

A scenic photograph of a rural landscape in New Hampshire. In the foreground, a paved road curves through lush green grass and trees. In the middle ground, a white church with a steeple is visible among other buildings. The background features rolling green hills and distant mountains under a blue sky with scattered clouds.

SIEMENS

Ingenuity for life

**Madison, Freedom & Tamworth
New Hampshire**

**PROPOSED ENERGY PROJECT
PRELIMINARY ENERGY SERVICES REPORT**

**Submitted by: SIEMENS INDUSTRY
April 2017**



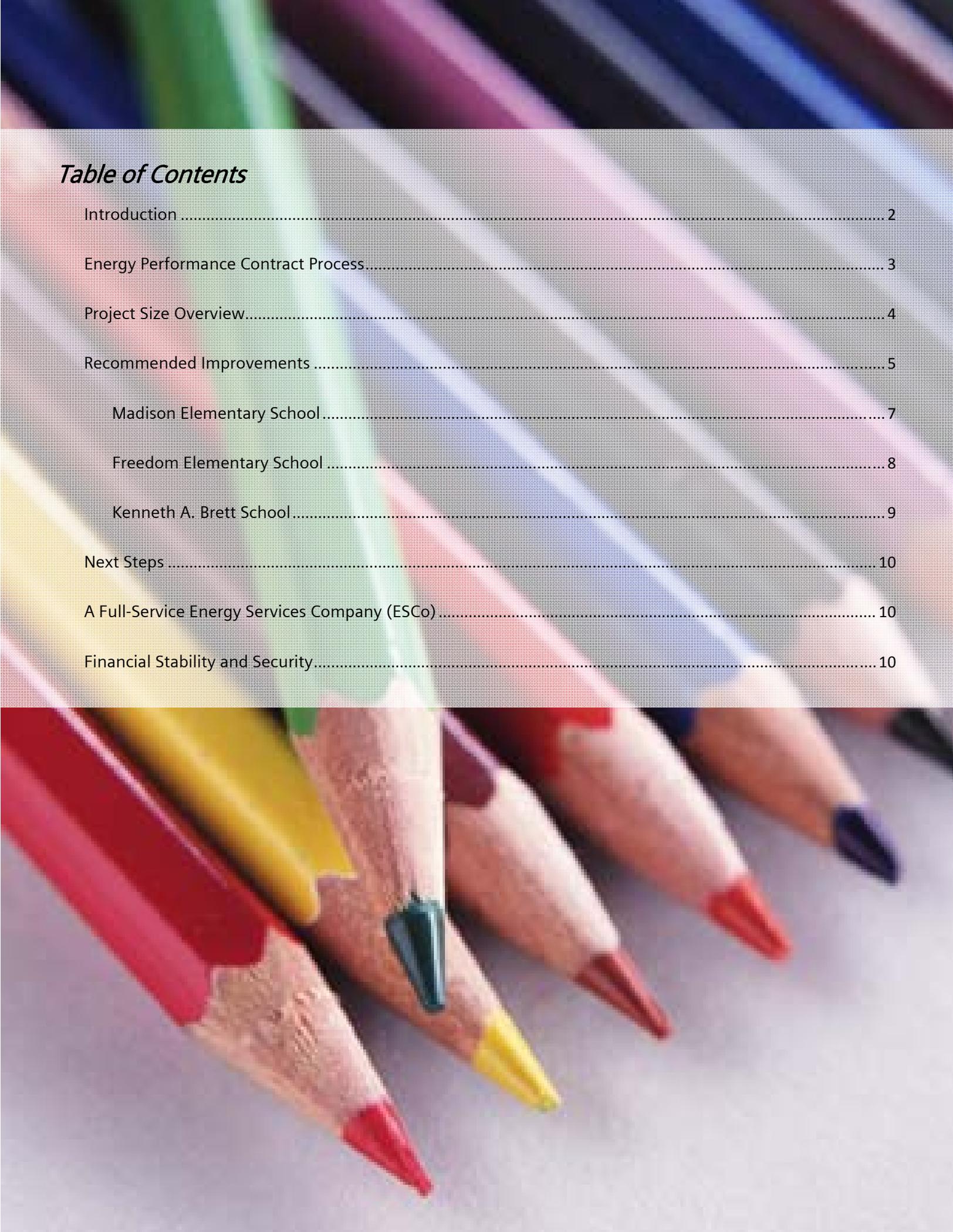


Table of Contents

Introduction	2
Energy Performance Contract Process.....	3
Project Size Overview.....	4
Recommended Improvements	5
Madison Elementary School.....	7
Freedom Elementary School	8
Kenneth A. Brett School.....	9
Next Steps	10
A Full-Service Energy Services Company (ESCO).....	10
Financial Stability and Security.....	10

