A CARBON CLOUD WITH PLATINUM LINING

Richard Stott, AIA, LEED AP[1]

INTRODUCTION

Picture this. On a freezing December day, a few days before Christmas, 2008 an electrical fire started in the basement utility room. The burn damage was so severe at the origin site that the exact cause could not be determined, but the theory is that a transfer switch connected to an emergency power generator started the fire when an auto test series was initiated. The fire quickly spread to the ceiling of the basement utility room, which was not fire rated, and burned the floor out of the kitchen above, at the center of the two-story home. In a very short time, the kitchen collapsed into the basement.

The fire began shortly after the five family members left for work and school and was discovered by a worker who arrived to complete a bathroom remodel. Thick black smoke poured through every vent to the outside. By the time firefighters gained control of the blaze, the 3,000-sq-ft house and everything in it was ruined.

If this image conjures a big black carbon cloud for you, imagine what the family was going through. Everything they owned was burned or covered with black soot and ice. It was a devastating blow to a smart young family going about their daily lives. It was the epitome of a dark cloud, and a silver lining seemed only like a myth.

About the same time, a group of local tradesmen called the Hamptons Green Alliance (HGA), who organized a few months earlier, were busy soliciting local architects. Through the AIA Peconic, the HGA sent an e-mail blast to all members in order to find a project they could initiate in order to exercise their old and new sustainable building skills. Their goals were to apply their cumulative knowledge and expertise in sustainable practices and integrate them into a sum greater than the parts. Each individual company had experience, but never before had they consciously collaborated on a design that integrated all their systems at once. All would share the benefit and help the HGA raise the bar on sustainable building so they could offer experience, expertise, and specific energy usage and production data, including life cycle analysis, to future clients. They offered their services at their cost, to any architect's client interested in a new house or remodel that would be rebuilt with the highest and best sustainable practices possible. At the peak of the financial panic, AIA members found no takers.

Richard (Ric) Stott, AIA LEED AP, architect, was a friend of the fire-struck family and of course offered help. After the first meeting with another family friend and architect Craig Lee, AIA, it struck Ric that this would be the perfect project for the Hamptons Green Alliance. The owner agreed, a meeting was scheduled, and a project involving all major trades, the architects, owners, and even the insurance adjusters was born. It was not hard for Ric to convince the team that the LEED for Homes program would be appropriate for this project and soon the team began meeting once a week to focus on goals, discuss strategy, and learn about the requirements of the LEED for Homes system.

By default, it was an "Integrated Project Delivery" (IPD). All the team members were in play from the beginning, the budget was fixed at what the insurance claim paid, plus the owners' out-of-pocket expense to add a family room and bedroom. The commitment was made by the HGA members to work for no profit, which allowed the family to make the additions and improvements.

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At weekly meetings, the team decided to pursue LEED Platinum status, to incorporate all renewable technologies that were economically feasible, but first and foremost we would incorporate high performance building science as our basic energy conservation methodology. Besides aiming for LEED Platinum status, the team also established the goal to rebuild this project as carbon neutral.

A major decision had to be made with respect to the existing structure. To demolish the house or salvage the frame was a dilemma. Building from scratch would be easier, faster, and probably cheaper, but was it the most sustainable? Does saving the remains of a charred wood frame add or subtract from the overall carbon footprint? Certainly, bringing the framing and sheathing to the landfill is not a carbon friendly concept. The family was concerned that if we saved the structure, it would retain the smoky smell and wanted a guarantee that no odors would be perceived, even on the hottest summer days. We contacted a number of fire renovation companies and they all agreed that full encapsulation would have to be performed on the structure after we cleared the burned and structurally compromised framing away. The majority of the frame was structurally sound and it would be difficult to recycle it, so the decision was made to re-use the frame and most of the exterior sheathing including a good portion of the existing cedar shingles.

KEYWORDS
LEED for Homes, LEED Platinum, solar thermal, evacuated tubes, geo-thermal, USGBC, Solatube, high/low density spray foam insulation, rainwater harvesting, photovoltaic, carbon neutral, wind turbine, Energy Star

RENEWABLE ENERGY AND SYNERGIES—SUN, WIND, AND WATER

By circumstance, the existing Southampton, New York, home was oriented straight south. The 1,500 sq feet of south facing roof offered a number of opportunities. The existing roof pitch was 8/12 or about 34°—nearly perfect for our 41° north latitude.

