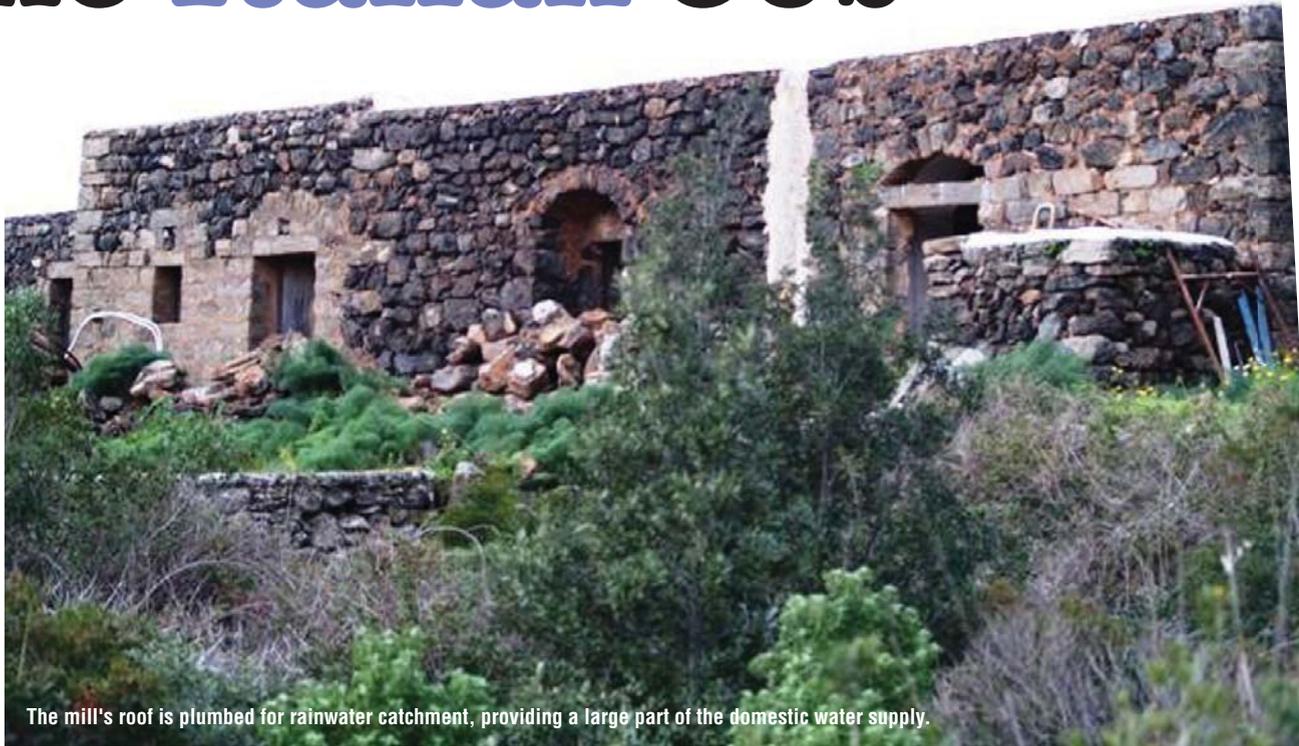


# The Italian Job



The mill's roof is plumbed for rainwater catchment, providing a large part of the domestic water supply.

## The challenges of installing solar radiant heating in an 800-year-old mill on a tiny Mediterranean island.

“People request solar thermal systems for the efficiency and energy cost savings you can achieve with an integrated thermal system that provides domestic hot water, space and pool heating — that it’s a sustainable technology is a bonus,” says **Bill Shady**, P.E., owner of Santa Cruz, Calif.-based Sustainable Design and Project Management. “Saving money over the long term helps save the planet by investing in renewable energy technologies today.”

Shady speaks from vast experience on the subject. His solar beginnings date back to the early 1980s when he obtained an associate’s degree in solar energy technology. He went on to get his bachelor’s degree in mechanical engineering

Photos courtesy of Bill Shady, Sustainable Design and Project Management.

before starting Sustainable Design and Project Management, a consulting mechanical engineering firm, in 2002.

