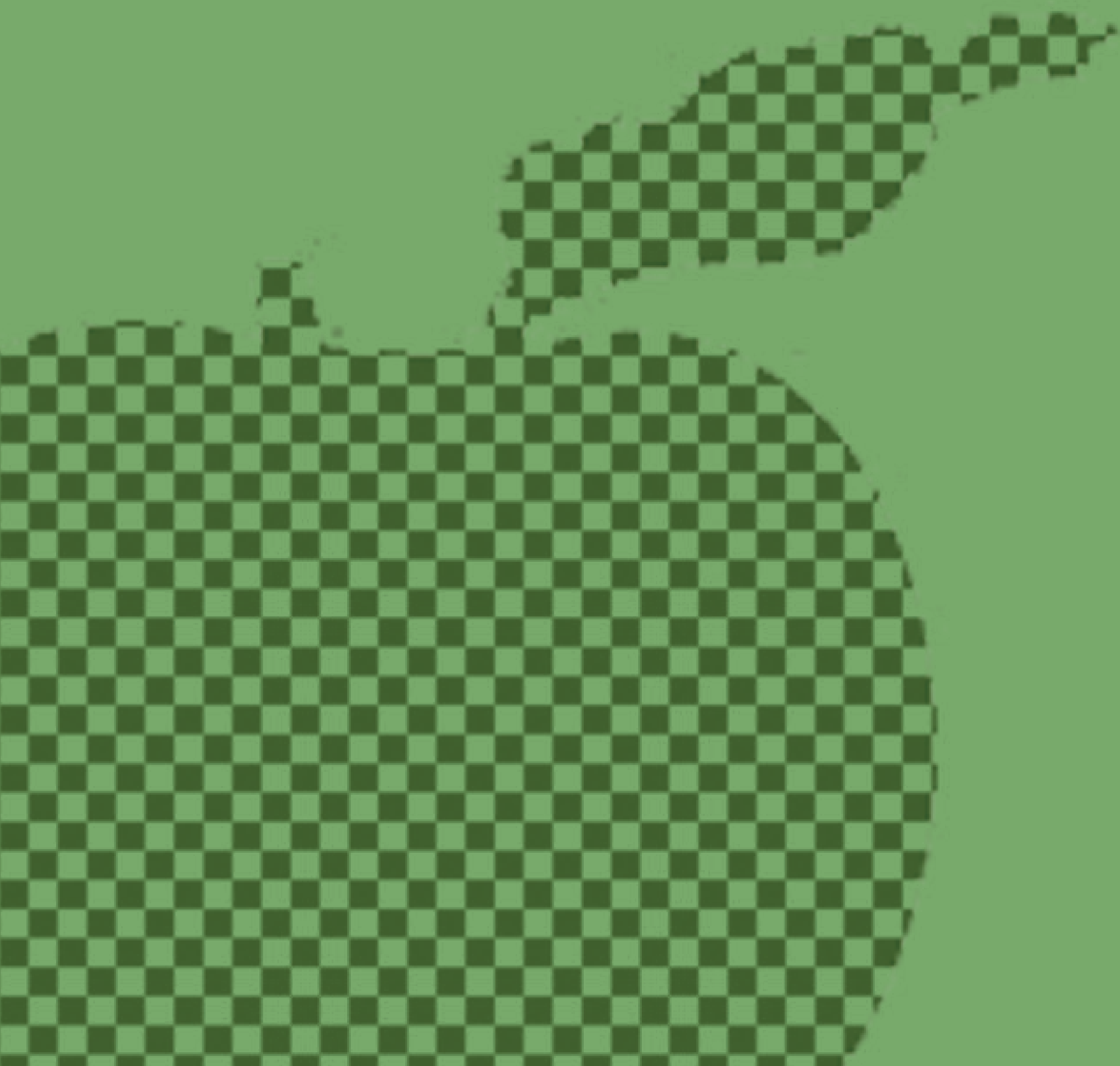
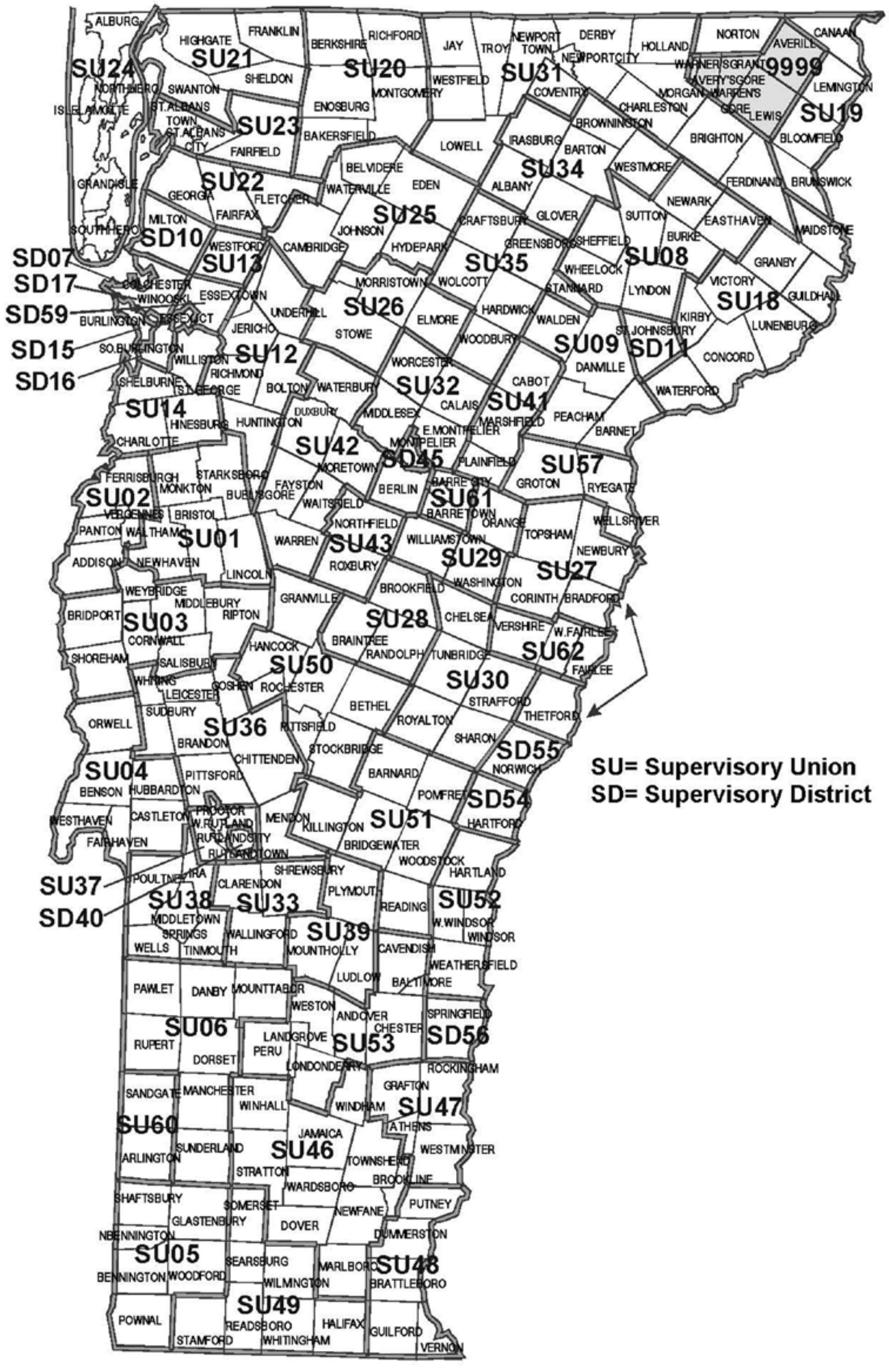
VERMONT SCHOOLS - GREEN RENOVATION GUIDE