Sun Systems—Two Types of Photovoltaics (PV)

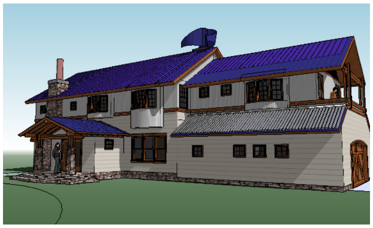
It would have been easy to install solar photovoltaic panels on an asphalt roof; we see it all the time. There were those on the team who pushed for panelized PV because they are more efficient and more cost effective than thin film or shingle type solar PV, but we all know what that looks like and wanted to do better. We decided on a Building Integrated Photo Voltaic (BIPV) system manufactured by Uni-Solar. Thin film photovoltaic panels fit perfectly between the ribs of a standing seam metal roof. There are two sections of roof area, the main roof and the garage roof. We extended the rafter tails to provide proper sun shading for summer sun at this latitude of 41°N, which also allowed us to install 18-ft long thin film photovoltaic strips. Each 18-ft strip produces 136 watts and there are 36 18-ft strips, for a total of 4,896 watts. The smaller roof has 21 68-watt strips, for a total of 1,428 watts.

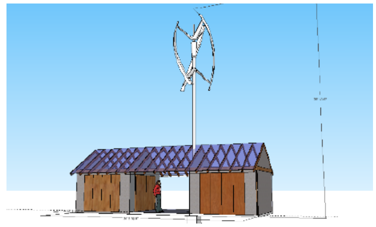
In order to bring the total to 10 kW, the maximum allowable for the local utility company rebate program, we added 16 standard type PV panels manufactured by Sun Power, 4 225-watt panels on an east-facing roof, and 12 230-watt panels on a west-facing roof. The 4 panels on the east roof are installed to resemble skylights and are barely visible from the ground. The 12 panels on the west roof are not visible at all from the property.

Wind

The prevailing wind is from the Southwest in summer and Northwest in winter. We originally planned for a 2.4-kW vertical-axis wind generator to be placed on the north side of the main ridge on a chimney-like structure. These Mag wind turbines, as they were known at the time, would work better in theory because the air hitting the roof plane would accelerate over the ridge. Engineers claim that an increase in velocity of up to 40% can be expected, but each installation must be analyzed with respect to average wind speed, terrain, obstacles, and turbulence. The increased velocity would reap a benefit in increased power production. Also, the vertical-axis turbine is more efficient in a turbulent and shifting air than a horizontal/propeller type turbine. During our energy analysis it was determined that two of these units would be required to reach our net-zero energy goal.

We liked the specifications and aesthetics of these units, but the manufacturer was not quite ready and could not confirm a delivery date, but, more important, could not provide a working unit with complete production data for comparison.





Even more of a problem was the fact that none of the vertical-axis turbines had received New York Energy Research and Development Authority (NYSERDA) approval and were not approved by the Long Island Power Authority (LIPA) for the rebate program. Since the budget had little room, the rebate was a requirement. In searching for an alternative, including horizontal machines, the one that claimed to be closest to NYSERDA approval was a vertical axis machine manufactured by Urban Green Energy (UGE), a Chinese company. The 4-kW unit was expected deliver between 8,000 and 12,000 kWh per year.

Inverters

Because we have four separate systems in terms of panel sizes and output, we need four separate inverters: one inverter for the 36 136-watt panels, one for the 21 68-watt panels, one for the 4 225-watt panels, and one for the 12 130-watt panels. The total wattage is 9,974 watts, just 26 watts less than the maximum allowable for rebate from LIPA. At the time of the application, fall of 2009, the rebate was $3.00 per watt for a total of $29,922. If and when the wind turbine is approved for rebates and the system is installed, another inverter specifically for the wind unit will be required.

Although there were a number of concept models that indicated the wind units on the house, the UGE unit was ultimately designed to be placed in the rear yard of the property and a shed/poolhouse was designed to be constructed in the future at the base of the 38-ft tall assembly.

Throughout the construction phase, we attempted to get more information about these units. The units are manufactured in China, and there are only two operating in the United States. The closest unit to our location is owned by Lucent Technologies, who bought the 4-kW unit as a test bed to potentially use on cell towers. Lucent engineers installed the unit on top of a large flat-roof building in New Jersey. The installation is not in an ideal location as surrounding trees and the building itself create significant turbulence. However, the Lucent engineers determined that the unit was only reaching about 20% of capacity, even when the wind was available to spin the rotor. This information, in combination with the fact that our local energy provider, the Long Island Power Authority (LIPA), had not yet approved the unit for its PV and Wind Energy Conversion Unit rebate program, was reason enough to abandon the wind energy aspect of this project, at least for now. For me, wind energy was the most exciting of the renewable technologies because it is new, has enormous potential, and is a visually pleasing application. Although I still hold hope for the inclusion of a wind unit, it is admittedly the most disappointing aspect of the project.

