

A Workshop and Sustainability lab for ICS

Prepared for: Faculty, Staff, and administration of ICS

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Goals

- Develop and implement systems for reducing the nursery greenhouse's reliance on non-renewable sources of heat and electricity; achieving off-grid status by 2020.
- Create a workshop which will house critical systems and provide a dynamic space for students K-12 to explore Science, Technology, Engineering, and Mathematics through the management of key systems.

An energy-neutral greenhouse by 2020

Following a generous donation from the Knittweis family, ICS will soon have the capacity to generate enough energy on-site to meet (or closely meet) the needs of the nursery greenhouse; when this equipment is leveraged with existing resources and grant funding for installation services.

1. A 16-panel solar array (max. output capacity 1568 watts) designed by students and installed by *Seaside Electrical Services*.
2. A small wind-turbine (max. output capacity 400 watts) installed on the roof of the barn.
3. A methane digester (max. output capacity unknown) which produces/captures natural gas for heating through the anaerobic decomposition of kitchen waste and other organic matter.

In addition to dramatically reducing the cost and environmental footprint of our school's nursery, the creation of a energy-neutral greenhouse will create a important model for our students and greater community.

Workshop and STEM lab

While the location/orientation of the solar panels and wind turbine *outdoors* will be dictated by exposure/aspect, the need to place the methane digester, batteries, inventor, and other *indoor* supplies creates a unique challenge - and opportunity. As such, it's recommended that we use the "barn" (already in need of a significant overall) as a operation center for these systems; fundamentally redefining the purpose of this space for learning and exploration. This SustainableSTEM lab will be both practical and instructional; providing the crucial space for facilities key systems while driving our cross-disciplinary, project-based instruction in the science and mathematics forward.

1. A traditional workshop for woodworking and other applications; to be used by maintenance staff and instructional faculty grades 6-12.

2. Space for electrical energy storage (batteries, inverter, and gauges); a working model for demonstrating sustainable design, engineering, and data collection/analysis.
3. (4) 50-watt "table-top" solar systems and (1) 400 watt wind-turbine for teaching applied engineering, mathematics, and physics.
4. A methane digester system; a working model for demonstrating biological decomposition, chemistry, physics, engineering, and advanced computing.

Objectives of the workshop and sustainability lab

- I. Help student's better define sustainability and assess the ways that sustainability topics are approached by a diversity of academic disciplines; giving students a greater capacity to solve large-scale problems using a multitude of tools and approaches.
- II. Expose students to activities that will better prepare them for participation in the 21st century green-jobs of tomorrow.
- III. Give students a greater opportunity to demonstrate competency in applied Mathematics and sciences; specifically the *Next Generation Science Standards Practices*
 - a. Asking questions (for science) and defining problems (for engineering)
 - b. Developing and using models
 - c. Planning and carrying out investigations
 - d. Analyzing and interpreting data
 - e. Using mathematics and computational thinking
 - f. Constructing explanations (for science) and designing solutions (for engineering)
 - g. Engaging in argument from evidence
 - h. Obtaining, evaluating, and communicating information
- VI. House and maintain key infrastructure for alternative-energy systems (biogas, solar, wind); supervising a robust data collection effort on this equipment and it's impact to ICS's environmental/cost footprint.

Project Budget

Funding source	Funding Amount
\$2000.00	Spark Grant - Island Institute
\$2000.00	Fast track grant - Perloff Foundation
\$3500.00	ICS Construction Fund

Estimated cost	Outcome
800.00	Frame for solar panel array
\$2450.00	Labor for installation at ICS and disassembly at Kennebunk home
\$250.00	Wiring, conduit, and other small supplies on already on hand.
\$4000.00	Barn renovation - new door/frame, new stairs, trim, siding.

Timeline

Action	anticipated date of completion	Person responsible
Solar panels, wind turbine, and accessories are removed from Kennebunk site and brought to ICS	April 14, 2017	Ryan Martin and Kennebunk area electrician
Methane digester disassembled at Kennebunk and brought to ICS	May 14, 2017	John Kerr, Ryan Martin, Charles Whitehead
Barn clean-out completed	May 15, 2017	Heather Knight and Melissa Olsen
Solar array at ICS completed	June 15, 2017	Ryan Martin and Seaside Electric
Barn renovation (interior walls, and benching) completed	November 2017	Ryan Martin, John Kerr, John Bolduc
Methane digester installed	June 2018	Ryan Martin, John Kerr, John Bolduc and contracted engineer