By 2005, he had three project engineers and was doing primarily HVAC design as a consulting mechanical engineer; almost 95 percent of that work was radiant and hydronic heating.

“From the outset, solar thermal integration was a feature that we were known for,” Shady explains. “I realized there was an opportunity to apply a lot of the technologies we’d been using in commercial buildings to small-scale residential projects. The manufacturers were seeing that as well.”

The firm now has clients all over the country — and the world.

That’s how Shady ended up in Italy to work on a unique job.

One of his American clients, **Bob Smith**, fell in love with an Italian island he discovered in the middle of the Mediterranean Sea. Over the years, Smith continued to visit the island, eventually purchasing several connected properties that include an 800-year-old house, a 20-acre organic winery and an olive orchard. He wanted to make his property sustainable and energy-independent but wasn’t sure how to go about it.

He contacted radiant heating panel manufacturer Warmboard, which recommended Pacific Solar Radiant, Inc., a business Shady started in 2006 with **Greg Cross**, a plumber who wanted to branch



**Left: Bill Shady, P.E., and the Pacific Radiant Solar team installed the home's solar thermal and PV systems, the radiant heating and cooling systems and the hydronic water heating system. Right: The site before the solar thermal and photovoltaic panels were installed. The solar systems were fabricated in California before being transported to the island.**

out into mechanical contracting. “We started a design-build company from scratch,” he says. “The only customers back then were my design clients. The projects were very far apart geographically, because that was the nature of my design practice.”

Smith hired the firm after discovering that it specialized in the integration of solar thermal radiant hydronic heating and cooling, domestic hot water, swimming pool and spa heating — as well as its experience traveling to remote locations.

#### **We Do Things Differently Here:**

The first task for Shady and his crew was to investigate the site and the geography to understand the obstacles and challenges of the project. They studied climate data and satellite images through Google Earth.

The process included learning about the history of the area. It was thought the house Smith bought was originally a mill built by the Moors in the 12th century. The most common building style has a domed roof made of cut and stacked volcanic lava stone, plastered on both sides. The mill is typical of island architecture for this period and continues to this day, even with new homes. The domed roofs are all plumbed for rainwater catchment that flows by gravity into a lava rock cistern that is also plastered. It provides a large part of the domestic water supply.

Smith wanted Shady to design an off-grid system that includes water collection and water treatment, electrical power, heating and possible cooling.

“Since we had designed and built projects with similar energy sources, we knew we had to source as many products from the European Union

the materials from Great Britain and Italy and had them shipped to the United States. The solar thermal and radiant floor heating systems were assembled in Pacific Solar Radiant’s manufacturing facilities in Santa Cruz and shipped in containers to the island. The electrical systems provided by Sandbar Solar and Electric, the electrical contractor that designed the PV electrical, were included in the shipments.

But the project did encounter a few obstacles. The first one came when the containers were detained in customs in Palermo, Italy. There were questions about documents and whether the system components bore the required CE (Conformitee European) mark. Most of them did, since they were manufactured in Europe. Smith had his attorney deliver the technical file to Italian Customs and the containers were finally cleared.

In late April 2008, the Pacific Solar Radiant crew of six men flew to Rome and then to the island to begin construction. That’s when the next challenge presented itself.

“If getting our crates through customs wasn’t challenging enough, getting them up the hill to the mill was an equally daunting task, since most of the roads were designed for donkey carts and maybe the odd Fiat,” Shady notes.

They hired a truck with a crane to remove the crates from the contain-

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— **Bill Shady, P.E., owner of Sustainable Design and Project Management**

as possible in order to minimize the chance of being stuck out in the middle of the Mediterranean Sea with the wrong parts,” Shady explains. “The most challenging aspect of the design was finding controls and pumps that were different dimensional units, and motors that were European voltage.”

The team was finally able to source

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Radiant floor heating and cooling is distributed throughout the home with PEX tubing in a grooved subfloor. The radiant cooling system draws water from the rainwater collection cistern.

ers; it showed up an hour late with two flat tires. They rented cars, which took a bit of a beating, in order to fetch odd parts from the local hardware store.