Hot Water (Solar Thermal)

A 214-sq-ft evacuated tube solar thermal (solar hot water) system will be installed on the lower garage roof. The array consists of 3 30-tube units manufactured by Sun Maxx. The total performance expectations are as follows: daily 105,000 BTUs,

Three 30-tube solar thermal evacuated tube units.

monthly 3,164,000 BTUs, yearly, 38,497,000 BTUs. They are connected in series on a section of roof that receives full sun, all day. The 3 30-tube units transfer heat via a manifold that circulates to two transfer units in the basement. The first heat exchanger transfers heat to a 100-gallon domestic hot water tank, the second exchanger transfers heat to a 250-gallon water storage tank where it is held to be used for various energy needs depending on the season and the demand. In the winter months, the heat from the storage tank is the primary source for the two-zone HVAC system. Hot water is circulated to the fan coil units when one or both thermostats call for heat. If the storage tank cannot meet the demand, the system switches over to the geo-thermal heat pump as a source for heat. In the summertime, the hot water storage tank supplies heat to the swimming pool after the domestic hot water tank reaches capacity. When the hot water storage tank cannot meet the pool heat demand, the system switches to the propane fired pool heater.

During the design process, we also considered using solar thermal heat for a liquid desiccant dehumidification unit, which uses latent heat in the water storage tank to dry humid inside air prior to cooling by the geo-thermal unit. The pool heat solution for the summertime heat dump was economically and functionally more valuable, especially since the family intended to avoid using summertime air conditioning.

Rainwater Harvesting

Lawn and landscaping requires a large amount of water. Electricity is required to pump well water since this location has no public water supply. The project includes a 1250-gallon water tank buried in the back yard. The gutters and leaders from the roof carry water to a filter and then to the tank where it is stored and used exclusively for landscape irrigation. This reduces the load on the domestic water use and the energy required to pump water from the on-site well. The 1250-gallon storage is capable of handling 100% of the irrigation needs.

Daylight

The original design concept included a linear skylight running the length of the upper hallway, about 40 feet long. The cost of building a shaft was complicated because the original house was a modular

Sola-Tubes light the second-floor hallway.

home. The roof, constructed of 2 × 6 trusses at 24″ on center, would have made it difficult to build. Using four Sola-Tubes™ we collect sunlight from four small domes on the back side of the roof. Sunlight is passed through highly reflective tubes about 10 inches in diameter and exits in the ceiling of the second floor hallway. This reduces the need for electric lighting and provides bright white daylight during the daytime. The tubes are so reflective that even moonlight is cast into the space at night. The interior side of the tube looks like a wide diameter recessed light; in fact, compact fluorescent electric lights are built into the four Solatubes so at night they light just like any recessed light. These units cost significantly less than skylights, about $500 each plus installation.

GEO-THERMAL HEAT PUMP

These units, also called water source heat pumps or ground water heat pumps, are basically air conditioning units that work in both directions, that is, they can run in one direction, compressing a gas which changes state into a fluid as it heats and is circulated to fan coils via insulated piping in the heat mode. The fan coil blows filtered air over the hot coils, which is distributed throughout the building for heat. When the unit is run in the cooling mode, the fluid is pumped through an expansion tank. When the fluid expands, it cools rapidly. The cold fluid is run through piping to the fan coil units where inside air is forced over the cooling coils and distributed. The primary difference between a geothermal heat pump and a standard air-to-air heat pump is that ground water from an open or closed loop system is used to "pre-condition" the air conditioning fluid. Since ground water is consistently in the 55°F range, the latent heat can be used to reduce the temperature spread of the fluid. We used an open loop system for this installation. There is a supply well and a dispersion well, and a variable speed pump that runs in proportion to demand.

The unit we include is manufactured by Florida Heat Pump ES061 Envirosaver, and is rated at 4/5 ton unit, a two-stage machine with high load and part load capabilities. With a heating airflow rate of 2000 cfm and 14 gallons per minute the Full Load rating is 68,000 BTUs and Part Load 48,000/48,000. The machine draws (power input) between 3.76 kW and 4.83 kW in the heating mode and between 3.15 kW and 4.72 kW in the cooling mode. The EER is 19.1 50°F fluid temperature and 12.8 at 100°F.