Save Energy - Save Money - Improve Performance



Vermont Supervisory Unions



SU01 Addison Northeast
SU02 Addison Northwest
SU03 Addison Central
SU04 Addison Rutland
SU05 Southwest Vermont
SU06 Bennington/Rutland
SU08 Caledonia North
SU09 Caledonia Central
SU12 Chittenden East
SU13 Chittenden Central
SU14 Chittenden South
SU18 Essex Caledonia
SU19 Essex North
SU20 Franklin Northeast
SU21 Franklin Northwest
SU22 Franklin West
SU23 Franklin Central
SU24 Grand Isle
SU25 Lamoille North
SU26 Lamoille South
SU27 Orange East
SU28 Orange Southwest
SU29 Orange North
SU30 Orange Windsor
SU31 North Country
SU32 Washington Central
SU33 Rutland South
SU34 Orleans Central
SU35 Orleans Southwest
SU36 Rutland Northeast
SU37 Rutland Central
SU38 Rutland Southwest
SU39 Rutland Windsor
SU41 Washington Northeast
SU42 Washington West
SU43 Washington South
SU46 Windham Central
SU47 Windham Northeast
SU48 Windham Southeast
SU49 Windham Southwest
SU50 Windsor Northwest
SU51 Windsor Central
SU52 Windsor Southeast
SU53 Windsor Southwest
SU57 Blue Mountain
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Vermont Schools - Green Renovation Guide

Save Energy - Save Money - Improve Performance

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Acknowledgements

This Guide was produced by the Vermont Green Building Network and supported by a grant from the US Green Building Council's Center for Green Schools.

The principal authors were Ted Ceraldi, Jennifer Cirillo, Jeff Forward, Wayne Nelson, Edward Pais, and Anne Tewksbury-Frye. Additional assistance was provided by Mandy Pais and Jesse Robbins. Edited by Edward Pais.

The case studies were completed with cooperation of the following school districts:
Burlington School District
Craftsbury Town School District
Orleans Southwest Supervisory Union

Defining Green Schools

Before embarking on a "Green School" project, it is necessary to understand the meaning of that term. Green and sustainable are two words that have often been defined in accordance with whatever product or building is trying to be sold, resulting in the devaluation of those words. Therefore, there is a need to step back and develop a definition that is both universally accepted and carries meaning. The Center for Green Schools has done this work and created the following definition:

> **green school** (grEn skül) **n.** a school building or facility that creates a healthy environment that is conducive to learning while saving energy, resources, and money.

Benefits of Green Schools

When schools are built in accordance with the above green school definition, typically three significant benefits are seen.

Green Schools improve student and teacher health, decreasing absenteeism and increasing retention

Government Accountability Office studies from the 1990s show that 15,000 schools in the US have indoor air that is unfit to breathe. The air has been found to be contaminated with greenhouse gases, toxic chemicals, volatile organic compounds (including formaldehyde), and mold spores. According to the American Journal of Industrial Medicine among other sources, mold spores are suspected to be increasing the prevalence of asthma that causes more 14 million missed school days every year. The improved indoor air quality in green schools is estimated to prevent 65 percent of asthma cases among elementary school-age children. It has also been estimated to reduce the transmission of viral illnesses by as much as twenty percent. It is estimated that one out of three schools have air quality issues that cause respiratory illnesses in children, and the problem is only expected to get worse.

Every year there are an estimated 40 to 60 chemical injuries per 1,000 custodians, resulting in costs to school districts of approximately $25 million between workers compensation and lost time. Switching to less hazardous green cleaning products helps reduce the risks of chemical injuries.

Green Schools help improve student performance

Beyond improving the health and reducing the number of sick days that keep students and teachers out of the classroom, there are other factors that result in improved student performance. The National Academy of Science in 2006 found that the background noise level in a typical school was 10 times louder than the acceptable range. Across the country, the average teacher requires two sick days every academic year from voice strain. Studies of 9- and 10-year-olds show that chronic exposure to noise impairs their cognitive performance and reading comprehension.