Introduction

In the United States, the Building Technologies Division of Siemens has helped our customers realize more than \$2 billion in energy and operational savings over the past 10 years. We have implemented more than 1,000 Guaranteed Performance-based Solutions projects for our customers, updating thousands of buildings with the latest energy savings technologies. We have negotiated more than \$3 billion in energy supply contracts on behalf of our customers, and we take pride in the fact that our shortfall payments to customers are less than 0.75% of our gross guarantees.

Siemens has performed a preliminary walkthrough of some of the school buildings that serve the Madison, NH region. Our approach is to identify the opportunities, or Facility Improvement Measures (FIMs), and work toward integrating them into your capital budget process as well as identify opportunities for other funding sources. Siemens provides a comprehensive solution to your building upgrades and cost-containment needs while remaining flexible to your suggestions and goals. The Siemens team consists of highly qualified individuals with years of experience servicing the energy and building needs both locally and nationwide. Our definition of success is improving the operation of these schools from an energy standpoint for your taxpayers, students and staff; reducing your costs; and building a long-term business partnership by investing in your community. We appreciate the opportunity to earn your business.

"Together we have forged a team that has dramatically improved the condition and operation of my buildings. I appreciate the ownership they seem to have in the process, the performance of my buildings, and the function of our relationships."

*Michelle Clark, Business Administrator
Hopkinton School District*

The objectives of this project are as follows:

- Achieve significant long term savings that will pay for capital improvements to the school buildings.
- Leverage all financial resources available, including but not limited to, the Federal Government and NHSaves.
- Work directly with the district to bring Siemens Sustainability and Education programs, lessons and initiatives to the classroom level.
- Involve students in the development and educational opportunities of the energy reduction project, giving them a real world approach to STEM Education.
- Achieve a guarantee for potential energy and operations & maintenance savings.
- Obtain consistent levels of occupant comfort and building functionality.
- Capture ancillary benefits that may accrue as a direct result of such energy related services and capital improvements.

"The Barrington School District's \$1,409,835 Energy Performance Contract enabled the district to complete lighting retrofit, building automation, boiler and mechanical upgrades, walk in freezer controls, and destratification fans with an annual energy savings of \$118,382. We were able to address many issues that had been on our facilities "wish list" for years."

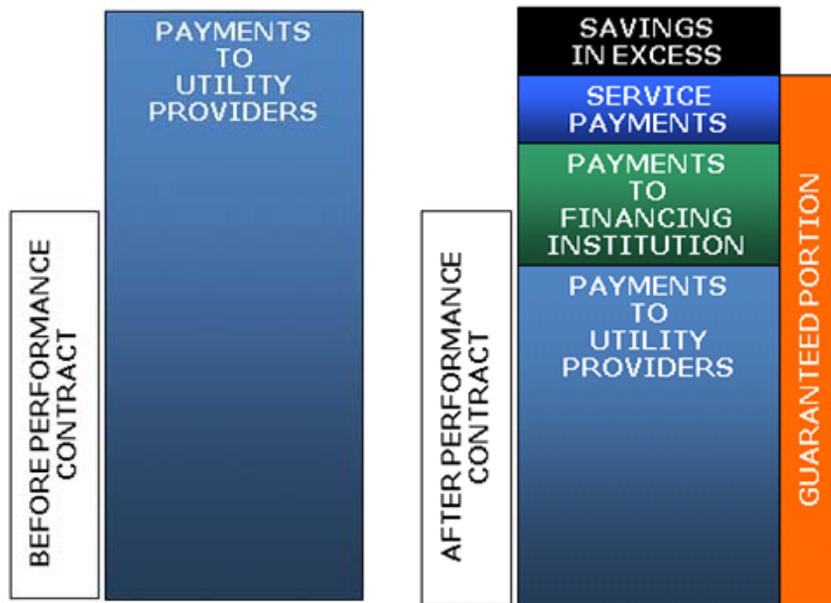
*Gail Kushner, Superintendent
SAU 74 – Barrington, NH*