THE BURNED STRUCTURE

All the high technology systems in the world don't mean much unless the building upon which they are placed is efficient and airtight to begin with. The original house, as mentioned, was a modular frame home. The exterior walls were 2 × 6 cavity walls and the roof was 2 × 6 as well. Fortunately, the existing framing was 24 inches on center. Once the decision was made to salvage the structure, the charred areas of the wood frame were removed and replaced with new-engineered lumber for floor joists and standard Douglas fir framing lumber. We matched the 24-inch on center construction and used 5/8 sheet rock throughout the home. The remainder of the framing that was left was encapsulated with KILZ, a primer, stain, and odor control product. The primer was spray applied to all remaining old lumber on the interior side of the home. The additions were framed using standard practices, but the exterior sheathing and roofing was covered with a ZIP System. ZIP offers roof and wall sheathing panels with a built-in protective overlay that eliminates the need for house wrap. Siding and roofing can be installed directly on the panel, and the panels are waterproof when installed making the project watertight, even before the roof is installed.

INSULATION

For a building that is heated and cooled via fan coils and ductwork, it is important to install properly sealed ducts that are in conditioned space. Ductwork that is distributing heat through a cold-vented attic is not an efficient system. Even worse, ductwork distributing cool air in a hot attic is not only inefficient, but could lead to mold and mildew problems. Especially if ductwork is poorly insulated and/or leaky, the cool air escapes into the hot, humid ambient air of the attic where condensation and mold are sure to follow. The original home had insulation in the ceiling of the attic. Old school design and construction that leads to mold, mildew, and inefficient system operation was what we wanted to avoid. Since we planned to use an air handler and extensive ductwork in the attic, we insulated the rafter cavity instead of the ceiling in order to enclose the entire attic. We used 6 inches of high-density spray foam insulation on the attic/roof rafters at approximately R-6 per inch. The walls were treated with low-density spray foam for a total R-value of about 24. In addition to carefully spraying, before the spray started and during construction all plates, new sheathing, and any connections to the outside were sealed with low VOC sealant to eliminate air leaks. When the blower door test was conducted for the HERS rating, the house was so tight that it allowed less than two air changes per hour.

WINDOWS AND EXTERIOR DOORS

There were a number of windows on the market that could have met our energy criteria but we also wanted a window considered "local" for the LEED point purposes, which means manufactured within 500 miles of the construction site. We found Green Mountain windows to meet our requirements. Green Mountain makes a window in their Milestone Series that has no jamb liner. The concealed balance system is covered in wood for the look of a true weight and chain–type double-hung window. Their Low E Krypton glass has a U value of .34. They also offer a 5/8 wide muntin and Simulated Divided Light spacer bars (SDL). Green Mountain infiltration specs are among the best in the indus-

try and a Design Pressure rating of DP 40 with the optional taller sill stop.

Green Mountain windows have a better interior finish and appearance than most production windows and the owner paid an additional fee to purchase them.

EXTERIOR SIDING AND TRIM

The original home was covered in red cedar shingles. It was our intention to salvage certain areas of these shingles, add new shingles where required, and stain the entire shingled area. As we began to deconstruct the building, we noticed that the cedar shingles were gun nailed at the factory. Most shingles had four or five nails in each piece, sometimes more. When asked if the shingles were any problem, the owner confirmed that shingles had been breaking and sliding off since he purchased the house. Since the majority of the shingle siding was improperly attached, we removed all the existing shingles and replaced them with pre-stained white cedar shingles, installing them correctly this time with two nails per shingle.

The upper siding above the second-floor windowsill height is inexpensive, 3/8 rough textured fir plywood. We pre-stained all this material on the ground with Cabot's solid body stain. The trim, water table, tapered vertical strips, and soffit trim were all cut from 5/4 × 6 STK decking salvaged from the original house.

INTERIOR TRIM

Interior window and door trim as well as all base and crown molding were created from leftover, unused stock that we found in the general contractor's barn. There was enough white oak, all in 5/4 stock that was left over from a windmill renovation 10 years prior, to do the three children's rooms. All the 5/4 stock was ripped into 3-inch pieces and then ripped in half again to make boards about 7/16 inches thick. The contractors had a large quantity of 5/4 × 12 cypress—enough to complete the rest of the house if we sliced it in half as well. After the milling operation, all stock was eased with a router and pre-cut to approximate length per each room take-off.

4 × 4 #2 cedar columns and built-up girders and built-in lights.

