Roadmap For A Solar Schools Project

How one school obtained full funding for a 72 kW solar PV installation

Prepared by Jeff Forward, Forward Thinking Consultants, LLC
September 30, 2009

Introduction

Large flat roofed buildings with good grid connections make ideal candidates for photovoltaic (PV) solar collectors. Vermont has many large centralized schools with flat roofs because in the 1960's and 1970's there was a significant movement to consolidate rural schools into union school districts. Camel's Hump Middle School (CHMS) located in Richmond is a good case in point. It is an 87,000 square foot school that serves approximately 500 students. It was built in the 1970's and has a large flat roof that was recently refurbished.

This past winter, Camel's Hump worked with Green Mountain Power to prepare a $250,000 grant application to the Vermont Clean Energy Development Fund for a 72 kW solar photovoltaic array on top of their school. The grant proposal was successful and the school secured another $250,000 in federal funding with the help of US Senator Bernie Sanders office.

This paper provides a roadmap for how this school conceived of the project, how it secured funding and how it is working to implement it.

Green Mountain Power's Solar Schools Initiative

In December of 2008, Green Mountain Power (GMP) Vermont's second largest utility, hired Forward Thinking Consultants to investigate the potential for establishing a Solar Schools Initiative. The idea was to identify all of the various incentives that are available for solar energy projects and see how they applied to schools. GMP reasoned that schools frequently are an excellent building type for solar PV, that the benefits from a solar energy project would benefit the entire community by reducing school operating costs and that renewable energy projects at schools provide an education benefit that is invaluable.

The first step was to identify a good candidate site and then explore funding opportunities for that site. Once the barriers and opportunities were identified for that school, they could be applied to other schools as well. In other words if the first candidate school was successful, then hopefully other schools could follow a similar path.

GMP was already engaged in an aggressive pursuit of solar PV projects. They had already established a solar rate tariff that pays producers of solar electricity 6 cents per kilowatt hour above the retail rate. And they established a goal of encouraging the installation of 10,000 solar panels in their service territory in 1,000 days. A Solar School Initiative fit well with their goals and objectives.

GMP committed to hiring Forward Thinking to investigate solar energy incentives for schools and once CHMS received their grant funding, GMP committed $14,000 in cash toward the project.

Camel's Hump Middle School

The school GMP chose to work with was Camel's Hump Middle School (CHMS) in Richmond. This school was chosen for several reasons. First it is in GMP territory and therefore was eligible for the favorable GMP solar rate. Secondly, this school abuts the I89 Interstate highway and is one of the most driven by and visible schools in the state. A solar project there would get a good deal of exposure. The school district had shown that it was committed to renewable energy and energy efficiency. They were an early adopter of woodchip boiler technology back in the early 1990's and was engaged in several projects to reduce its electrical energy consumption. Finally, Mr. Forward of Forward Thinking is a school board member for this district and knew his way around the building and who to talk to get buy-in and authorization for grant proposals.

The school building itself is 87,000 square feet with a large flat roof. The school recently replaced a good portion of the roof so a solar array would not need to be removed for roof replacement for quite some time. Additionally, this school had been built in 1972 and was originally electrically heated. Although it converted to a woodchip boiler system in the early 1990's, it still had much of the infrastructure necessary to easily interconnect a electric generation source to the grid.

Clean Energy Development Fund

The first funding source that was identified for this project was the Vermont Clean Energy Development Fund (VCEDF). In 2005, the Vermont General Assembly established the Vermont Clean Energy Development Fund with the goal of increasing the development and deployment of renewable energy resources - in Vermont. The Fund was established and funded through proceeds due to the state from Entergy Nuclear VT as part of their purchase of the Vermont Yankee nuclear power plant.

Forward Thinking prepared a VCEDF grant application for a 72 kW solar array atop CHMS for the school district. This turned out to be a significant effort. Mr Forward worked closely with Alteris Renewables, a solar technology provider to characterize the project and prepare the technical information needed for the grant. He then wrote the text and collected all of the necessary approvals from the school board and the district to submit an application.

At the time, the VCEDF would fund as much as 50% of the project cost up to $250,000 for a large project. Forward Thinking worked with Alteris to size a solar array with the goal of obtaining the largest grant possible. Alteris determined a 72 kW array would cost approximately $520,000 and the grant application requested the maximum amount of $250,000.

Federal Funding

Once the VCEDF grant was secured, getting funding for the remaining costs was critical for the project to move forward. In the current economic climate it would have been difficult and unlikely for the school board to propose a $250,000 bond vote for a project with an extended payback period. In this case, even with the favorable GMP solar rate, the project would have had less than a 5% annual rate of return or over a twenty year payback if the district had to pay the $250,000 matching funds that the VCEDF required.

