Solar Powered WiMAX & WiFi

How to Use Solar Energy to Power Your Wireless Network

Whitepaper

Solar Energy

The cost of installing and maintaining a diesel generator or bringing grid electricity to remote sites is high and could be cost prohibitive in many cases. With the latest advancements in solar panel and battery technologies, the cost of installing and maintaining solar power systems could be significantly lower. Many of Tranzeo's full spectrum of WiMAX and WiFi devices consume as little as 6 watts, making them ideal for use with solar-powered systems.

Solar Powered Remote Monitoring Station
Volcán San Cristóbal , Nicaragua

The Solar Power System

To maintain power during "no sunlight" periods, a battery is used to power the device, and a solar panel is then used to keep the batteries charged. A solar panel charge controller and an inverter make up the rest of a typical solar power system. The charge controller is used to properly charge the battery, and the inverter is used to convert the DC voltage to AC voltage. However, since Tranzeo's WiMAX and WiFi devices require a DC voltage, they can be powered directly from the battery, eliminating the need for an inverter and improving overall system efficiency.

About Solar Panels

A solar panel is made up of an array of photovoltaic cells. The watt/amp rating of the panel will depend on the number of cells and their size. Photovoltaic cells are made of 2 layers of thin silicon wafers that are oppositely charged, and are connected together via a grid of very fine finger-like electrical contacts to channel the DC current to the output terminals.

Covering the silicon wafers is a layer of toughened glass that is strong enough to withstand extreme weather conditions and temperatures, and thin enough to not filter out or reflect sunlight. Since silicon is made of sand, which is also reflective, a thin layer of anti-reflective material is used. The back of the solar panel and the frame are usually made of aluminum.

More efficient panels are made of Monocrystalline cells , which are cut from silicon that has been grown from a single crystal. Monocrytalline cells are uniform in appearance. Polycrystaline cells, on the other hand, are made of multifaceted silicon crystal, which require more surface area to produce the same amount of energy as Monocrystalline cells, and therefore are less efficient. Ploycrystalline cells are less uniform in appearance and have a shattered glass look.

To make the panel more flexible and to reduce cost, manufacturers have also created what is known as thin film solar panels, which are less efficient than Monocrystalline and Polycrystalline panels.

Regardless of the technology, most panels will provide 25 years of working life, and manufacturers are offering up to 25-year product warranty to support it. So, choose the solar panel technology that meets your system requirements and fits your budgets.

Tranzeo Wireless Technologies Inc.
19473 Fraser Way, Pitt Meadows, BC, Canada V3Y 2V4 • T: 604.460.6002 • F: 604.460.6005 • Toll Free: 1.866.872.6936 • www.tranzeo.com

Solar Powered Remote Communication Tower
British Columbia, Canada

Sunlight and Geographical Area

The amount of sunlight we get per day is different around the world. You need to know how many hours of peak sun you'll have in your area in order to correctly choose the right panel size and rating. This is normally stated as kilowatts-hour per square meter per day ($kWh/m^2/d$), which is also known as solar peak hours. You could use this online Solar Panel Calculator to find out how many peak hours of sunlight you can get in your area.

Maximizing Sun Exposure

This is also dependent on the geographical area and varies with the season. In most cases, it's difficult to continually change the orientation of the panel to get maximum exposure to the sunlight. Generally, solar panels should face South in the Northern Hemisphere and North in the Southern Hemisphere. The angle of the solar panel should also be equivalent to your latitude plus or minus 15° depending on the season (plus 15° in the winter and minus 15° in the summer).

Taking Care of Your Investment

Generally, solar panels require little or no maintenance as there are no moving parts. However, in areas or seasons with little or no rain, dust and dirt build-up can greatly impact efficiency, so occasional cleaning and inspection for damage is highly recommended.

Electrical Wiring

The size and the length of the electrical cable is very important for optimal system performance. Choose the correct diameter cable to match the amp rating of the panel and the distance between the panel and the charge controller/inverter. You could use this online DC Cable Sizing Calculator to figure out the correct diameter for you cable.

Large Systems

You may need to install multiple wireless devices at a remote location in order to provide the coverage needed to reach across rugged, mountainous terrain. In this case, multiple solar panels and larger battery capacities will be required.

Additional Energy Sources

To provide power backup, and to compensate for reduced sun exposure in the winter, additional energy sources such as diesel or propane generators or wind turbines can be combined with solar power systems to ensure uninterrupted service.