Another common problem impacting many conventionally designed schools is poor lighting and excessive glare. Green schools are designed to provide high-performance lighting, daylighting, and reduced glare. Recent studies have found significant improvements in student performance due to improved quality and consistency of lighting in schools.

Green Schools save money

A common concern with green schools is that they cost too much. While in many instances the initial construction cost for green projects is higher, there are times when the green strategies implemented have actually reduced construction costs. In addition, the operations costs of green schools are typically significantly lower than that of a conventional school. Greg Kats, the author of *Greening America's Schools: Costs and Benefits*, found that green schools used approximately one third less energy and water of a conventional school. These savings would allow school districts to hire additional staff, purchase new computers or textbooks without increasing their operational budget, or to reduce the property tax burden on the residents of the district. Bonding authorities are also becoming more willing to take these savings into account when developing project financing.

Characteristics of a Green School

The Center for Green Schools created the following list of typical characteristics of green schools:

- Conserves energy and natural resources
- Saves taxpayer money
- Improves indoor air quality
- Removes toxic materials from places where children learn and play
- Employs daylighting strategies and improves classroom acoustics
- Employs sustainable purchasing and green cleaning practices
- Improves environmental literacy in students
- Decreases the burden on municipal water and wastewater treatment
- Encourages waste management efforts to benefit the local community and region
- Conserves fresh drinking water and helps manage stormwater runoff
- Encourages recycling
- Promotes habitat protection
- Reduces demand on local landfills

It is sometimes said that with declining student enrollment and reduced revenue, it is too expensive to build green schools. In fact, studies have shown that it is too expensive not to build green schools. This guide will focus on green renovations to conventionally constructed schools in the state of Vermont. Two case studies, one in Burlington and one in Craftsbury, will be presented. While Vermont does not currently have any LEED (Leadership in Energy and Environmental Design) or NE-CHPS (Northeast Collaborative for High Performance Schools) rated public schools, Craftsbury Academy has applied for the NE-CHPS rating. Additional resources for designing green schools will be included in this guide.

Whether as students, staff, teachers, or administrators, well over 100,000 people work or study in the 325 Vermont K-12 schools every day. The design of new or renovated green schools will help protect their health and improve their learning. In Vermont, school infrastructure represents one of the most significant costs for each municipality. Through significant reductions in annual operations and maintenance expenses, and reduced liability exposure, green schools offer benefits to all residents of Vermont.

Craftsbury Academy

Profile:
- Craftsbury, VT
- Population: 1,162
  - Density: 0.04 per acre
- Students: 158 students
- Town and school websites
  - www.townofcraftsbury.com
  - www.craftsbury.ossu.org

The school serves grades 5-12 with the high school (9-12) located primarily on the second floor of the building. This building also serves as the main office for the administration of the entire Craftsbury school district.

History:

Craftsbury Academy is one of the oldest operating schools in the United States. The original Academy building was constructed in 1868 with a major renovation and additions of the two side wings in 1929. The current renovation project and the planning for a new gym began in June of 2010. The certificate of substantial completion for the academic buildings was issued in June 2011, after spending 19 months to move from design to completion. The gym construction is scheduled for completion in August 2012.

Teachers, students, school board members, and administrators worked cooperatively with the architect, engineers, lighting designers, and other consultants to develop the program guiding this sustainable renovation. The overall vision was the preservation of the 19th century school building while modernizing it for 21st century technology and ensuring the sustainability of the facilities. The sustainability goals focused on energy efficiency, but also strongly considered the health of the students and teachers, and the environmental impact of acquiring the construction materials.

The initial renovation estimates came in at $3 million. Craftsbury Academy, with the assistance of a $300,000.00 grant, completely renovated the first floor of the Annex building (1800 sf) as well as completed a technological and furnishings upgrade of the other renovated areas. The final costs for the renovation were approximately $3.3 million. The success of this project was recognized by the school receiving the Efficient Vermont / Better Building by Design Award: Best of Best.

Renovations:

Natural light/daylighting: The renovation took advantage of the 1868 design that was dependent upon natural lighting for all interior spaces, as Thomas Edison did not patent his light bulb until 1879. The original window

Courtesy of Ted Ceraldi

design, including sizing and number of windows, allows for the electric lighting to be turned off for most of the school day and academic year. All classrooms and common areas have control modules wired to motion/sound sensors and direct switching. There is a high and low switching circuit as well as a front and rear circuit in each room. This allows for consistent light control throughout the classrooms.

Borrowed lights: Installation of borrowed lights off common areas and hallways enabled natural daylight and electric light to illuminate interior spaces.

Lighting: Super T-8 full-spectrum fluorescents with occupancy sensors in all classrooms and common areas.

Window replacement: The historical classification of the Academy prevented replacing the window sashes on the double hung windows. In order to preserve the historical character of the windows while achieving minimum heat transfer through windows, the sashes were rebuilt and reglazed with a low-E glass. Exterior wood storm windows were installed and the bronze weather stripping was replaced on all sashes. Interior window treatments include Gordon's locally manufactured "Ecco" shades that are drawn down at the end of each school day providing a higher R-value and as needed during class teaching events (movies etc.).

The window assembly maintained the historical character of the Academy while providing for maximum solar gain during the day and maximum R values during the night. The R values for the complete assembly are:

- Storm window sashes = 1.5 including air space
- Re-glazed wood windows = 1.1
- Ecco shades = 4.5

The total R value with the shades is R =7 and R = 2.5 without the "Ecco" shades. The incoming solar gain during the day approximately equals the heat loss when the shades are up.

General wall assembly: The existing walls date essentially back to the original 1868 construction. The typical wall was comprised of the following assembly: interior paint; plaster over wood lath; rough cut 2x6 studs or 2x8 framing; 5/4 rough cut board sheathing; clapboard siding; and exterior paint.