With these barriers in mind, Forward Thinking and GMP approached US Senator Bernie Sander's office. One disadvantage a public school has over a private developer is that the federal government is currently offering a 30% tax credit for eligible renewable energy projects. Since schools pay no income tax, they are not eligible for this incentive. The case made to the Senator's staff was that this disadvantage wasn't really fair. They argued that schools in general make excellent sites for solar projects and that this school in particular was an exceptional because of its visibility and its strong commitment to renewable energy. If the federal government is going to offer generous incentives for renewable energy projects, then schools should be eligible for the same incentives as the private sector. Indeed a case could be made that schools should receive more favorable treatment because the benefits are spread over the entire community. Senator Sander's office was impressed and wound up matching both the VCEDF grant and GMP's cash contribution dollar for dollar.

With the Senator's help, the project is now fully funded. The project is in the design stage and construction will begin and be completed during the summer of 2010.

Process

Most school construction projects follow a well established path. First a need is identified and preliminary design work is performed enough to describe the project and estimate costs. Then funding is secured, often through a bond vote. Once funding is secured, final design and specifications are developed. Then the project is put out to bid. The school board is typically very involved with the development of the project and it is the responsibility of administrators to manage the project. From initial conception to construction can take many months if not years.

For a project that is innovative or involves alternative technologies, often a champion needs to be involved who can keep the idea alive. For example, over 25% of the student population in Vermont are in wood heated schools today. Vermont has over 40 schools that heat with wood, more than the rest of the country combined. These wood heated schools are of all different sizes and they are in every region of the state. The one common factor amongst all of them is that each had a local champion who kept the idea of biomass heating alive and in front of local decision makers during the long process of developing the project.

In the case of the Camel's Hump Middle School Solar PV Project, Jeff Forward of Forward Thinking was ideally situated to be an effective champion. Forward Thinking was hired by GMP to investigate the incentives that could be applied to solar projects on schools. GMP and Forward Thinking chose to learn by doing and so chose a particular school to work

with. The school that was chosen was Camel's Hump Middle School in Richmond in part because it was located in GMP service territory and in part because Jeff Forward had such a strong connection to the school. Mr. Forward has lived in Richmond where this school is located for over 30 years. He is a renewable energy consultant with a reputation in town on energy issues and technologies. In fact, he is the Town Energy Coordinator and has been since 1992. He also serves on the school board. While all of these factors are not necessary for an effective champion, they certainly helped.

Because Mr. Forward attended regular school board meetings he was able to keep the board up to speed on the development of the grant and the goals of the project. While it is not necessary to be on the school board to be an effective champion, it is important to attend regular meetings and make sure the project is getting the necessary buy in along the way. And because he was working with GMP on their Solar School Initiative, he was able to secure their support early on in the project.

The project is now in the design stage and will likely go out to bid sometime this winter. Construction will take place during the summer of 2010. It is important for the champion to follow the project through construction to make sure that key elements of the project are not dropped. Mr. Forward continues to be involved by meeting with the design team and suggesting complimentary projects that may be cost effective to consider at the same time the solar project is being developed.

Complimentary Projects

Transformers

One of the attractive attributes of Camel's Hump is that when it was built, it was originally an electrically heated school. This meant that the school had an established high voltage interconnection with the utility grid that presumably could be used to feed power back to the grid as well. However, since this school was built in 1972 and the transformers in the building were nearing the end of their useful lives. The district had in its capital plan a plan to redesign the internal electrical distribution system of the school and hopefully eliminate some of the transformers that were no longer needed. Transformers have stand-by losses and this building had more transformers than they now needed and they were grossly oversized since they were originally designed to accommodate electric heat.