Solar Power and Wind Turbine Deployment
British Columbia, Canada

Why Tranzeo

Tranzeo offers a complete family of 802.16d (802.16-2004) WiMAX products for 3.5GHz, 3.65GHz, and 5.8GHz spectrums including indoor and outdoor Subscriber Units and Pico Base Stations. As well, we offer a comprehensive line of 900MHz, 2.4GHz, 4.9GHz, and 5.8GHz 802.11a/b/g and 802.11n standards-based WiFi products including Routing Access Points, CPE's, Full-Duplex PtP Bridges, and advanced Mesh Routers and Access Points for complete turnkey solutions.

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Design Example

You need to determine the following parameters, before you can properly design a solar power system that will meet your project needs:

1. Daily peak sun hours for the deployment area (kWh/m²/day)
2. System voltage, which is normally 12 or 24 volts
3. Maximum load requirement of your wireless device in watts (or Amp-hours)

Once these parameters are determined, then you can select the right battery and solar panel size based on the Amp hours needed.

Data:

Area: **Kuwait City**

Minimum Peak Sun Hours: **2.9 kWh/m²/day**

Average Peak Sun Hours: **5.48 kWh/m²/day**

System Voltage: **12V**

Max Load for WiMAX CPE: **6 watts** (0.5A at 12V) in Full Tx mode, and at maximum output power with 300ft of Cat5 cable

Operation Time: **24 hours** (number of hours of use per day)

Battery Backup Time: **3 days** (how long the battery will keep the device on without sunlight)

Calculations and Solar Panel Selection:

Daily Consumption (kWh) = (watts x hours) / 1000 = (Volts x Amps x hours) / 1000 = $\frac{(6\ watts\ x\ 24\ hours)}{1000} = 0.144\ kWh$

Daily Load at 12V = $\frac{0.144\ kWh}{12V}$ = 12 Ah

Required Battery Capacity = Load (Ah) x Backup Time (days) = 12 Ah x 3 days = 36 Ah

The minimum number of peak sun hours tells you how many hours of sun you can expect in your area under worst case conditions. In this example, it's 2.9 hours. So, we selected a cost effect **12V 85W solar panel** to produce nearly 14Ah of electricity each day, enough to keep the wireless device powered and to keep the battery topped up under worst case conditions.

A 12V solar panel typically outputs around 18V, so it can charge a 12V battery. At 85W, this panel will produce around 4.7A of current, which is sufficient to power up the wireless device (12Ah in this case) and maintain the battery charged under worst case conditions.

Daily Solar Panel Output (worst case) = solar panel current x min. peak sun hours = 4.7A x 2.9 hours = 13.63Ah

The average peak sun hours for this area is 5.48 hours, so the solar panel will generate more than 25Ah, nearly twice the worst case condition.

6A 12VDC Solar Controller will be required in this case.

These are very rough calculations to show that it's feasible to use solar power to power a Tranzeo WiMAX or WiFi device. Professional system design and professional installation of all solar power systems are highly recommended for worry-free network operation and maintenance. Please consult with your local solar panel supplier and professional installer for more information.

Online Resources

Solar Electric Supply, Inc.
http://www.solarelectricsupply.com/

Energy Matters – Historical Weather and Climate Data
http://www.energymatters.com.au/climate-data/

Energy Matters – Power System Design Calculator
http://www.energymatters.com.au/climate-data/saps-electricity-usage.php?

SunWize Technologies Inc.
http://sunwize.com/industrial-solar/index.php

Ameresco Solar
http://www.amerescosolar.com/SolarSite/SolarSiteMain.aspx

Energy Matters – DC Cable Sizing Calculator
http://www.energymatters.com.au/climate-data/cable-sizing-calculator.php

TRANZEO®
WIRELESS TECHNOLOGIES INC.

About Tranzeo Wireless™

Tranzeo Wireless Technologies Inc. (TSX:TZT) leads the wireless broadband industry for value, by producing high-performance wireless network equipment with a low cost of ownership and unparalleled service allowing communities and businesses to communicate without boundaries. Since the company's inception in 2000, Tranzeo's optimum cost effectiveness, premium quality and responsive support have attracted a growing number of devoted dealers, distributors, and customers worldwide. Tranzeo's full spectrum of point-to-point and point-to-multipoint radios, WiMAX equipment, and mesh network solutions are designed for use by wireless internet service providers, governments, campuses, military, carriers, enterprise, and systems integrators worldwide.

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