During the renovation, the overall wall assembly was preserved but upgraded to reflect the sustainability goals. New interior water based paint was used. The wood lath and plaster was repaired as required. Borate dense pack insulation was added between the existing studs. The rough cut board sheathing was spray prepared and Tremco Exo-Air breathable membrane and home slickers were installed to complete the assembly. New trim and clapboard siding matched the existing historic details.

General thermal insulation: Closed cell spray foam was utilized to seal air leaks in all areas where possible; borate dense pack cellulose insulation; and packing around window frames. Many newly constructed buildings have R values that are as low as 19 for the walls and 38 for the roof. The renovated Craftsbury Academy has R values of

Project Team:

Orleans Southwest Supervisory Union
Superintendent: JoAn Canning

Craftsbury Town School District
Principal: Merri Greenia
Facility Manager: Dylan Laflam
School Director: Harry Miller

Design Team
Architects: Bast & Rood Architects
Mechanical Engineer: Yeaton Associates
Electrical Engineer: Lee Carroll Engineers
Thermal Envelope Consultants: Murphy Cell-Tech
General Contractors: Laferriere Construction Inc.

60 for the walls and between 80-100 for the ceiling and roof.

Electrical system: New 600 amp 3-phase service was added with a slab mounted transformer and underground service into and between all buildings. The main switch gear and distribution panels are located in the Academy building mechanical room.

Mechanical systems: An energy recovery unit (ERU) was located in stair tower attic, Munters model#PV-MZ-4070. This system balances the ventilation air to 4710 CFM in with 4710 CFM out while incorporating heat recovery capabilities. The ERU captures the heat of the air being exhausted and utilizes it to warm the fresh outside air. This unit provides filtered fresh air to every space within the Academy building. Science fume hoods vent directly to the outside with the maximum separation possible between exhaust and air intakes.

Heating: The main boiler is an Advanced Climate Technologies bioenergy, biomass boiler capable of burning wood chips or wood pellets. The output is at a maximum of 875,000 Btu's providing enough heat for a hot water radiant floor and wall mounted radiators. The main boiler is fed via a 36 ton exterior silo through a flex auger.
Two (2) Elite 3200 propane back up boilers @ 299,000 Btu's each were also installed. A 1000 gallon buried propane tank was added for the back up boilers.
Separate fresh air intakes for combustion air were installed and calculated in accordance for maximum output of boiler.

Controls: Thermostats are located in every room with controls directly or remotely set by central building management systems. The central building management system is computer controlled with a direct digital control system (DDC) providing real time management with a continual data base update. Data is collected and printed out throughout the year, allowing for increased control and reduced energy costs.

Plumbing system: All new water saver plumbing fixtures and controls were installed throughout the Academy. All piping has been insulated to maximize energy efficiency. A complete sprinkler and fire suppression system has been installed throughout the Academy.

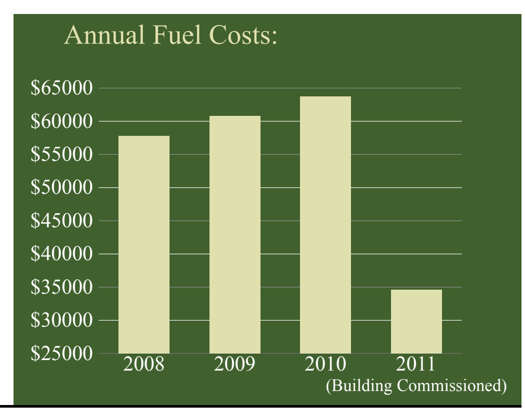
Finishes: An interior water based paint was used over plaster or gypsum board. A water based clear floor finish has been applied over the existing and new maple flooring. Ceramic tile was installed in all bathrooms. These natural finishes have resulted in no off-gassing issues.

Energy Savings:

Estimated prior to commissioning = $28,000.00/year.

Actual first year savings
$29,120.00 or 46%

Savings will increase as construction and building closure is completed.



Sustainability Academy at Lawrence Barnes

Profile:
- Burlington, VT
- Population: 42,417
  - Density: 6.43 per acre
- Students: 208 Students
  - Pre-K: 23 students
  - K-5: 185 students
- Town and school websites
  - www.burlingtonvt.gov
  - sa.bsd.schoolfusion.us

The school is an elementary magnet school located in the Old North End neighborhood of Burlington. There is a focus of integrating sustainability into the curriculum and campus practices.

History:

In 1958, the Lawrence Barnes school was erected on North Street in Burlington's Old North End. In 2009, it transformed into the country's first sustainability-themed elementary magnet school.

The Sustainability Academy defines sustainability as "the shared responsibility for improving the quality of life for all – economically, socially and environmentally – now and for future generations."

The Lawrence Barnes teachers and staff started with small steps towards developing a more sustainable school in 2004 with the support of Shelburne Farms' Sustainable Schools Project.

They looked at opportunities to apply the lens of sustainability to their curriculum, mapped the K-5 scope and sequence, and located the Big Ideas of Sustainability (or key concepts) in the state education standards. Classroom teachers participated in workshops focused on sustainability. During these workshops, they met with local resource people (including the director of the local food shelf, farmers, waste managers, livable wage advocates, and urban planners); read articles on education for sustainability and place-based education; and analyzed student work for evidence of understanding sustainability concepts.

They realized immediately that if they were to explicitly teach about sustainability, then the building, campus and their operations needed to reflect what they were teaching. This part of the curriculum – building and campus as text and learning lab – might be considered the implicit curriculum. This part of the curriculum may not show up in the education standards or in lesson plans but it is at the heart of the work at the Sustainability Academy. It reflects the curriculum, vision and mission of the school. In this K-5 school, the campus is the place where students can express and make meaning of their learning.

