

Social Sustainability in Agriculture through Engineering

Highlights of USDA NE-SARE Projects Advancing Agriculture with Farmer-Oriented Technical Solutions

Christopher W. Callahan, PE – UVM Extension Agricultural Engineering
chris.callahan@uvm.edu – 802-447-7582 x256

The practice of engineering involves leveraging technology to improve lives through problem definition, analysis and design and eventual implementation, fabrication and/or construction. In the process of problem definition, client challenges are articulated and it is in this process that social sustainability pressures are most clearly observed. Ensuring farm viability whether motivating **entrepreneurship**, considering farm succession or just improving production, often leads to careful consideration of farm infrastructure, processes, flow, and technology where agricultural engineering may be beneficial. Adoption of technology by farmers is often motivated by labor efficiency in support of quality of life measures such as **work and family balance** and **health and stress**. Additionally on-farm practices (e.g. alternative manure handling, digesters, improved ventilation, storm water management) are often changed in response to external, off-farm pressures for social integration such as **neighbor and community relations**. Finally, extension engineering programming provides **equity** by delivering research-based knowledge to the region's farmers to support their needs in a form that boosts their existing knowledge to address critical needs.

Three USDA NE-SARE projects are highlighted in this poster to demonstrate the connection between engineering and social sustainability.

More Power, Fewer Headaches Digester Tracking (SARE ONE06-053)

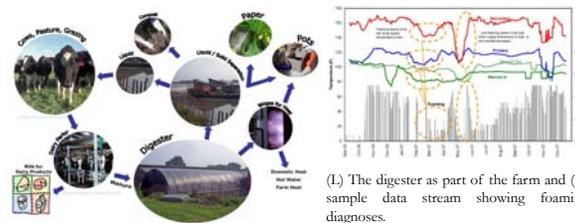
This project aimed to track and better understand the performance of a manure digester at Freund's Farm (E. Canaan, CT). The digester performance was measured nearly every day for 16 months, providing a database for review and analysis.

Outcomes:

- Based on the information gathered the team **determined system performance**: boiler burn rate (202-313 kBTU/hr), gas quality (60% CH₄), digester system efficiency (55%), digester system reliability & availability (82% & 95% respectively), and boiler combustion efficiency (70-90%).
- The team also **identified possible causes of foaming** which has been an issue preventing reliable digester operation.

Impact:

- Enhanced data collection** and data discipline provides short-term feedback to **respond before a major problem occurs**.
- Quantified emissions reductions** of green-house gases and global warming contributors. CH₄ and CO₂ emissions are 425 and 410 tons respectively. (**15.8 million miles of road travel**.)
- System layout **lessons learned for future digesters**.



Storing Food Better Farmer and Processor Storage Curriculum (SARE ONE13-176)

The goal of this project was provide **education on food storage for farmers and processors** to increase postharvest competency and capacity in the region and ultimately improved product quality and farm viability.

Outcomes:

- Development and delivery of a food storage curriculum** for farmers and processors focused on produce. Topics: crop physiology, optimal storage conditions (temperature and humidity), storage infrastructure (cold rooms, equipment, structure and materials), and controls and monitoring.
- 337 participants attended in-person workshops** totaling 1600 contact hours of educational programming.
- 1122 participants and 2200 contact hours** including meeting and conference presentations combined with webinars.
- A web-based clearinghouse** of related resources was also developed (go.uvm.edu/cropstorage). The site hosts workshop materials, developed under the project, but also collects other existing resources with relevance to the topic. This site has had 18,000 page views over 3 years.

Impact:

- Evaluation indicated **strong, relevant knowledge development** with improved understanding of topic and related resources noted among 97% of workshop participants.
- The project has also **increased awareness of the need for additional work** in the postharvest arena leading to several other initiatives that will have lasting benefit to the region.
- This project coincided with and supported improved **direct consultations with 660 producers** over 3 years.



Theresa Snow, Salvation Farms, tries out a sling psychrometer for measuring humidity in a workshop tailored to gleanng organizations.

Sharing Open-Source Ideas Among Farmers Innovative Impact Assessment of Farm and Food Innovations (ONE15-230)

This project will deliver an improved **collective innovation, distribution & education, and impact assessment** platform for sustainable **farm and food innovations** as a result of enhancements to the FarmHack.net website. The FarmHack.net website hosts more than 159 farm and food innovations including the results of many SARE funded projects in areas such as biofuels, planting and cultivation equipment, monitoring, and processing equipment.

Many **farm and food innovations suffer from limited distribution, collective innovation and evaluation of impact**. These projects represent significant social, commercial and personal investments and their impact could be greater.

The project will lead to the enhancement of the FarmHack.net website to allow improved integration of SARE funded hardware and software innovation projects and others.