

WindStream Technologies: Product Overview

The SolarMill®, WindStream Technologies' hybrid system is based on a modular, scalable, distributed renewable energy system designed and optimized for on and off grid installations. At its core is a highly efficient wind energy device, utilizing three (3) low-profile vertical axis wind turbines (VAWT) mounted on a single base. The units can be interconnected to increase a user's energy production capability in low speed and turbulent wind environments commonly found at lower elevations. The turbines begin producing power from wind speeds as low as two (2) meters per second. With a design life of 20 years, the turbines are silent and do not pose a threat to wildlife.

In an effort to provide more consistent energy generation than a "wind only" or "solar only" system, WindStream Technologies has developed a first-of-its-kind, fully integrated, renewable energy "HYBRID" product. The SolarMill incorporates P.V. technology within a compact footprint, creating the greatest energy generation density for any product on the market. The hybrid concept of the SolarMill is unique, seamlessly utilizing wind and solar energy generation in one unit. This allows the product to be an effective solution in markets where the natural resources available for wind or solar energy alone do not justify investment into *any* small wind product.

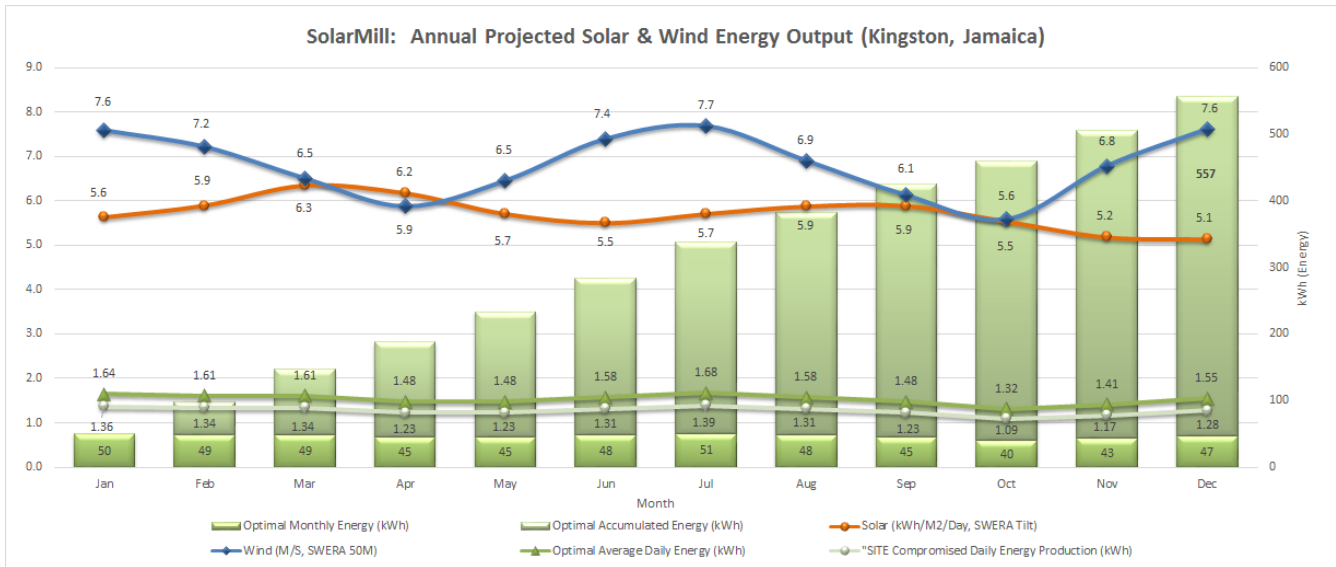
Onboard each SolarMill is WindStream Technologies' proprietary Maximum Power Point Tracking (MPPT) electronics and solar charge controller, which maximize the power handling and generation capabilities of both the wind turbines and solar panels. This system maintains all power generation at maximum efficiency without the need for additional hardware or software. Standard solar or wind systems do not offer this ability, as this is unique to the WindStream platform.

Hybrid Solutions

WindStream's engineers have developed a product to overcome the "inconsistent" nature of renewable energy resources. By integrating wind and solar technologies in a single unit, now, for the first time, a customer can reliably depend on a renewable energy generation device. A hybrid energy solution levels out the highs and lows of energy generation periods due to seasonality as solar irradiation and wind speeds change throughout the course of the year. A truly hybrid solution will compensate for seasonal losses of power generation not solely depending on one type of renewable energy system. It is easy to see that the combination of wind and solar is a natural one, and one which is complementary on a seasonal basis.



SM1-1P Product Model



As seen above, winter months with typical reductions in solar irradiance (shorter days) bring an increased power in potential wind energy. This relationship extends to the daily cycle as well. During the mid-day, wind speeds are typically lower, but the solar potential is high. Conversely, at night winds are more typical, but there is no power available to the P.V. elements in the system. P.V. is operational only during daylight hours, which limits the overall production of a system. Wind has the potential to produce 24 hours a day, given the right conditions, but most importantly throughout evening hours when solar is not available.

WindStream Technologies has determined the renewable resources available in 90% of the world can easily justify a hybrid energy system, not just to balance annual energy output, but to capture the available resources at the lowest cost per watt in the market for a renewable energy platform.

SolarMill Technology: Product Features

All components of the system from the turbine blades to the neodymium magnets used in the generators have been designed and tested to operate in the harshest of environments.