Key Partners:
- Families
  - Building gardens, campus design committees, grant writing, and weekend greening & cleaning events
- Burlington School District, Maintenance, and Food Service Staff:
  - Responsible for daily efforts
- Shelburne Farms' Sustainable Schools Project:
  - Professional Development for teachers
  - Community Engagement
- Friends of Burlington Gardens
- ReStore and Youth Build
- Chittenden Solid Waste District
- Seventh Generation

Partnerships:

The school is sustained by a collaborative partnership between families, many local community partners, Shelburne Farms, and the Burlington School District. "The school engages young citizens in making a difference in their community by exploring social, economic, and environmental issues through integrated, hands-on curriculum steeped in service-learning." (Vermont Education for Sustainability Guide with permission from Shelburne Farms).

In addition to professional development for the staff, the school and Shelburne Farms' Sustainable School Partnership (SSP) have included families by offering evening programs such as book groups on sustainability themes, community-wide dinners, and wellness programs emerging from the traditional P.T.O. When the school began using the sustainability theme as an integrative concept, they brought on even more partners from the community. The community partnerships on topics such as food & gardening, composting, and energy have supported the campus and cafeteria transformations. While the teachers and staff integrated these ideas into their curriculum, assessments, and everyday teaching, they have worked with the families, community partners, and students to make the campus a learning laboratory.

Examples of Incorporating Sustainability:
- Fourth and Fifth grade students learning about energy and electricity while exploring the alternative methods for heating and cooling their school. They learn about the geothermal and solar system and use the solar array data to learn new math concepts.
- Second and Third graders learn about the water cycle and urban run-off by building rain barrels to water the school's many gardens.
- First graders learn about cycles by exploring the school's composting and recycling systems in the cafeteria and for snack waste.
- Kindergarten students plant an ABC Literacy Garden with herbs and perennial flowers to attract pollinators to the campus and learn early literacy skills.
- All students participate in being stewards of the campus' gardens, blueberry plantings, shrubs and trees.
- All students and staff enjoying healthy, fresh and local produce, dairy, and meats from the school's cafeteria.

Renovations:

Lighting: T-8 full-spectrum fluorescent bulbs replaced T-12 fluorescents. In addition to using more efficient light fixtures, the total number of fixtures were reduced by 33%. 60/40 indirect/direct fixtures were utilized to provide more even lighting with less glare.

Occupancy sensors: All classrooms and common areas were equipped with occupancy sensors.

"I am very sensitive to fluorescent lighting and often, in the past, needed to keep my classroom lights off to avoid getting headaches, The new lighting in my room adjusts with the light outside and I feel more like I'm in natural light all day, which is great!"

Natural light/daylighting: Daylight-harvesting sensors were incorporated into the lighting design, reducing the light used based on the actual amount of natural daylighting in the classrooms

"The hallway light is amazing! The light in our room is wonderful. Children do not complain about the glare, their reading stamina has increased and they can see their work----cool! With our long, dark winters, light improves everyone's mood, including mine!"

Borrowed lights: Clerestory glazing was restored between the classrooms and interior hallways to provide natural lighting into the hallways, reducing the number of lighting fixtures required to illuminate the hallways. On the second floor skylights were added in the hallways and library to provide additional natural lighting for these spaces.

"It feels like you're outside ! It really has changed our overall look….it's so bright!"

Building facade: The existing single pane windows were replaced with energy-efficient triple paned tinted windows. An entry vestibule was created to reduce heat loss from students entering and exiting the school. Thermal insulation was significantly increased, reducing the amount of heat lost to the exterior.

"I used to smell Gordon Stamp all the time, and now I don't.....even when they are making rubber! I am noticing a reduction of asthma and colds. I have to add that I do not miss the days I needed to fix my heater with a fork or sit in my classroom with mittens, hat, and coat on, because the boiler was down…again……"

Mechanical systems: Closed-looped geothermal systems replaced the boiler system that previously heated the school facilities. In addition to providing heat, the system is also able to offer cooling. This features enables the building to be used in the summer for both school and community purposes. The heating and ventilation systems were able to be separated, allowing for increased and improved ventilation.

"Personally, I believe that our new air system has made a big difference for my health. Before I started here I worked part time in a childcare center and contracted pertussis. During the last 11 years, while working here, I would always get a respiratory infection when the heat went on in the fall. I thought when I moved into a new home that it would make a difference, not really knowing it was quality of air at school that was the problem. This year is the first year in all those years that I have not been sick, and I feel it is because of the new air system."

Controls: The new control system monitors each room independently and is able to provide heating, air conditioning, and ventilation as required to each space. This has in turn created more comfortable and healthier classroom spaces. The control system is also capable of functioning without an onsite facility manager. In the future with this system implemented district-wide, facility management could be conducted from a single central location.

"I enjoy being able to dim down the lights to a half setting for parts of the day. It gives a calming effect."

Solar energy: Two solar photovoltaic systems consisting of five 225 watt solar panels for a total of 2.25KW were installed on the roof of the school. One of the systems is a pole mounted tracker system and the other is a ballasted fixed solar array. The tracker system senses the location of the sun and rotates the array to maximize the amount of solar energy captured by the panels. The ballasted array is fixed at a 10 degree tilt in a true south orientation. Utilizing the two different systems allows students to compare the production of energy from them. These solar panels were funded by a combination of a $50,000 government grant and a $10,000 donation from Seventh Generation at no cost to the school district.

Utility monitoring: A utility monitoring system is being designed and will be installed in the main lobby of the school. The display will provide an animation of the resources generated and consumed. It will monitor solar, geothermal, gas usage, water consumption, and electrical usage.

Plumbing system: New water saving plumbing fixtures and controls were installed throughout the Academy. All piping has been insulated to maximize energy efficiency.

Finishes: Low-VOC paint was used to paint all interior surfaces.

Gardens: One of the most replicated features of this school has been the planting of gardens. The students and food service staff are able to pluck herbs from the indoor herb garden and bring them home to use for their own meals. Each class has a raised garden bed to cultivate vegetable and flowers. The school has an additional herb and vegetable garden used for school lunches that is maintained by parents during the summer. The produce is used in the school lunch program, both reducing the costs of providing lunches for the school and increasing the amount of fresh vegetables consumed by the students.

