SunDrum® Solar HarvestHP™ Performance in Hospitality Market

Introduction

In January 2017, SunDrum® Solar commissioned a 42.3kW (27.3kW thermal and 15kW DC electrical) HarvestHP™ commercial system on a hotel in Bakersfield, California. This hybrid system is a source for hotel domestic hot water (DHW) and thermal heating for a 500ft^2 outdoor swimming pool as well as a grid-tied PV array to offset some of the hotel's power requirements.

The HarvestHP™ system combines the efficient hybrid solar collectors developed and patented by SunDrum® Solar with the thermal efficiency of water-to-water heat pump technology to provide enhanced system performance. When the sun is shining, the system is in "Active Mode" capturing thermal and electrical energy from the sun like any traditional photovoltaic and flat plate solar thermal system. When the sun's direct rays are weak or not available, "Harvest Mode" uses the thermal collectors to absorb heat energy from the environment and utilizes the heat pump to boost the temperature of the fluid making this system capable of gathering solar energy on-demand 24 hours a day thus coming a long way in overcoming the criticism of solar being an intermittent energy technology.

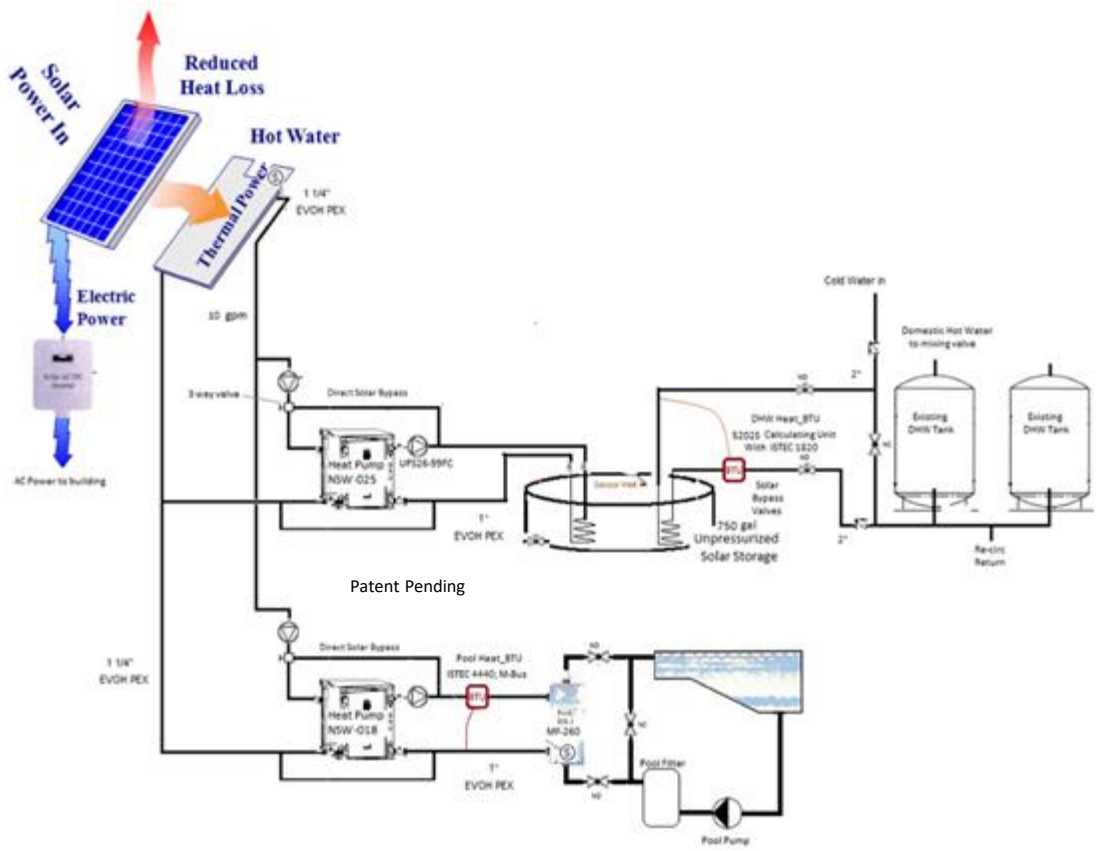
SunDrum® Solar HarvestHP™ Hybrid PV/T-HP Array on Hotel Roof

System Description

The hotel installed 60 ReneSola 250W modules, 42 of which were converted to hybrid PV/Thermal panels using SunDrum® Solar SDM-100 650W collectors. The unique design of the SunDrum Solar thermal collectors enables them to be easily mounted or retrofitted behind most brands of PV panels providing benefits as follows:

- Cools PV modules, increasing electrical energy production and extending their life
- Captures over five times more energy from the same footprint on the roof
- Preserves the aesthetics of a PV-only installation
- PV and thermal systems are each sized to meet individual energy needs.

