

**Private Residence
Gloucester MA**

High Performance Renewable Energy Roofing System

This project is an outstanding example of a retrofit roofing project on a historically significant home. The design incorporates a cutting edge roofing system assembly that includes an R-50 insulation system and building integrated solar thermal and solar electric PV systems that provide electricity for the home, as well as solar thermal energy (heat) for water, space and swimming pool heating. The architecturally integrated roofing assembly provides both energy efficiency (reduced heating and cooling costs) and renewable energy systems in a cost effective and attractive package.

The roof area is approximately 10 square in area, roofed with solar electric (PV) tiles installed directly over the integrated solar thermal system. The renewable energy system has a 8.5kW PV rating (electricity) and a 6 kW thermal equivalent rating, producing the equivalent of ~20,000 kWh electricity annually while reducing the carbon footprint of the house by ~29,600 pounds of carbon annually.



The **Dawn Solar Thermal System** collects solar heat from beneath the roof area. A non-toxic propylene glycol antifreeze solution circulates under the hot roof and moves energy between

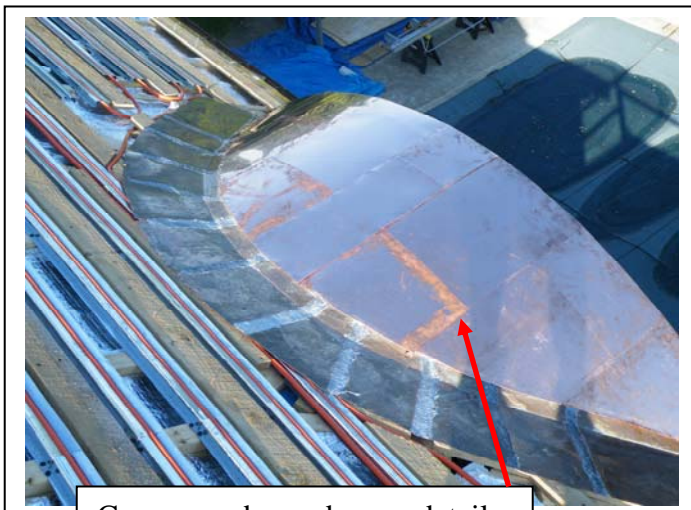
the Dawn Solar collection system and the heat exchanger(s) within the solar storage tank. Operation of the solar collection circulator is controlled by solar differential controls that monitor the temperature difference between the collector and the bottom of the solar storage tank.

In the **Domestic Water Heating**; when domestic hot water is drawn from the main water heater, water replacing it will be preheated by the hot water in the solar storage tank, thereby reducing the use of fossil fuels, bio-fuels or electricity.

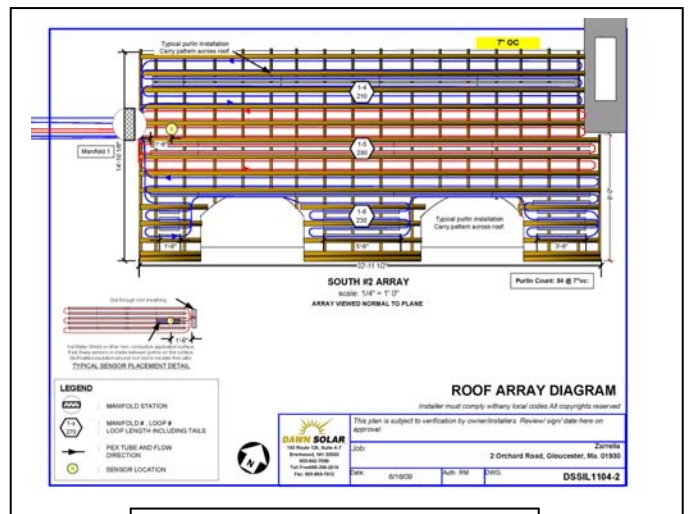
In **Space Heating Applications**; when the thermostat calls for heat and sufficient energy is available in the solar storage tank or the solar collector array, solar energy will be transferred from the tank and distributed to the building until the thermostat is satisfied or until the solar energy supply is depleted. In this project, a hydro –air heat exchange coil was installed in the return air ducting of the second floor heating system.

In **Pool Heating**; when the pool thermostat calls for heat and sufficient energy is available in the solar storage tank or the solar collector array, pool water is pumped through a pool heater tank, heated by the solar heat exchanger in the tank and returned to the pool. This process continues until the thermostat is satisfied or until the solar energy supply is depleted.

The **PV System** includes an 8.5 kW grid tied PV-Tile system (rated at standard test conditions) with matching non functional tiles at the building rakes to finish the entire ~1000 square foot south facing roof.



Copper eyebrow dormer detail showing the solar thermal array



Solar thermal array layout