Energy Savings:

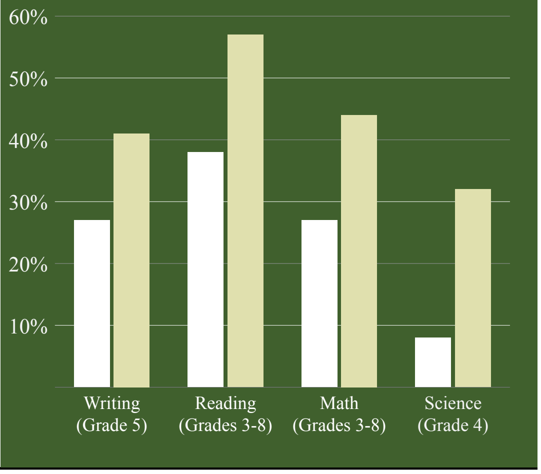
The improved building facade and more efficient heating system have reduced annual heating costs from $40,000 per year to $15,000.

Heating cost savings = $25,000.00 or 63%

Student Performance:

Since the renovations have been completed, student performance in NECAP assessments has shown a remarkable improvement, ranging from one and half times as many students in reading to four times as many students in science testing at a proficient level or above.

NECAP Assessment of Students at Proficient or Proficient with Distinction:



Steps for a Successful Green School Project

If you hope to bring a green project to your school, you first need to explore the opportunities available. Here are some areas to start with:

- **Energy Audits**: Find out if your school has been assessed recently for energy efficiency. If not, help find resources for performing an energy audit. Many states and utility companies have energy efficiency programs that will provide low-cost or free walk through audits for public schools. If you find a teacher who is interested in incorporating energy efficiency into their curriculum, you've found a terrific opportunity. The Cool School Challenge and the US Department of Energy have programs available in helping students conduct school wide energy audits.

- **Capital Plans**: Find out if the school has a capital plan that outlines which capital projects will be undertaken and when they are scheduled. This may be relevant to any green project that you hope to promote.

- **Decision Makers and Allies**: Find the movers and shakers within the school district. These could include a school business manager, school facility director, district superintendent, school principal, enthusiastic teacher, or school board trustee.

Once you've identified the opportunities and resources within the community, it's time to choose a project. Once you have evaluated all of the available information regarding the current condition of the school, choose your focus. If the school doesn't have a current energy audit, this is where you need to start. Until you've benchmarked the current condition, you cannot know where you need to go.

In choosing a project, work with energy professionals to identify the most cost effective projects. In many instances, you may be able to find an energy professional who is willing to donate his/her time - such as a parent who is an architect or a neighbor who works with renewable energy.

When you've chosen the project, find a way to estimate project costs and project cost savings. You will need to give decision makers some idea of cost as well as cost savings. Without this step the project is unlikely to be adopted. The first question any decision maker will ask is "how much is this going to cost?"

Project costs can be presented in a variety of ways. You need to determine the upfront capital cost first. Here are the common methods of presenting costs.

- Simple payback is a very common way to present costs. If a project costs X dollars and saves Y dollars per year, then X/Y equals the simple payback. The problem with this approach is that it doesn't take into consideration fuel cost inflation, nor does it take into consideration the opportunities for financing a project.

- An alternate and arguably better way of presenting this same information is as a return on investment. For example: if a project has a 5 year simple payback, it also has a 20% return on investment if you exchange the numerator and denominator. A 5%, 10% or 20% return on investment is much more attractive way to present information than a 5, 10 or 20 year payback.

- Life Cycle Cash Flow is a more accurate method for presenting project cost information. To calculate you need to determine the following factors:

  1. Capital costs for purchasing and installing equipment. Make sure project cost estimates include both materials, labor, and design fees. Subtract any incentives for energy efficiency measures. Also research whether the project might be eligible for state school construction aid.
  2. Fuel costs: the base fossil fuel costs should be based on the average cost over the past year. Fuel costs should be projected over the life of the component and escalated for inflation. Commercial boilers last 30 years. To determine future energy costs, some fuel price escalation needs to be incorporated. For fossil fuels, the 20-year average of Energy Information Agency data for the relevant region is an excellent choice.
  3. Operation and maintenance costs need to include labor and major repairs. These too should be adjusted for inflation. For this calculation, the twenty year average for the Consumer Price Index is a good option.
  4. If a project is financed, the debt service also needs to be included in the analysis so that decision makers can understand the total impact on their annual budgets.

After estimating costs, you'll need to present your proposal to decision makers. Schools are challenging in part because there are so many decision makers. The decision makers fall into four major categories - *voters*, *school board members*, *building facility managers*, and *school administrators*. Furthermore, the school administrators can be further subcategorized as *superintendents*, *school business managers*, *school principals*, and *district facility managers*.

It is important to keep in mind that there is usually a significant amount of work that has been done on similar projects and can be utilized for the project that you are pursuing. Many non-profits have documented work done on previous projects, created best practice manuals, and cost benefit calculations. ASHRAE, Center for Green Schools, Efficiency Vermont, US Green Building Council, Vermont Energy Investment Corporation, and Vermont Green Building Network are some examples of organizations that can assist with this information and can be located in the resources section of this guide.

Throughout this process it is critical to have a champion dedicated to seeing that the project is carried through completion. The champion is often someone who is deeply concerned about the daily school environment, such as a parent, school board member, teacher, or another individual who works in the schools. Ultimately, objective information will be the most persuasive and is critical for carrying the project forward. Depending upon the size and breadth of the project, when data is compiled and a program is developed, a school board should proceed while considering retaining an architectural firm that has a track record in green building design. The architectural firm would typically develop a green team of engineers, lighting consultants, and manufacturers with established green building practices. The architect will coordinate the efforts of this green team.

Glossary:

ASHRAE: American Society of Heating, Refrigerating, and Air Conditioning Engineers

Bioenergy: Energy derived from biomass

Biomass: Organic materials such as wood or agricultural crop residues

BTU: British Thermal Unit or the amount of energy required to raise one pound of water one degree Fahrenheit in temperature

CFM: Cubic Feet per Minute. This is a measure of air flow.

