

Energy Savings in a Manhattan Co-op

At Cabrini Terrace, decision makers come equipped with a good deal of knowledge and a powerful determination to save energy.

by Andrew Brooks

Projects to install advanced energy efficiency measures in multifamily buildings can be complex and capital intensive. They demand vision, knowledge, and perseverance on the part of key players and decision makers. When the building is a cooperative or condominium, these needs are magnified. Cabrini Terrace is a multifamily building that exemplifies what can be accomplished when this is the case.

Cabrini Terrace is a 217-unit private co-op apartment building located in the Washington Heights neighborhood of northern Manhattan. Nearly four years ago the president of the co-op board, Jim Dwyer, set the building on a path toward energy efficiency. He has scarcely had time to look back.

Inspiration

Dwyer's lightbulb moment (no pun intended) occurred back in 2003. Recently returned from Iraq, where he had been reporting on the early stages of the U.S. invasion, Dwyer had become acutely aware of the political ramifications of our country's dependence on foreign oil. As he walked out of his building on an exceptionally windy day, his hat blew off of his head. While chasing his hat down the street, he had the sudden notion of capturing that wind and using it to produce power for his building. He began to research alternative energy, reaching out to a variety of energy professionals to get their opinions about installing



Thanks to the political resourcefulness of the board of Cabrini Terrace, all PV systems up to 50kW in New York became eligible for a 25% state tax credit.

small-scale wind turbines on the roof of Cabrini Terrace.

The general consensus was that wind turbines in an urban setting were still a relatively untested technology, and that other proven technologies—namely, PV or combined heat and power (CHP)—might be more suitable. Dwyer examined CHP and PV from a return-on-investment perspective and decided that CHP was the best bet (see “A Macro Market for Micro-CHP?” p. 32), so he began to look for an expert in the field. All of the energy professionals he had spoken to thus far pointed him in the direction of Steve Stone and Jim Armstrong of DSM Engineering Associates (DSMEA).

Luckily, Dwyer and the board at Cabrini never expected a lightning-fast payback from the PV system. They understood the necessity of addressing inefficiencies in existing building systems before addressing in-house power production. For this, Cabrini Terrace brought in Fred Goldner of Energy Management and Research Associates, and the organi-

zation that I work for, the Association for Energy Affordability (AEA), to perform an energy audit under New York State Energy Research and Development Agency (NYSERDA's) Residential Technical Assistance program, known as ResTech.

The ResTech audit would take a holistic view of the building, its shell and its systems, and help Cabrini address the “low-hanging fruit” of energy conservation opportunities. The audit report would also qualify the building for the low-interest Energy \$mart loan that it desperately needed to fund the more costly projects.

While the ResTech audit was under way, Stone's initial site visit revealed that Cabrini Terrace was probably a good candidate for CHP, but that the building would

have to convert from direct metering to master metering (with submeters for the apartments) in order to move forward with either CHP or PV. This conversion was necessary because in New York City, feeding power back out to the local utility grid is not allowed under the utilities interconnection specifications. Therefore, the CHP and PV systems must be connected to an electrical load sink large enough to utilize their full output, or their output must be reduced as required to prevent power flow back to the grid—neither of which was desirable.

Metering Decisions

Jim Carey of Bay City Metering was brought in to explore the move to master metering. Typically we think of submetering as an energy-saving measure only when the building is master metered to begin with. However, under a master meter, the building could purchase electricity at a discounted wholesale price while still charging the shareholders what

they would have been paying to the utility. This rate differential would create a revenue stream that could be funneled into the CHP or PV financing plan.

In February of 2006, Dwyer sent out a letter to the shareholders that explained the benefits of master metering from a financial standpoint. The letter also explained how master metering would enable Cabrini Terrace to move forward with CHP and PV in the future. Dwyer was able to garner the necessary support so Bay City Metering moved ahead with obtaining a \$64,000 incentive from NYSERDA's Comprehensive Energy Management (CEM) program, and Cabrini Terrace made the conversion to master metering.

