Chemical Engineering Senior Design Project Faculty Template:

Working Project Title: Aquaponics Fish Waste Dewatering System

Faculty Advisor: Kristina Wagstrom

External Sponsor? Yes _X__ No ___ (partner)

External Sponsor: Bigelow Brook Farm, Eastford, CT as part of USDA's Small Farms Innovation Project

Sponsor Contact/Liaison: Rob Torcellini

Keywords: Sustainability, food, agriculture, environment

Technical Readiness Status: (Select One):

_____ Low: *A fairly new idea or highly experimental concept, with little prior art.*

__X__ Moderate: *Lab or pilot scale proof-of-concept; Full-scale design and optimization needed.*

_____ High: *Established product/process; looking for alternatives, improvements, or optimizations.*

Project Background:
Provide approximately one-two paragraphs here about the general nature of the project and how it integrates with chemical engineering.

Bigelow Brook Farm is a medium-sized farm located in Eastford, CT – just up the road from UConn. The farm includes a moderate-sized aquaponics system. In an aquaponics system, the waste water from fish is supplied to plants. The plants use the nutrients from that water to grow which also removes the nutrients from the water making it safe again for the fish.

With many aquaculture systems, fish waste can be difficult to manage. Bigelow Brook Farm currently takes their fish waste, decants some of the nutrient water from it, and dumps the sludge in our fields since it is a low quantity. Unfortunately, many places are not able to dispose of their waste in this method. The few commercial ways to dewater sludge are primarily designed for larger scale systems. The goal of this project is to develop a small dewatering system that makes it possible to use or sell the solid waste as a soil supplement.

Statement of Need: Provide the scope of the project here that you anticipate the students will look at and the general expectations for deliverables that you as a project mentor will expect.

Students working on this project should expect to work collaboratively with the farm in the development and building of a prototype fish dewatering system. Students will need to research existing methods and either adapt those methods to smaller scale use or develop a novel approach to efficiently dewater the fish waste so it is useable for other purposes.

This project will benefit not only Bigelow Brook Farm, but also a large number of moderate-sized urban aquaponics systems that struggle to effectively manage the remaining solid fish waste that the plants in the aquaponics system cannot use. The goal is to "upscale" the waste into a useful final product.

Design Requirements: Provide 3-6 relevant, specific, and measurable design requirements to constrain the "solution space" and to measure performance of the final product. (Note: Design Requirements should be crafted so that it is possible to quantify performance of the students' solution against extant alternatives. Design Requirements may come in advance directly from the sponsor, or may be generated collaboratively by the group, advisor, & sponsor during technical development.)

The following is a tentative list of the design requirements. The students will develop a finalized list as a team and in partnership with Bigelow Brook Farm. The final design will:

1. Dry the fish waste so that it is easily transported.
2. Provide faster drying times than using standalone evaporation.
3. Meet standard regulations and best practices for safe handling of fish waste.
4. Be cost effective for small and moderate-sized farms.

Skillsets/Interests that will be valuable for this project: Provide some information here on what skills you think would be particularly valuable for students considering this project to have. (Check all that apply):

CHEG Fundamentals:

_X_ Thermodynamics
__ Kinetics
_X_ Fluids
__ Heat Transfer
_X_ Mass Transfer
__ Process Control

CHEG Fields:

__ Bioengineering
__ Drug Delivery
__ Electrochemistry

__ Heterogeneous catalysis
__ Polymer processing
_X_ Other: __Sustainability, Agriculture, Environment____

CHEG Cross-Cutting:

_X_ Design of experiments
__ Process simulation
__ Risk assessment & uncertainty analysis
__ Constrained optimization
_X_ Other: _Prototyping, Community Partnerships__

Primary Performance Measures to be Used (check all that apply):

_X_ Collection of Primary Data (Experiments)
_X_ Hand Calculations based on First Principles (Theory)
_X_ Computer Modeling
__ Aspen (steady-state process simulation)
__ COMSOL (finite element multi physics modeling)
__ MATLAB
_X_ Other: _SOLIDWORKS and 3D Printing__