OTHER INTERIOR DETAILS

The master bedroom used to be located in part of the modular home. When we added space for a new master bedroom, we removed the floor of the bedroom module and created a two-story living room space. The concept worked well, but we needed some additional supports in order to carry the transferred loads from the roof. A series of columns were created from the ceiling of the second floor to the basement for this purpose. The 4 × 4 structural columns were constructed out of common and inexpensive #2 cedar. Again, all edges were eased with a router and a wire dropped through the center of each girder held up by the columns. The top of the columns became a built-in light as well, and a simple 4″ box with a porcelain fixture and CFL bulb made it easy and inexpensive. Finally, we stopped in some salvaged plexiglass that we "frosted" with 600 grit sandpaper to the back side.

INTERIOR STAIN

We used a no-VOC Ecoprocoat by TimberSoy for all the interior trim. We used one coat throughout, which saved significant time and money. Since all wood was sanded and all edges eased it was much more efficient to install and stain. All interior trim joints are butt joined with eased edge connection, to make installation easy and reduce the risks of miter joints separating. The same stain on different wood species allows for some variation, but brings a consistent color throughout the interior.

INTERIOR PAINT

All interior paint was Benjamin Moore Eco spec, which was donated by the company.

GETTING THE FAMILY INVOLVED

A house fire is a devastating event—a physical, emotional, and financial drain. It was hard for this family to come home to ruins. Everything they owned was covered in thick black soot or stuck in puddles of frozen black ice. It's not easy to recover from that kind of trauma and it took a toll, especially on the children. The kids were 15, 13, and 10 years old at the time of the fire. The 13-year-old boy took the tragedy the hardest. He began to fail in school and couldn't sleep. The architect/author began to work with Jeremy by sending e-mails and inviting him to help with LEED research. In the process Jeremy got involved and began to learn how his new home would be re-built in a better way. After school, Jeremy came to the office a few times to learn the principles of 3D design software and got a real feeling for the shape and volumes of his new home. Soon Jeremy was back on track in school and devoted to his tennis talent; he began playing again.

Dad, a local lawyer, was in no less shock, just better at hiding it. During demolition, the architect insisted on saving the old decking without knowing exactly what would be done with it. During the coming months, the decking was de-nailed, cleaned, and re-cut into strips for exterior siding and soffit details. The remainder was ripped in half and used for the second floor decking, installed on edge. Dad was a stranger to carpentry, but learned to enjoy ripping and re-sizing all that lumber to be re-installed as decorative trim. It helped make him feel like a part of the construction team and left him gratified that he had helped to rebuild his home for his family.

There were pizza parties, too. At one point in the spring of '09 we got the family members together with a few friends, the architect, and Tim Dalene from Telemark Construction and had a de-nailing party in order to take all the nails out of the decking lumber. The lumber was then stacked and covered, to be used later. Another time, the kids' school teacher, a group of friends, and family convened at the site to stain the exterior siding and trim, again followed by a pizza party. These times really brought people together and advanced the project and the spirit of all those involved, but especially the family who established a new connection with their home.

The technology of the home is an opportunity, and two of the children are using the various systems of the home for an Advanced Placement Science project at school. Mom and the youngest daughter were heavily involved in seeking and selecting natural, healthy products that helped with the LEED Point system.

SMART HOME TECHNOLOGY

Intelligent security systems protect and monitor a home. Here is what we provided for this family. A central station monitor and email alerts immediately notify them of trouble. Energy monitoring and management systems let occupants see their home's energy consumption in real time. Smart thermostats allow remote and programmable temperature control for added comfort, convenience, and energy savings. Smart switches are programmed as well as remote control. Automatic dimming can greatly extend bulb life while reducing energy consumption, and the hot water control can reduce energy consumption for hot water by 25%. Omni Home Automation is manufactured by Home Automation, Inc.; the system integrates and controls security, heating, cooling, light, appliances, web-cams, and audio/video. Systems can be controlled by the amount of daylight, time or day of the week, temperature, humidity, or occupancy, and owners can monitor and control their home via telephone and or Internet for added safety, comfort, convenience, and energy efficiency. Cree recessed lighting was used throughout the home, which saves about 75% of the power over incandescent lighting. The Event Notification server monitors the home for unauthorized entry, fire, water leaks, low temperature, carbon monoxide, or any other system that requires a sensor. Notification can be in the form of e-mail, text, or cell phone.

CARBON NEUTRALITY

The team agreed early on to make this a carbon neutral project.

Phase 1

The General Contractor, Telemark Construction, Flanders Heating and Air Conditioning, Excelsior Plumbing and Heating, Bartick Electric, Sunstream Solar Inc., and Connected Hearth Smart Homes all completed an extensive analysis to determine the carbon footprint of each of the companies which was applied for and verified by Verus Carbon neutral, http://www.verus-co2.com/. The companies calculated their businesses, employee travel time, types of vehicles, etc. and came up with their own carbon footprint. It was an educational look at how each company's carbon footprint could be reduced. Each company took whatever steps possible to reduce its in-house footprint, then carbon offsets were purchased to neutralize the total carbon footprint.