The Appeal of PV

Soon after the meters went in, the building formed a committee of highly motivated shareholders that would be dedicated to seeing all of these potential energy projects through to completion. Although the economics for CHP appeared more attractive on paper, the building as a whole was sold on solar electric. Dwyer noted that CHP was difficult for many residents to wrap their heads around, but solar panels were "sexy."

Stone brought in a variety of solar contractors to offer Cabrini proposals. Ultimately, the winning bid was awarded to AltPower of New York City. Once the costs came in, Dwyer and the board began to research their financing options. They found that there were both state grants and federal tax incentives available for PV projects. However, they also discovered that New York State's tax credit for 25% of the installed cost applied only to PV systems that were 10 kW or less; this was 5 times smaller than the planned system at Cabrini Terrace. Not to be deterred, board members Laura Hembree and Gene Berstein spoke with Herman D. Farrell, a Democratic state representative, and Dean Skelos, a Republican state senator. After listening to the argument put forth by the Cabrini

residents, Farrell and Skelos determined that by expanding this tax credit they would enable the installation of renewable energy devices throughout New York City. They sponsored a bill that changed the tax credit so that it could be used by apartment houses, and then-Governor Eliot Spitzer signed the bill into law on July 3, 2007. All PV systems up to 50 kW became eligible for the 25% state tax credit.

Early on in the process, Dwyer had discovered that NYSERDA was not only an invaluable source of information but also a critical funding resource for all energy-related projects in New York State. NYSERDA was offering an incentive that amounted to \$200,000 toward the PV system.

In addition to what the state offered, there was a federal tax credit worth up to 30% of the system cost. Unfortunately, individuals who pay the alternative minimum tax are not eligible for that credit; and it just so happened that many of Cabrini's residents were subject to that tax. Therefore, the board had to remove it from their budgeting plans. They could not assess the shareholders for the value of a tax credit that most shareholders would never realize.

To top it off, all of the PV proposals, as well as the CHP proposal, had included depreciation in their financial analyses. However, private cooperative apartment buildings in New York City are operated in such a way that they do not make a profit, and actually retain book losses every year. No profit means no income tax. No income tax means no benefit under the capital depreciation provisions of the tax code. Dwyer and the board had to rethink their financing once again and figure out how they could get PV to pay for itself over time.

In February of 2007 Cabrini was facing a deadline. The state was about to lower its \$4/W PV subsidy, which would have resulted in a \$25,000 loss of financing for Cabrini. Dwyer and the board explained to Anthony Pereira of AltPower that they were no longer going to be able to factor depreciation or the federal tax credit into their

financing plan, and that they were not even certain whether they would make the cutoff date for the higher-level state tax credit. The parties reviewed all cost elements and reached agreement on a new budget that would enable the project to move forward.

Completion of the ResTech audit enabled Cabrini to gain access to the low-interest loan, which covered the balance of the PV system and the metering project. After that, things moved very quickly. The system was installed, and, with much fanfare, it was commissioned on January 24, 2008.

Combined Heat and Power

The CHP system is presenting its own unique set of technical and financial challenges to Cabrini Terrace. The revenue stream from the meters and the PV system is currently enabling the design for the CHP system to move forward, but further financing will be necessary before the installation can begin.

When Dwyer initially contracted with DSMEA to perform the CHP feasibility study, he requested that it also examine the potential for an absorption chiller for the lobby area, and the implementation of backup power generation in the event of a blackout. The building was in the process of having its lobby renovated at the time, and the board had planned on installing a 5-ton electric chiller. The idea was that the building could instead install an absorption chiller to increase the thermal utilization of the CHP system in the nonheating months. The DSMEA study revealed that the absorption chiller would offset only about \$3,000 in electrical costs for the electric chiller; however, the use of CHP thermal energy to drive the chiller would reduce the energy available to produce domestic hot water (DHW). As a result, the DHW load requirements would have to be met by the boiler. The fuel costs associated with that DHW production would be approximately \$4,000. Therefore, DSMEA did not recommend the installation of the absorption chiller.

