the data produced by this project will have a positive impact on several agricultural practices and standards in Vermont.

   A preliminary list includes:

   - Providing demonstrated proof that there is a viable and economical boiler under 500,000 BTU/hour capacity produced in the U.S. with UL and ASME certifications that can burn several different biomass fuels.

   - Providing emission data for a variety of grass fuels which should aid in the decision on which species of grass others might consider as a fuel.

   - Providing costs to accompany any recommendations for which grass and which size of pellet or puck another operator might consider selecting to use as a fuel.

   - Providing a resource list of people or companies that could assist another operator who is considering combustion testing of other forms of biomass or biomass blends, or someone who is considering purchasing and operating an **Evoworld** biomass boiler with grass fuel.

2. *Products, software tools and/or technologies currently ready for adoption and/or transfer.*

   The data and information collected and disseminated as a result of this work will allow **Evoworld** wood chip boilers, that are manufactured in capacity sizes ranging from 25 KW to 500 KW, will represent viable choices for any business owner or farmer who wishes to install one and burn grass pellets or pucks.

   The cost comparisons for the production, processing and manufacture of either pellets or pucks from the species of grass tested as part of this project will help potential adopters of this process to decide how best to proceed for their application and budget.

3. *Potentially promising products, software tools and/or technologies not yet ready for adoption and/or transfer, and a description of what is needed to reach that maturity.*

Continuing to work on densification and combustion testing of additional grass species or blends of biomass in the pellet and puck forms should lead to more cost effective and trouble free fuels for use by business, farm and small industrial consumers.

4. *Identification of any new data or research needs to inform broader efforts in the project's topic area.*

   The Project Director will cite any sources of new data or research in the final report that is filed and post links to that information on the Meach Cove Farms website, www.meachcovefarms.org/biomass.html.

5. *Project activities that have been featured on recipient or partner websites and success stories that could be amplified by NRCS.*

   The **Vermont Sustainable Jobs Fund** website for energy projects at www.vsjf.org

   The **University of Vermont Agricultural Extension Service** website at http://pss.uvm.edu/vtcrops/?Page=energycrops.html

C. EQIP Requirements

Provide the following in accordance with the Environmental Quality Incentives Program (EQIP) and CIG grant agreement provisions:

1. *A listing of EQIP-eligible producers involved in the project, identified by name and address;*

   The primary EQUIP-eligible producer for the project is:

   Meach Cove Real Estate Trust
   P.O. Box 309
   Shelburne, VT 04582

2. *The dollar amount of any direct or indirect payment made to each individual producer or entity for any structural, vegetative, or management practices. Both biannual and cumulative payment amounts must be submitted.*

   There are no ($00.00) direct or indirect payments for structural, vegetative or management practices under this project.

3. *A self-certification statement indicating that each individual or entity receiving a direct or indirect payment for any structural, vegetative, or management practice through this grant is in compliance with the adjusted gross income (AGI) and highly-erodible lands and wetlands conservation (HEL/WC) compliance provisions of the Farm Bill.*

The Project Director, Christopher W. Davis, certifies that there will not be any direct or indirect payments made to an individual or entity for any structural, vegetative or management practices through this grant. The AIG and HEL/WC provisions do not apply to this project.

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