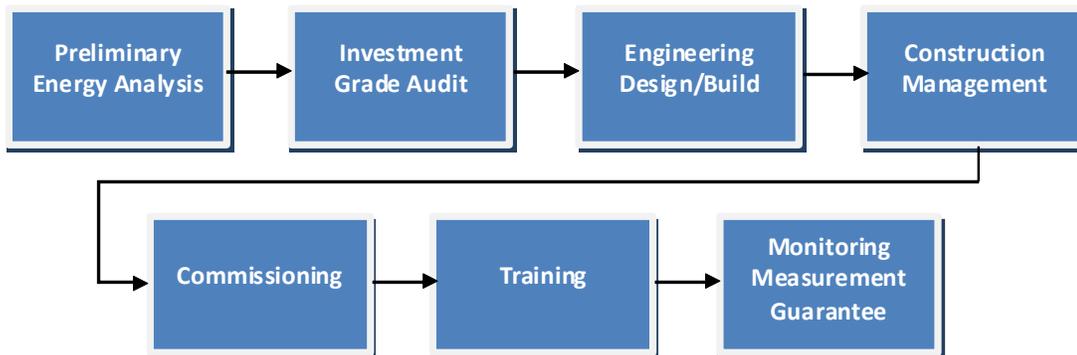
Energy Performance Contract Process

Performance contracting is a procurement process that enables K-12 districts to use energy savings within their existing buildings to fund necessary building upgrades, retrofits and other improvements (i.e. fire and security, infrastructure improvements, etc.) without having the customer budget any additional money (although any customer contribution would increase the size of the project). Siemens installs energy efficient equipment (lighting, controls, boilers, chillers, etc.), which reduces the existing energy budget, paying for the new equipment over time. There are no upfront costs and annual savings are guaranteed over the term of the agreement.

The following graph is a representation of the benefits of reallocating saved energy and operating dollars into facility improvements:



Siemens provides a structured approach and proven methodology to deliver innovative and cutting-edge design, engineering, and appropriate technologies—all designed to maximize the cost effectiveness of your project and optimize energy and O&M savings for your organization. We follow an extensive process to develop and implement the right solution for the customer. Siemens believes strongly in an interdisciplinary team approach to energy related projects. This team includes the Siemens account manager, Siemens energy engineers, Siemens project managers, and the owner. The following flow chart summarizes the steps involved for the schools in moving this preliminary proposal to a completed project.



Some benefits of the program include:

- Improved facility infrastructure
- Lowered operating costs
- Self-funded modernization of infrastructure
- Guaranteed cost reductions
- Reduced financial risk
- Improved operating efficiencies
- Improved occupant satisfaction and comfort



Estimated Savings Opportunities

Estimated energy savings were calculated for three schools: Madison Elementary School, Freedom Elementary School, and the Kenneth A Brett School in Tamworth. Generally, these new savings are related to equipment replacements (Due to age or failure) and the increased energy efficiency associated with the new equipment. In this analysis, Siemens Industry provides the anticipated project size and a description of the types of improvements recommended to achieve the estimated savings. These descriptions are intended to demonstrate the type of equipment modifications, installations, or replacements that Siemens Industry would consider as part of this project. In addition to the listed measures, all buildings would receive new user-friendly front end controls. There is also a potential for introducing thermal solar for domestic water heating system-wide, and a School/Municipality biomass partnership in Madison.

Project Size Overview

The utility data shown below was used to calculate potential savings and project size. Based on the District's current usage and our vast experience with guaranteed energy projects in New Hampshire and Maine schools, we expect that the district would save 30% in energy costs, or \$44,327 per year. This, along with a customer contribution of \$130,000, would allow the District a \$2,500,000 project.

School	1 year - 2016				
	Gallons #2	Fuel Oil \$	Kwh	kwh \$	sq.ftg
MES	8,816	\$17,329	233,262	\$36,193	35,669
TES	17,955	\$37,276	203,098	\$31,828	58,000
FES	5,066	\$10,132	109,908	\$15,000	25,000
Totals	31837	\$64,737	546,268	\$83,021	118,669
Total Energy Spend		\$147,758			
30% Project Savings		\$44,327			
Yearly Customer Contribution		\$130,000			
Potential Project Size		\$2,500,000			

Recommended Improvements

Lighting

The installation of new high-efficiency lighting will create cost savings for the schools to help drive the project as well as provide the optimal light level for your students to learn! Benefits to replacing the lighting throughout the schools include reduced energy costs, longer lamp life, reduced maintenance costs, reduced air conditioning costs, and consistent light color and quality.