Dwyer and the other Cabrini residents had decided early on that if the PV and the CHP systems were going to be generating nearly 70% of their electrical energy on site (DSMEA estimate), they should certainly be capable of supplying standby power in an emergency. Therefore, they requested that standby power for one elevator; cold fresh-water supply to the apartments; and access/egress lighting throughout the hallways, stairs, and public common areas be included in the CHP proposal. As mentioned earlier, feeding power back out to the grid is not currently allowed in New York City. This prevented DSMEA from designing the CHP system around a synchronous cogeneration unit in direct parallel connection with the grid. In other words, the CHP units would not be able to function as the backup power units, so a separate backup generator would need to be factored into the design at an additional cost of approximately \$100,000.

There is still a chance that the primary CHP units could also function as the backup power units if DSMEA decides to go with microturbines instead of the more common reciprocating engines. This and many other technical issues associated with the CHP system are still being examined.

Multifamily Performance Program

At that time, NYSERDA was preparing to roll out its new Multifamily Performance program. This program would offer Cabrini Terrace the opportunity to receive significant incentives to install the measures recommended in the ResTech audit, to partially fund the CHP project, and to include additional measures in the overall scope of work. Dwyer contracted with AEA to guide Cabrini through this new program and help the building through the challenging process of getting engineering studies performed, as well as bidding and awarding contract work.

AEA performed NYSERDA's initial benchmarking analysis of Cabrini

Terrace, which ranks a building's current energy performance level in reference to a nationwide HUD database. The building scored in the 50th percentile. This is a relatively high score, compared to that for typical New York City buildings, but it is still low enough to allow plenty of room for improvement. Once a finalized scope of work was agreed upon, AEA was able to project a 26% overall savings potential.

One of the highlights of the Multifamily Performance program is that the incentives are staged over the duration of the project. The fourth and final incentive—the performance incentive—is calculated based on the amount of energy the building actually saves after the measures have been installed. A market rate building like Cabrini Terrace, depending on its initial benchmarking score, receives \$125–\$200 per unit for reaching the 20% energy reduction target. For each additional percentage point of savings, the building receives an additional \$20 per unit. Those incentive rates are doubled for affordable housing.

One potential savings opportunity outlined in the initial audit report was to upgrade the elevator system. AEA brought in vertical transportation system consultants Van Deusen and Associates to perform a feasibility study for upgrading the two existing elevator motor generator (MG) sets to AC motors with variable-frequency, variable-voltage drives. The study revealed that the MG sets had been replaced relatively recently and still had significant useful life left in them. The high cost associated with their replacement, and the relatively small savings potential that the study revealed, helped AEA determine that the measure was not cost-effective and should not be undertaken.

Among the other audit recommendations were numerous upgrades to Cabrini Terrace's heating system, which is a two-pipe variable-vacuum steam system fed by a 300 hp Scotch marine boiler. Significant balancing issues were found with the steam distribution.

The primary steam supply valve is currently being controlled with an Intech 21 ZVLC outdoor reset control, which modulates the valve to vary the flow of steam based on outdoor temperature. AEA determined that by upgrading the existing steam valve controller to include indoor temperature sensors located in apartments throughout the building, and an online monitoring platform, it could target ideal locations in which to install thermostatic radiator valves. Installing these valves in the overheated apartments would enable Cabrini to lower its overall temperature, realizing approximately \$5,000 per year in savings.

Another heating system measure that is being explored is the installation of an advanced micromodulation combustion control system to monitor and modulate the firing rate of the burner. This control maintains consistent fuel to air ratios across the full range of firing rates, and thus maximizes combustion efficiency.

Stay Tuned

What began for Dwyer as the simple idea of reducing his building's energy costs and environmental impact has turned into a managerial saga of epic proportions. But the results that Cabrini Terrace has realized thus far, and is expected to realize when work is completed, are a testament to what an apartment building with an informed and proactive leader and a motivated and determined group of residents can accomplish. **H_e**

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For more information:

Readers interested in programs and strategies for energy efficiency in multifamily housing may want to attend AEA's upcoming conference, **Multifamily Buildings 2008: New Opportunities**, to be held July 21-23 in New York City. Web site: www.aeancf/MFB2008.