Closed Loop Geothermal: Ground source heat pumps that use the near constant underground temperature of water for heating and cooling the building. Closed loop systems have a carrier fluid, often a mixture of water and antifreeze, to transfer the heat between the heat pump and the underground water.

Commissioning: The process of testing a building after the construction is complete to ensure that all systems are operating correctly as designed and at maximum efficiency

Daylight Harvesting Sensor: A sensor integrated with the lighting system that detects the prevailing light level and turns on the lights when the ambient lighting is insufficient.

Energy Audit: This is an analysis of the energy flow and usage in a building and can be utilized to target energy efficiency improvements.

ERU: Energy Recovery Unit. A mechanical unit with a heat exchange in the ventilation system. This captures the heat from the air the is being exhausted and is used to warm the fresh air that is entering the building. Some units are able to transfer moisture between the exhaust and supply air.

Full-Spectrum Fluorescent: A lamp that emits light in all parts of the visible spectrum and parts of the ultraviolet-A region. It has a color temperature of 5000 Kelvin or greater and a color rendering index of at least 90. These lamps provide a better simulation of natural daylight than traditional fluorescent lamps.

Green Schools: A school building or facility that creates a healthy environment that is conducive to learning while saving energy, resources, and money.

Indirect / Direct Fixture: A fixture that casts light both upwards and downwards. The upward light is reflected off of the ceiling, providing indirect lighting that does not have glare.

Low-E: Low emissivity coating. This is a very thin metallic coating applied to glazing that permits most of the sun's light to enter while blocking up to 90% of heat radiation. The improves the R-value of the window.

Low VOC: Products that have no or low amounts of volatile organic compounds (VOC).

NECAP: New England Common Assessment Program. These are a series of reading, writing, mathematics, and science achievement tests and are administered annually at select grade levels.

R-Value: This measures the resistance to heat flow or insulation. A higher value represents less heat loss.

Sustainability: The shared responsibility for improving the quality of life for all - economically, socially and environmentally - now and for future generations.

VOC: Volatile Organic Compounds are harmful chemicals that readily evaporate into the atmosphere.

LEED Scorecard

LEED 2009 for Schools New Construction and Major Renovations

Project Checklist

Project Name

Date

Sustainable Sites — Possible Points: 24

Y	?	N			
Y			Prereq 1	Construction Activity Pollution Prevention	
Y			Prereq 2	Environmental Site Assessment	
			Credit 1	Site Selection	1
			Credit 2	Development Density and Community Connectivity	4
			Credit 3	Brownfield Redevelopment	1
			Credit 4.1	Alternative Transportation—Public Transportation Access	4
			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
			Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	2
			Credit 4.4	Alternative Transportation—Parking Capacity	2
			Credit 5.1	Site Development—Protect or Restore Habitat	1
			Credit 5.2	Site Development—Maximize Open Space	1
			Credit 6.1	Stormwater Design—Quantity Control	1
			Credit 6.2	Stormwater Design—Quality Control	1
			Credit 7.1	Heat Island Effect—Non-roof	1
			Credit 7.2	Heat Island Effect—Roof	1
			Credit 8	Light Pollution Reduction	1
			Credit 9	Site Master Plan	1
			Credit 10	Joint Use of Facilities	1

Water Efficiency — Possible Points: 11

Y	?	N			
Y			Prereq 1	Water Use Reduction—20% Reduction	
			Credit 1	Water Efficient Landscaping	2 to 4
			Credit 2	Innovative Wastewater Technologies	2
			Credit 3	Water Use Reduction	2 to 4
			Credit 3	Process Water Use Reduction	1

Energy and Atmosphere — Possible Points: 33

Y	?	N			
Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
			Credit 1	Optimize Energy Performance	1 to 19
			Credit 2	On-Site Renewable Energy	1 to 7
			Credit 3	Enhanced Commissioning	2
			Credit 4	Enhanced Refrigerant Management	1
			Credit 5	Measurement and Verification	2
			Credit 6	Green Power	2

Materials and Resources — Possible Points: 13

Y	?	N			
Y			Prereq 1	Storage and Collection of Recyclables	
			Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 2
			Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
			Credit 2	Construction Waste Management	1 to 2

Materials and Resources, Continued

Y	?	N			
			Credit 3	Materials Reuse	1 to 2
			Credit 4	Recycled Content	1 to 2
			Credit 5	Regional Materials	1 to 2
			Credit 6	Rapidly Renewable Materials	1
			Credit 7	Certified Wood	1

Indoor Environmental Quality — Possible Points: 19

Y	?	N			
Y			Prereq 1	Minimum Indoor Air Quality Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
Y			Prereq 3	Minimum Acoustical Performance	
			Credit 1	Outdoor Air Delivery Monitoring	1
			Credit 2	Increased Ventilation	1
			Credit 3.1	Construction IAQ Management Plan—During Construction	1
			Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
			Credit 4	Low-Emitting Materials	1 to 4
			Credit 5	Indoor Chemical and Pollutant Source Control	1
			Credit 6.1	Controllability of Systems—Lighting	1
			Credit 6.2	Controllability of Systems—Thermal Comfort	1
			Credit 7.1	Thermal Comfort—Design	1
			Credit 7.2	Thermal Comfort—Verification	1
			Credit 8.1	Daylight and Views—Daylight	1 to 3
			Credit 8.2	Daylight and Views—Views	1
			Credit 9	Enhanced Acoustical Performance	1
			Credit 10	Mold Prevention	1

Innovation and Design Process — Possible Points: 6

Y	?	N			
			Credit 1.1	Innovation in Design: Specific Title	1
			Credit 1.2	Innovation in Design: Specific Title	1
			Credit 1.3	Innovation in Design: Specific Title	1
			Credit 1.4	Innovation in Design: Specific Title	1
			Credit 2	LEED Accredited Professional	1
			Credit 3	The School as a Teaching Tool	1