High Performance

Turbines

At the core of each product is the Vertical Axis Wind Turbines (VAWT) that have been selected for use by the WindStream engineers. In developing the product, WindStream conducted extensive research regarding the design and construction of Savonius type turbines.



Our models involve light, efficient turbines that have enough transient response to fully take advantage of the energy creation opportunity that bursts of wind provide. The turbines want to be optimized for the wind speeds that are typical in the urban landscapes and capable of collecting wind energy when others have not yet started, which our Savonius design has made possible. WindStream currently maintains a proprietary stamping process (pilotless progressive die with differential pre-stretch) for the turbine blade in the U.S.

Generators

WindStream has designed, tested and manufacturers its own generators to uniquely suit the conditions in which the SolarMill products will be placed. The topology we've chosen is a coreless axial-flux permanent magnet (AFPM) machine. Typical generators are high-speed, low-torque devices. In those cases a gearbox is used to increase the rotational speed of the rotors inside the generator. Gearboxes add additional friction, negatively affecting performance and efficiency, and require periodic maintenance. Gearboxes are the single most common point of failure in any wind turbine. We utilize a direct drive permanent magnet solution which is free from the maintenance issues that commonly plague gear driven generators. AFPM machines can offer greater torque capability operating at lower speeds. The generator was custom-designed specifically matched to the torque of the turbine thus optimizing the rotational and torque characteristics of the turbine to the generator.

Electronics: Wind and Solar

WindStream has designed and built its own MPPT electronics circuitry which controls all aspects of the power generation of both the wind and solar sections of the products. This "smart" controller handles the onboard electronics that properly load the generators and output the energy that is then used by the customer. The WindStream controller dynamically adjusts each of the generators in the system based on wind speed and direction of the wind in order to maximize the power that can be extracted from the available wind energy. This processor controlled unit then rectifies the AC power to DC and passes it along to the adjacent SolarMill to be summed and either stored to a battery and then passed along to an inverter and used by the customer.

On and Off Grid Installation

SolarMills are distributed energy systems designed for either grid connected, or off-grid applications. The product utilizes a built in charge controller to regulate a 48VDC lead acid battery system. When grid connected, the electrical energy created is directly fed into the electrical service panel offsetting the overall draw. In off-grid applications, it is output via a DC/AC or DC/DC converter according to the type of loads that need to be served.

Reliable

Corrosion Resistant & Steel Construction

All steel parts are pre-galvanized and also coated with PPG Spectracron® 360 2K, which provides another level of corrosion resistance. Aluminum, or Stainless components are used where appropriate. The main structure is made of heavy gauge steel for enduring strength. All fasteners are zinc coated and the plastics are stabilized against UV so they won't break down in the sunlight.

Circuit Protection

The electronics provide circuit protection for over-voltage and over-current by monitoring the current and voltage in each system.

Mechanical Braking System

The unit is equipped with a failsafe centrifugal braking system designed to protect the turbines and generators at high wind speeds. The braking system is self-resetting and will automatically disengage when the wind dies down. The brake provides no friction prior to engaging.

Affordable**Easy Assembly**

SolarMills are mass-produced utilizing manufacturing processes commonly found in the automotive and aerospace industries and a patented (pending) process to produce our steel turbines. These products produce energy from winds coming from any direction, pose no threat to the environment or to wildlife, are silent and free from hazards and other mechanical deficiencies often found in horizontal axis devices, and do not require complicated masts, guy wires or foundations for installation.

Mounting Options

There are several options for mounting the SolarMill, which can be configured to multiple heights and can accept panels as necessary. SolarMills can accommodate practically any roof type. In some instances it is unnecessary to penetrate the roof and you may use a ballasted structure instead.

Inverter Options

WindStream has identified two low-cost inverter options that allow for off grid or on grid installations.

Company Profile – WindStream Technologies

WindStream Technologies, Inc. was launched in 2008 with the concept of creating renewable energy solutions for a mass market focused on developing nations and areas of the world where energy costs are high and environmental concerns are of great importance. After establishing an academic alliance with the world class engineering institution, Purdue University, the Company began research and development in New Albany, Indiana which has resulted in the prototyping, piloting and successful deployment of its products all over the world. In 2011 the company designed and built its proprietary manufacturing facility which has been established in North Vernon, Indiana and is currently in full scale production, The Products are made in the U.S.A., and have been sold and installed in countries as far reaching as India, Italy, Jamaica, Norway, Spain, Sweden, and Peru. With a clear focus on providing renewable energy products for on and off grid applications that have a well-defined return on investment and off-set of a customer's carbon footprint, WindStream is fast becoming the leader in the small scale distributed renewable power category.

Installations around the World

- (1) ACC, the third largest cement contractor in India, using SolarMills to achieve government mandated renewable energy objectives.



- (2) Seaside installation sponsored by the Mayor of Atlantic Highlands. These red white and blue units face the Atlantic coast on the New Jersey coast.



- (3) Jamaica Public Services' installation at the JPS E-Store in April 2013.



- (4) One SM2-3P in downtown Lima, Peru providing energy to the seventh floor offices.



- (5) An array of SolarMills atop Franklin Templeton Investments in Hyderabad, India.



- (6) Installation at Caribbean ESCo drying facility consisting of PV, wind, and thermal energy production in one system.



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