Building Envelope

As a means to reduce the heating demand in the school, insulation is an integral part of a building's envelope and must function as designed to ensure that proper space conditions (heating and cooling) can be maintained for occupant comfort. Many older buildings have leaky doors and poor or missing weather stripping. Windows also often have leaky seals and are missing caulking between the window and the building. Openings in the roof and wall joints can also contribute to heat loss. Air leakage is random movement of air into and out of a building through cracks and holes in the building shell. In technical terms, air leakage is called "infiltration" (air moving into a building) or "exfiltration" (air moving out of a building). Siemens recommends a comprehensive weatherization program to reduce or eliminate sources of air leakage in all buildings. This would include but is not limited to:

- Replacing all worn or missing weather seals on all exterior doors
- Resealing and caulking all windows and skylights
- Caulking and sealing all pipe and flue penetrations through exterior walls and roofs
- Caulking all joints between walls, ceilings and foundations

Benefits include:

- Heating, cooling, energy will be reduced
- Heating ventilation and air-conditioning run times will be reduced prolonging equipment life
- Occupant comfort will improve
- Reduce drafts and cold spots in buildings

Ventilation and Heating System Automation

The amount of fresh air required in a space varies based on occupancy. The more people in the space, the more outside air should be delivered. The existing air handling units supply conditioned air to the spaces and have minimum control of outside air. The occupancy of these spaces varies throughout the day, but currently the amount of outside air delivered to the space remains constant. Demand control ventilation (DCV) is a control strategy that adjusts the amount of outside air based on the number of occupants and activity taking place in various spaces. Not heating or cooling unnecessary quantities of outside air conserves energy. Ventilation should be based on space requirements including the number of the occupants and activities within the space rather than using a fixed strategy based on design occupancy.

Siemens recommends using carbon dioxide (CO₂) sensors in the return air streams of air handling units to monitor the percentage of CO₂ in the space. Based on that percentage, the outside air, return air and exhaust air dampers can be more accurately controlled to supply the space with the proper amount of ventilation air. This reduces the energy required to condition the outside air. This type of control, called demand control ventilation, offers a means of optimizing the amount of ventilation required for a building or space. Energy savings are achieved by limiting the volume of outside air that must be conditioned.

DCV modulates ventilation to maintain target cfm-per-person ventilation rates based on actual occupancy. CO₂ is used as an occupancy indicator to modulate ventilation below the maximum total outdoor air intake rate while maintaining the required ventilation rate per person.



We recommend installing or implementing an open protocol control system with energy savings control sequences including occupancy-based Demand Control Ventilation (DCV) with 2-way control valves on (8) unit ventilators; Start Stop Time Optimization; DCV on cafeteria H&V unit (interlocking with kitchen hood); positive pressure building ventilation control; differential pressure pump speed control; and oil boiler plant optimization. The benefits to this measure are improved occupant comfort and reduced energy consumption.

Walk-in Cooler Replacement

In virtually all coolers and freezers, air is cooled by forced-circulation evaporators containing fan blades powered by fractional horsepower motors that move air across the evaporator coils. Typically, these fans run continuously even though, on average, full airflow is only required when the refrigeration compressor is operating. Replacement of the walk-in cooler, including sensors to control energy expenditure would reduce fan energy and costs, increase fan motor life, and reduce fan-generated heat in the cooler.

Heating and Mechanical Systems

Unit Ventilators: In unit ventilators that are past their life expectancy, not only is the efficiency and effectiveness of these units diminished, it is difficult to find the associated replacement parts. We recommend replacing these units, including upgrades such as new controls, new valves and any additional items required based on code requirements.

High efficiency motor replacements: We recommend the replacement of some of the Air Handler Units (AHU) and any other motor that would yield energy savings.

Water Heater Replacement: We recommend the replacement of the current oil-fired domestic water heater in Madison Elementary with a high-efficiency propane fired water heater. Benefits to this measure include lower fuel costs, protection from oil price swings, flexibility to switch fuels in step with regional availability, and the potential for reduced maintenance costs and emissions.

Boilers: In addition to the replacement of the boiler in Kenneth A. Brett School with high-efficiency boilers, we recommend re-piping the boiler room and HW circulation runs and replacing the HW pumps.