The final obstacle occurred when they met with the Italian construction contractor and his crew. “Everything he and our foreman had agreed upon a year earlier was ‘forgotten,’” Shady says. “Their construction methods and tools were outdated and somewhat primitive. None of us spoke Italian and they spoke no English.”

So, the crew picked out the guy with the best English — Alfredo, who grew up on the island and knew where to find everything the crew needed. “Even with our careful packing, we would have been lost without him,” Shady states.

**The Particulars:** Due to the high cost of propane and the cost to transport the multiple tanks up to the mill, Shady and his team decided to design a high solar fraction. Solar fraction is the percentage of annual expected energy use that the collector array generates.

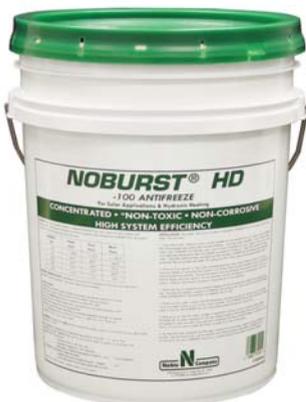
“A high solar fraction normally means that at certain times of the year, usually summer in the Northern Hemisphere, you generate more than you need for domestic hot water and space heating,” Shady explains. “Serving the pool where you would otherwise burn fuel is the best way to ‘shunt.’ If there is no pool, then some form of low-energy-use dump of heat is required. This gives you the highest true solar fraction.”

The mild Italian climate and the minimal load in the summer led the Pacific Solar team to the installation of a shunt fan assembly to relieve solar gain from the system. The addition of a heated swimming pool in a future phase of the project will keep the shunt to a minimum.

Additionally, five 16-tube Sunda Seido 1 evacuated-tube collectors are installed on a low-profile ground-mount array, piped to a 50-gallon domestic water heater and a 200-gallon insulated storage tank. All solar

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# The Italian Job

fluids are closed loop and all thermal storage is domestic hot water. Radiant floor heating is distributed through Uponor TruFlow manifolds with thermal actuators and five zones of control. Composite PEX-al-PEX tubing was installed in the Warmboard thermal subfloor for heating and cooling.

Controls for the project were Kanmar injection-mixing controllers with pumps supplied by Wilo and Grundfos. The innovative Wilo Stratos Eco is the first known application of the pump in the region, Shady says. It provides heating with the bare minimum use of valuable solar power

stored in the battery system or used as it is being generated. The Kanmar temperature controllers are also variable speed, thereby limiting the power used and maximizing the wire-to-water heating efficiency of the system.

Cooling is accomplished through a heat exchanger in the radiant floor loop that draws water off the rainwater collection cistern and cools the water going into the home down to a comfortable 67 degrees F for passage into the interior of the building.

The home is continually conditioned in the wet and windy winter season — beginning in October and continuing into late spring — by the solar thermal array. In order to monitor the system remotely, a Sensophone remote monitoring system with a cellular data modem allows alarms to call out and the users to call in to download temperature and climate data in real time to diagnose potential problems.

**An Engineered Solution:** After Shady returned from Italy, he began to work on a simple, engineered system that could be installed in remote locations — the ClimateRight System. It's an easy-to-install system that evolved from the design and engineering work he has done over the past eight years, including the extremely long-distance Italian project. It's factory-built and factory-tested in Oregon and California; all a contractor needs to do is rough in the utilities with a standardized, dimensioned wall-hung template, bolt it to the wall and make the final connections.

And while he believes solar thermal and solar radiant systems will continue to gain in popularity, Shady says the economic climate today is a hindrance. He wants to change that by having a financing option that contractors can offer their customers, making it easier for them to buy the product.

"People love to do these projects, they just don't have the money," he explains. "The biggest factor in growing the solar thermal business is the opportunity to lease the equipment. When I offer a customer a completely engineered product *and* I can offer financing, that's when this thing is going to take off."

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