Phase 2

In order for a project to be truly carbon neutral we must go further than buying offsets for the contractors who build the home. All the products integrated into construction must also be analyzed. A new breed of accountant keeps track of the carbon in every product. Since this is a LEED for Homes project that we expect to be Platinum rated, all materials in the process were carefully selected to be local, recycled, re-used, healthy, and practical products. There is an embodied carbon footprint in nearly everything we use for construction so the entire list must be carefully reviewed to determine the exact carbon footprint. The Environmental Protection Agency (EPA) has a wealth of information on preferred building products. The following link to EPA may help: http://www.epa.gov/opptintr/epp/.

Telemark Construction is in the process of this analysis. EPA has a list of embodied carbon for all the most common building materials listed in their database. All materials in the database average a footprint for materials. There are other companies like Climate Earth (http://climateearth.com/) that can help companies account for their building's environmental impact. Telemark Construction is in the process of developing their own carbon tracking system that could revolutionize the construction product reporting practices of our country and perhaps internationally.

LEED STATUS (THE PLATINUM LINING)

Unlike all other LEED systems, the LEED for Homes category is not an online application with templates and forms. A LEED provider is hired to monitor and account for the project and a LEED rater is hired for on-site inspections. The process might seem strange to any practitioner who has been involved with a commercial LEED project and it is. In reality, the process and documentation is similar, but the compilation and information transfer is more difficult and time consuming. Since Telemark Construction agreed to administer the LEED work, they felt the time pinch the most. No question that the LEED process takes longer, but the end result pays off and the next project will be smoother and easier.

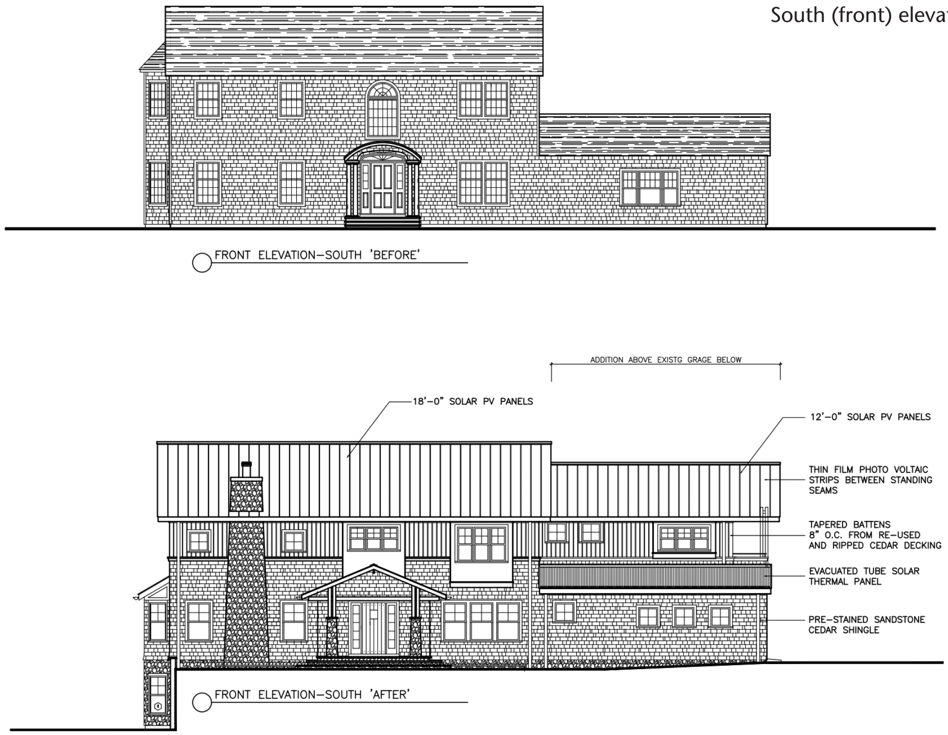
As I write this article, the last submittals are being sent to the LEED provider for review. This home has four bedrooms and one room that could potentially serve as a bedroom bringing the total to five. The benchmark (neutral) size for a five-bedroom home is 2850 sq ft. Since this home is 4,500 sq ft, an additional 10 points are required for any LEED rating. Therefore, 100 points are required for LEED Platinum for this size home instead of 90 points for a 2,850 sq ft home.