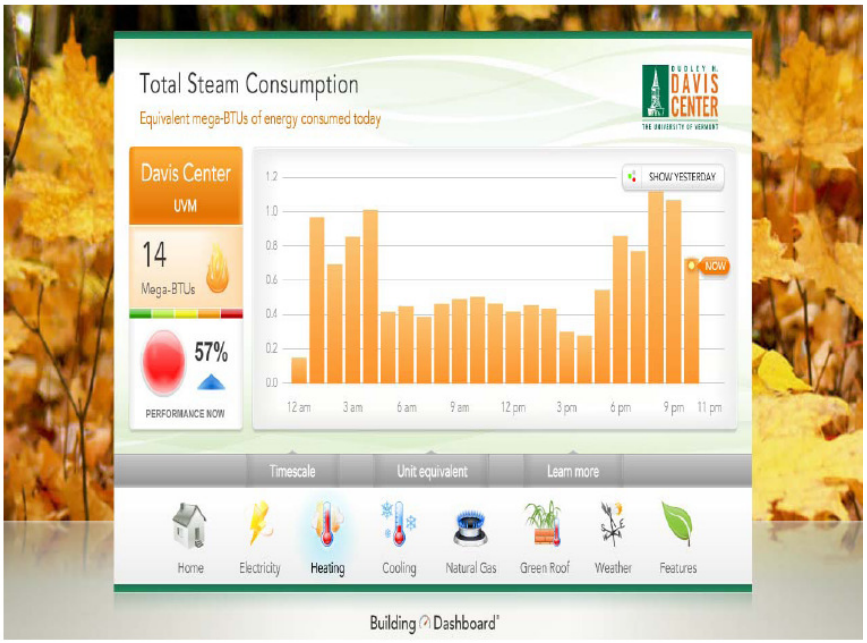
The district decided that the time to re-design the electrical system was before the solar systems was installed. This is a significant project that is expected to cost at least $250,000. But it is a necessary project that compliments the solar project and will save nearly as much energy as the solar PV will produce.

Lighting Retrofits

Another project that was considered at the time the transformer replacement project was underway was an extensive lighting retrofit. The district asked a lighting engineer to walk through the building to identify possible energy efficiency improvements. The thought was that there may be some economies to be gained by incorporating efficiency improvements at the same time as the transformers were being addressed. The lighting engineer did indeed

find some significant opportunities, but the timing was a little off. By the time the lighting engineer completed his report, the transformer project was well underway and it was felt that the lighting efficiency measures could be done as a stand-alone project some other time.

Energy Dashboard



The district is planning to integrate the solar PV equipment with its curriculum. An "Energy Use Dashboard" system will be installed at the school at the time the solar PV system is installed. The Energy Use Dashboard will track real-time and historical, energy production data from the solar array and also resource-consumption data from other significant building systems such as boilers systems and electrical energy use. In addition to providing useful data for efficient building operation, this tool will help bring home an important sustainability message to classrooms. This type of web-based software will help broaden the public's understanding of the environmental impacts of resource use, while demonstrating environmental leadership and the wise use of tax dollars. An example of such an energy use dashboard can be seen above and found at the Davis Center at UVM. http://buildingdashboard.com/clients/uvm/davis/.

Energy Bond

The Federal American Recovery and Reinvestment Act (ARRA) established a new tax-credit bond called Qualified School Construction Bonds to finance the construction, rehabilitation, or repair of a public school facility or the acquisition of land to build a public school facility. Vermont received authorization to issue $25 million of these bonds in 2009 and will likely get authorization for another $25 million in 2010. The successful fundraising for the solar project and the transformer upgrades at CHMS helped focus the district's attention on energy infrastructure and energy efficiency opportunities. So when the state department of education announced the availability of zero interest Qualified School Construction Bonds, the school board's finance committee identified necessary energy infrastructure improvements and searched for other energy projects that could save on operating costs.

These zero interest bonds can be used for any qualified school construction project, but the district felt that this was a tough time to go to voters for just any project. They felt that a project that saved on operating costs would have a much better chance of passing. So the finance committee mined its capital plan and found that their two remaining schools needed to upgrade their electrical transformers too, an expensive but necessary capital improvement project. Then the district took the knowledge gained from the energy audit of CHMS and extrapolated the costs and savings to all three of the district school. They identified a total of $200,000 worth of interior lighting efficiency improvements in all three schools that had a combined annual savings projection of over $56,000. Finally, a seventh grade class had recently applied for a grant to replace a couple of parking lot lights with solar powered LED lights. The class did not get the grant, but they did establish an estimated cost that the finance committee was able to extrapolated to the rest of the parking lot lights in two schools.

The board ganged these three projects, transformer upgrades, interior lighting retrofits and solar parking lot lights together into a $1.3 million Energy Bond that was put to voters in October 2009. It passed 800 – 300.

The key to this successful bond vote was twofold. First the bonds were zero interest, saving the district over $375,000 in interest over 15 years. The voters recognized that some of these projects, the transformers in particular, were projects that needed to be done and the zero interest deal helped the district do them more cost effectively. Secondly, by ganging several energy projects together, the overall operational savings were projected to be more than the cost of the bond over the 15 year life of the bond. The interior lighting efficiency measures in particular were extremely cost effective.

Yet these efficiency measures would have been difficult to implement unless they were attached to another project that required bonding. $200,000 is typically too small to bond for in and of itself and too large an amount to squeeze into an annual budget. By linking the efficiency projects to the larger transformer project, the district was able to combine costs and savings and justify the bond to the voters.