Madison Elementary School

Recommended Measures

- LED lighting throughout building
- Building Envelope Weatherization
- Install a new open protocol control system with but not limited to
 - Energy savings control sequences
 - Start Stop Time Optimization (SSTO)
 - Occupancy base demand control ventilation (DCV) on (8) unit ventilators with 2-way control valve
 - Occupancy base demand control ventilation (DCV) on CAV boxes and associated air handler
 - CO2 base demand control ventilation (DCV) on Cafeteria H&V unit, with interlocking with kitchen hood
 - Positive pressure building ventilation control
 - Differential pressure pump speed control
 - Oil boiler plant optimization
- Replacement of (4) old unit ventilators
- High efficiency motor replacement on cafeteria air handler and any other motor with saving opportunity
- Combine electrical power entrance into (1) three phase entrance
- Replacement of oil fired domestic hot water heater, with high efficiency propane fired.
- Walk in Cooler replacement
- Capital improvement measures such as roof replacement and oil tank replacement



Freedom Elementary School

Recommended Measures

- LED lighting throughout building
- Building Envelope Weatherization
- Implementation of energy savings control sequences on existing DDC control system, including any required expansion of the control system
 - Occupancy-based demand control ventilation (DCV) on unit ventilators with 2-way control valve
 - CO2 based demand control ventilation (DCV) on H&V units
 - Positive pressure building ventilation control
 - Differential pressure pump speed control
 - Oil boiler plant optimization
- High efficiency motor replacement on any other motor with saving opportunity
- Capital improvement measures such as roof replacement



Kenneth A. Brett School

Recommended Measures

- LED lighting throughout building
- Building Envelope Weatherization
- Implementation of energy savings control sequences on existing DDC control system, including any required expansion of the control system
 - Start Stop Time Optimization (SSTO)
 - Occupancy-based demand control ventilation (DCV) on unit ventilators with 2-way control valve
 - CO2 based demand control ventilation (DCV) on Gym and Stage H&V unit
 - CO2 based demand control ventilation (DCV) on classroom H&V unit
 - CO2 based demand control ventilation (DCV) on new Cafeteria H&V unit, with interlocking with kitchen hood
 - Positive pressure building ventilation control
 - Differential pressure pump speed control
 - Oil boiler plant optimization
- Installation of new cafeteria H&V unit
- Potential replacement of Unit Ventilators
- High efficiency motor replacement
- Re-piping of Boiler room and main hot water circulation runs.
- Replacement of oil fired boiler with new higher efficiency oil boilers
- Replacement of Hot water system pumps
- Capital improvement measures such as roof replacement, etc

Next Steps

The Siemens Energy Team recommends that the Madison, Freedom, and Tamworth Schools move forward with an Investment Grade Audit (IGA) as the next step in developing an energy saving performance contracting program.

A Full-Service Energy Services Company (ESCO)

Siemens is a full-service energy service company that can leverage global resources in energy services, renewable energies, sustainability, mechanical system design and installation, technology, and performance solutions. Whereas other ESCOs must procure all equipment from vendors and then mark up this equipment accordingly, Siemens' 'one company' delivery alleviates construction and warranty issues in a one number, one-call approach to problem solving.

The core of our offer is a cooperative approach to designing and building your project. Siemens provides an array of equipment directly from other Siemens' companies, such as Sylvania and Westinghouse, and from the worldwide network of Siemens' partner companies, such as Carrier, Trane, Viessmann and ABB, all at a significantly lower cost than you would pay through another ESCo. We therefore never insist on installing any one manufacturer's products; instead, we recommend the most cost-effective technology for the application.

Financing is available from Siemens Financial Services. No other ESCo can provide both in-house financing and global financing power to help you get the lowest cost for your performance contracting program.

"The quality and experience of Siemens' team of technicians is paramount in fostering creative energy management solutions, realistic project timelines, and accurate budget estimating, with quality installation."

*Jude G. Cyr, Business Manager
Auburn Department of Education*

Financial Stability and Security

Beyond technical capabilities, Siemens continues to be a dominant global and local leader in financial growth, stability and security. In today's economic climate, it is important to research the financial stability of the ESCo you are choosing as a long-term energy management partner. We back our performance contracts with our \$126 billion in annual international revenues and 117 years of security.

By combining the insight and oversight of services with the experience and capabilities of Siemens, the Energy Team is confident that we will provide these schools with an exceptional energy saving performance contracting program. We also offer the flexibility and the resources to align our team with your project immediately, so that together, we can best meet your energy performance goals.