USGBC is in final review of the project and has confirmed 104 points. Certainly LEED Platinum will be achieved; Energy Net Zero may or may not be achieved, but the goal has taught us volumes about the practice and the potential. It is a function of energy uses over the next year and also may depend on whether the wind turbine is brought online or not. So far, between April 15, when our monitoring equipment came on line and today, June 1, 2010, the home was energy positive, meaning we have produced more energy than consumed. But this story is not about the numbers, the goals, or the accomplishments; it is about the family, the community, and how a tragedy can be so meaningful to so many people. For this family, the 15 months between the fire and moving in to their new home was a journey to a new way of thinking. It may be a positive perception that every cloud has a silver lining. The adage teaches us to think about what good might come of something bad. This carbon cloud resulted in a platinum lining only because the team had the spirit and foresight to reach for something very special. We all carry homeowner's insurance to protect us from a loss and restore what we had prior. In this case the owners and all stakeholders changed the way they think about sustainable building and sustainable living; a true, transformative learning experience.

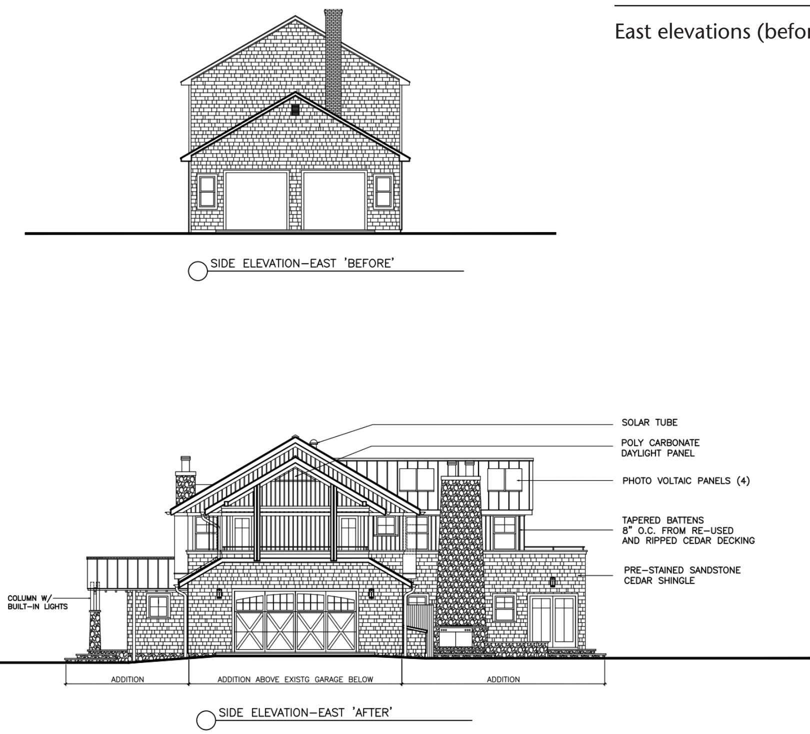
Front (before) with separate designated re-cycle dumpsters.

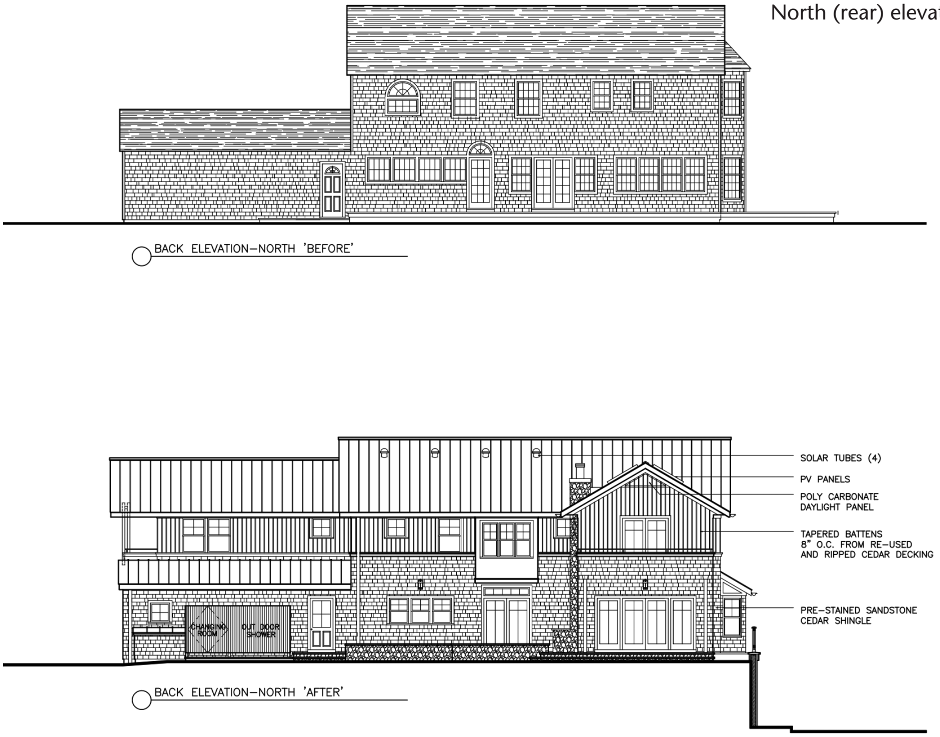
Sketch-Up model showing two 2.4-kW roof-mounted Mag wind units.