Regional Priority Credits — Possible Points: 4

Y	?	N			
			Credit 1.1	Regional Priority: Specific Credit	1
			Credit 1.2	Regional Priority: Specific Credit	1
			Credit 1.3	Regional Priority: Specific Credit	1
			Credit 1.4	Regional Priority: Specific Credit	1

Total — Possible Points: 110

Certified 40 to 49 points   Silver 50 to 59 points   Gold 60 to 79 points   Platinum 80 to 110

Resources:

ASHRAE Advanced Energy Design Guides
http://www.ashrae.org/standards-research--technology/advanced-energy-design-guides
Building Minds, Building Buildings
http://www.aft.org/pdfs/psrp/bmmbgreenguide0109.pdf
Center for Green Schools
http://www.centerforgreenschools.org
Cool School Challenge
http://www.nwf.org/Global-Warming/School-Solutions/Eco-Schools-USA/Become-an-Eco-School/Cool-School-Challenge.aspx
Efficiency Vermont
http://www.efficiencyvermont.com/Index.aspx
Greening Our Schools: A State Legislator's Guide to Best Policy Practices
http://www.centerforgreenschools.org/docs/GreeningOurSchools_PRINT.pdf
LEED for Schools
http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1586
Making the Grade: A Step by Step Guide for School Energy Champions
http://www.efficiencyvermont.com/for_my_business/solutions_for_me/K_12_schools/general_info/publications_and_resources.aspx
National Action Plan for Greening America's Schools
http://www.centerforgreenschools.org/docs/USGBC%20Mayors%20Summit%20Report_FINAL.pdf
Northeast Collaborative for High Performance Schools (CHPS)
http://www.chps.net/dev/Drupal/node/35
Paid from Savings Guide Executive Summary
http://www.centerforgreenschools.org/docs/paid-from-savings-guide-exec-summary.pdf
Shelburne Farms - Sustainable Schools Project
http://www.sustainableschoolsproject.org/
United States Department of Energy - Energy Education & Workforce Development
http://www1.eere.energy.gov/education/lessonplans/default.aspx
U.S. Green Building Council
http://www.usgbc.org/
Vermont Energy Investment Corporation
http://www.veic.org/index.aspx
Vermont Green Building Network
http://www.vgbn.org/
Vermont Superintendent's Association - School Energy Management Program
http://www.vtvsa.org/school-energy-management-program.php
VNRC Comprehensive Energy Guides
http://www.vnrc.org/energy/resources/energy-planning-implementation-guidebook-for-vt-communities/

SD07	Colchester		264-5999
SD10	Milton Town		893-3210
SD11	St. Johnsbury		748-4744
SD15	Burlington		865-5332
SD16	South Burlington		652-7250
SD17	Winooski		655-0485
SD40	Rutland City		773-1900
SD45	Montpelier		223-9796
SD54	Hartford	White River Junction	295-8600
SD55	School Administrative Unit #70	Hanover, NH	(603) 643-3073
SD56	Springfield		885-5141
SD59	Essex Town		878-8168
SD62	Rivendell	Orford, NH	(603) 353-2170

SU01	Addison Northeast	Bristol	453-3658
SU02	Addison Northwest	Vergennes	877-3332
SU03	Addison Central	Middlebury	382-1274
SU04	Addison Rutland	Fair Haven	265-4905
SU05	Southwest Vermont	Bennington	447-7501
SU06	Bennington/Rutland	Sunderland	362-2452
SU08	Caledonia North	Lydonville	626-6100
SU09	Caledonia Central	Danville	684-3801
SU12	Chittenden East	Richmond	434-2128
SU13	Chittenden Central	Essex Junction	857-7000
SU14	Chittenden South	Shelburne	383-1234
SU18	Essex Caledonia	Concord	695-3373
SU19	Essex North	Canaan	266-3330
SU20	Franklin Northeast	Richford	848-7661
SU21	Franklin Northwest	Swanton	868-4967
SU22	Franklin West	Fairfax	849-2283
SU23	Franklin Central	St. Albans	524-2600
SU24	Grand Isle	North Hero	372-6921
SU25	Lamoille North	Hyde Park	888-3142
SU26	Lamoille South	Morrisville	888-4541
SU27	Orange East	Bradford	222-5216
SU28	Orange Southwest	Randolph	728-5052
SU29	Orange North	Williamstown	433-5818
SU30	Orange Windsor	South Royalton	763-8840
SU31	North Country	Newport	334-5847
SU32	Washington Central	Montpelier	229-0553
SU33	Rutland South	North Clarendon	775-3264
SU34	Orleans Central	Barton	754-6945
SU35	Orleans Southwest	Hardwick	472-6531
SU36	Rutland Northeast	Brandon	247-5757
SU37	Rutland Central	Rutland	775-4342
SU38	Rutland Southwest	Poultney	287-5286
SU39	Rutland Windsor	Ludlow	228-2541
SU41	Washington Northeast	Plainfield	454-9924
SU42	Washington West	Waitsfield	496-2272
SU43	Washington South	Northfield	485-7755
SU46	Windham Central	Townshend	348-6801
SU47	Windham Northeast	Bellows Falls	463-9958
SU48	Windham Southeast	Brattleboro	254-3731
SU49	Windham Southwest	Wilmington	464-1300
SU50	Windsor Northwest	Pittsfield	234-5364
SU51	Windsor Central	Woodstock	457-1213
SU52	Windsor Southeast	Windsor	674-2144
SU53	Windsor Southwest	Chester	875-3365
SU57	Blue Mountain	Wells River	757-2766
SU60	Battenkill Valley	Arlington	375-9744
SU61	Barre		476-5011

VGBN

U.S. GREEN BUILDING COUNCIL CHAPTER

VERMONT GREEN BUILDING NETWORK - PO BOX 5384 - BURLINGTON, VT 05402