The hybrid solar array is rated at 42.3kW (27.3kW thermal and 15kW DC electrical). The system also includes a 1.5-ton heat pump for pool heating in addition to a 2.5-ton heat pump for preheating the DHW via a 750-gallon DHW preheat storage tank. Gas water and pool heaters are used as back-up. The schematic diagram below illustrates the mechanical design.



Schematic Mechanical Design for Pool and DHW SunDrum® Solar HarvestHP™ System

The rooftop of the hotel has 8-feet tall parapet walls, which create extensive shading, thus limiting the roof area devoted to a solar array. Consequently, it was decided to roof-mount the PV/Thermal array using the D-Dome racking system with east/west orientation. While shading is an important consideration for the PV design, it has less impact on the HarvestHP™ thermal system.

This next generation HarvestHP concept can deliver energy on-demand even when the sun is not shining as well as nighttime. During peak sun hours, the system is in “Active Mode” and transfers harvested energy directly to the 750-gallon concrete storage tank utilizing it as a thermal battery. This mode does not require use of the heat pump, thus minimizing the system’s electricity consumption. During the night and low light conditions, the solar thermal system uses the energy stored in the air to deliver DHW, thereby significantly reducing gas consumption. Additionally, the ability of the sun to daily recharge with solar heat provides a unique advantage over traditional geothermal systems, which do not replace the heat removed from the ground daily.

This system consists of two load circuits, a DHW and a pool loop. This dual arrangement allows for superior energy delivery by optimizing the system’s output and improving its Coefficient of Performance (CoP). The customized heat pump schedules can switch the system to “Active Mode” during the peak sun hours and permit the heat pumps to go on/off according to the loads and demands. This feature allows the system to operate with a CoP of ~4.8. The system controls are also capable of adjusting to avoid peak electricity rate periods.

The monitoring systems shown below, illustrates the system’s controller/data-logger, which communicates with the facility’s internet service provider (ISP) to make available web-based monitoring/control/data logging. Various solar thermal system parameters representing the performance and activity are displayed. The information is presented with graphs and digital screens for the client to access real-time water consumption, system’s energy collection, output, temperature points of water in DHW tank, heat pump source and load circuits in and out of the HarvestHP™ unit as well as the swimming pool.

Sample Screen Shots of SunDrum® Solar HarvestHP™ Control/Data Logging Web Pages

Financial Performance

The client benefits from the federal solar Investment Tax Credit (ITC), which grants a tax credit totaling 30% of the installed cost of the renewable energy system plus Modified Accelerated Cost Recovery System (MACRS) depreciation. Also the project qualifies for the California Solar Initiative (CSI) program, a performance-based incentive, focusing on thermal energy efficiency. Based on the system's output, the CSI provides $10.10/Therm with a $49,914 cap for solar DHW and $2.50/Therm with a $12,355 cap for solar pool heating, all of which the client will be able to collect during the first two years of operation.

The Bakersfield hotel system has been active for a year generating thermal energy and has demonstrated it can save the client 2,442 therms of natural gas or 58.2 therms per 650 watt SDM100 collector. With credits and savings, ROI can be four (4) years or less and provide the client significant savings over the system's 25 year or longer life.

All electric energy used by the system to generate the thermal heat was offset by electricity produced by the PV panels. Additionally, the PV array can be expanded to accommodate future increased energy demands.

Conclusion

This commissioned PV/Thermal Heat Pump (PV/T-HP) system is designed to deliver thermal energy to heat domestic water and the outdoor pool. The system has been active for a year generating thermal energy and allowing the client to take advantage of the government's renewable energy incentive programs. The unique design allows the SunDrum® Solar's hybrid modules to collect more solar energy from the roof than other available solar technologies. By dramatically increasing the number of hours a solar thermal system can operate on a daily basis, the HarvestHP™ offers unmatched energy savings as well as a faster return on investment.

For any business/industry looking to reduce energy costs and promote their "green energy" approach to conservation-minded customers, NO other system on the market today can capture more renewable energy per square foot of roof space.

The SunDrum Solar HarvestHP system is the direct result of the game-changing approach to on-demand, 24/7 energy capture, representing an exciting step forward for solar system design and the solar industry.