South (front) elevations (before/after).

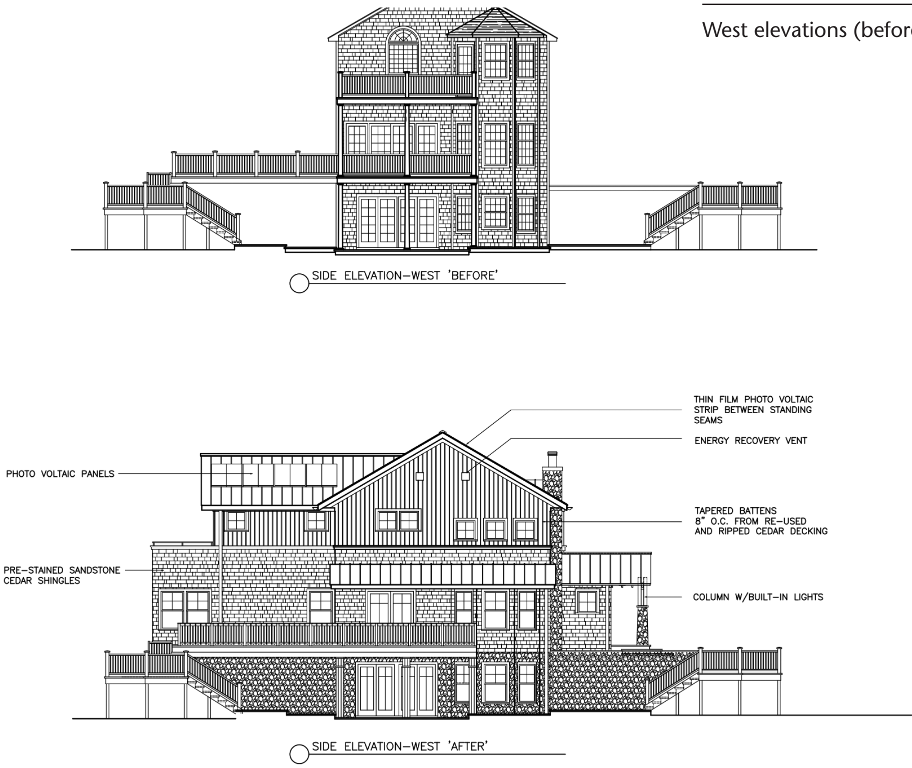


East elevations (before/after).





North (rear) elevations (before/after).



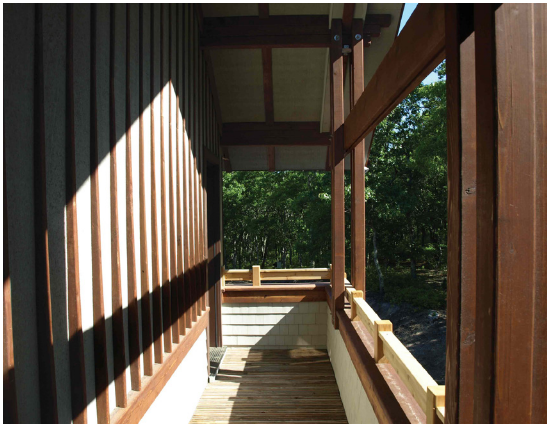
West elevations (before/after).

Front looking northeast.

Front looking northwest.

Rear looking north.

East balcony.



Re-claimed siding re-cut and used for trim.

Interior trim and finishes using inexpensive (#2 cedar) or reclaimed lumber.

5/4 decking sliced in half for edge exposed decking.

Buffet with columns.

LED lighting in built-in columns.

A Home Depot kitchen.

Stair built from reclaimed glue lams.