



Welcome to Campbell Scientific, world leaders in measurement solutions for renewable energy applications



From complete turnkey solutions through to individual dataloggers and sensors with supporting software and peripherals, Campbell Scientific have the solution for any renewable energy monitoring application.

Our clients include energy companies such as RES, Vestas, Iberdrola & SSE, wind/solar resource assessment consultancies such as Garrad Hassan (DNV GL), and many others across the value chain.

Over the years we have become well known for robust, reliable and low power systems and have become the industry standard for datalogging in renewable energy. Systems are fully configurable and can use any type of sensor and communications options.

For further information
call our renewables team on
+44 (0)1509 828888 or email:
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Wind Energy



Measurements Matter in wind energy – from initial resource assessment and on into operational phase.

For 5 decades, Campbell Scientific has been a world leader in wind monitoring and measurement. Our technical expertise and reliable datalogging systems have been pivotal in supporting wind resource assessment, power performance analyses and operational phase management ever since the post oil crisis wind energy boom of the mid 1970's.

Our turn-key systems offer field proven reliability, high power efficiency, the broadest range of communication options and compliance with all relevant industry standards to ensure measurement accuracy.

Applications



A datalogger based system mounted on a met mast
Image courtesy of Meteoright

Wind Energy Site Assessment

Turn-key data acquisition systems specifically designed for wind resource assessment. Ideal for rapid installation on tubular or lattice met tower installations and designed for easy field servicing.

Our wind prospecting systems allow you to take full advantage of your wind resource assessment investment, whether you are using your current met tower and sensors or adding sensors to expand your system's capabilities.

Our systems record standard met measurements for wind energy site assessment and annual yield forecasting (P50, P75, P90), long term wind speed distribution and wind flow modelling.

Measurements : Wind speed, wind direction, air temperature, differential air temperature, temperature gradients, relative humidity, barometric pressure



Sensors are mounted at various points up to hub height
Image courtesy of Lufft GmbH

Power Performance Testing

Robust wind monitoring solutions specifically designed for the wind energy market. Our systems deliver key wind energy weather data in a configurable turn-key package designed to simplify installation, maintenance and commissioning.

Supporting any sensor configuration and 2-way communication options, our wind monitoring stations are commonly deployed as the permanent met tower for power producing facilities.

Built-in security features keep the stations and your data secure, and can be designed to meet IEC 61400-12-1 Power Performance Measurements of Electricity Producing Wind

Measurements : Wind speed, wind direction, air temperature, differential air temperature, temperature gradients, relative humidity, barometric pressure



Aircraft warning light intensity controlled automatically by visibility sensor

Intelligent Control of Wind Turbine Obstruction Lights

The aircraft warning lights that are used on wind turbines are typically of a very high intensity of over 20,000 Candela - an essential aid to navigation in poor conditions, but nonetheless an intrusion in urban areas when visibility conditions are good.

Our systems use visibility measurements to control light intensity. Such systems are now a legal requirement in Germany, with many other countries set to follow suit. Our forward-scatter visibility sensor is perfectly adapted for this application and will meet all legal requirements.

Measurements : [Visibility](#), [MOR \(Meteorological Observable Range\)](#)



Lightning poses a persistent and real threat to safe turbine maintenance

Icing Warning & Lightning Warning/Detection

Ice accumulation affects wind turbine operation in various ways, including mechanical and electrical failures, safety hazards, measurement and control errors and power losses. Our reliable ice detection systems are used to correctly activate de-icing systems rapidly to optimise production and avoid component failure.

Lightning is another persistent and real threat, not only because turbines are tall, isolated towers composed of sensitive electronics (essentially, they act as large lightning rods), but the evacuation time for maintenance workers is significant, and can put them at risk if lightning strikes are not anticipated correctly. Our reliable systems can be used by maintenance companies to accurately establish when evacuation is necessary and when work can be resumed, avoiding unnecessary suspension of work whilst remaining acutely sensitive to the danger posed by lightning strikes.

Measurements : [Ice accumulation](#), [freezing rain](#), [atmospheric electric field](#)

Wind Energy Case Studies

A Campbell Scientific datalogging system has been monitoring the site of the world's largest offshore wind farm, providing consistently reliable and accurate data in harsh conditions. The London Array project in the outer Thames Estuary is currently the world's largest offshore wind farm, and is a great example of the monitoring system requirements for wind power companies.

www.campbellsci.eu/london-array

Npower renewables, the UK's leading wind energy developer, has monitored numerous prospective and operational wind farm site locations across the UK, Europe, Africa and the USA. Npower renewables has used Campbell Scientific equipment at the majority of these sites, often in very harsh conditions including offshore.

www.campbellsci.eu/wales-wind-prospecting

The California Independent System Operator (ISO) operates the wholesale power system in California, with the goal of providing higher transmission reliability while controlling costs. The California ISO acts as a key platform to achieve

California's clean-energy goals. In order to meet its goals and manage the power grid, the California ISO requires renewable-energy generating facilities to report secure, real-time weather and power data. A Campbell Scientific monitoring system has been used to achieve this, collecting all data from the met stations and power meters.

www.campbellsci.eu/calwind





Measurements Matter in solar energy– for PV (Photovoltaic) or CSP (Concentrated Solar Power) plants.

Obtaining accurate site specific meteorological data provides the best method to accurately assess the likely true return on investment for a solar power plant installation. Efficient ongoing operation, supply forecasting and site maintenance planning can all be enhanced by the integration of met measurement data.

Our turn-key measurement systems comply with all relevant industry standards and provide field proven reliability. With options on datalogger, sensor, communication, power and mounting these systems can be tailored to meet the project requirements.

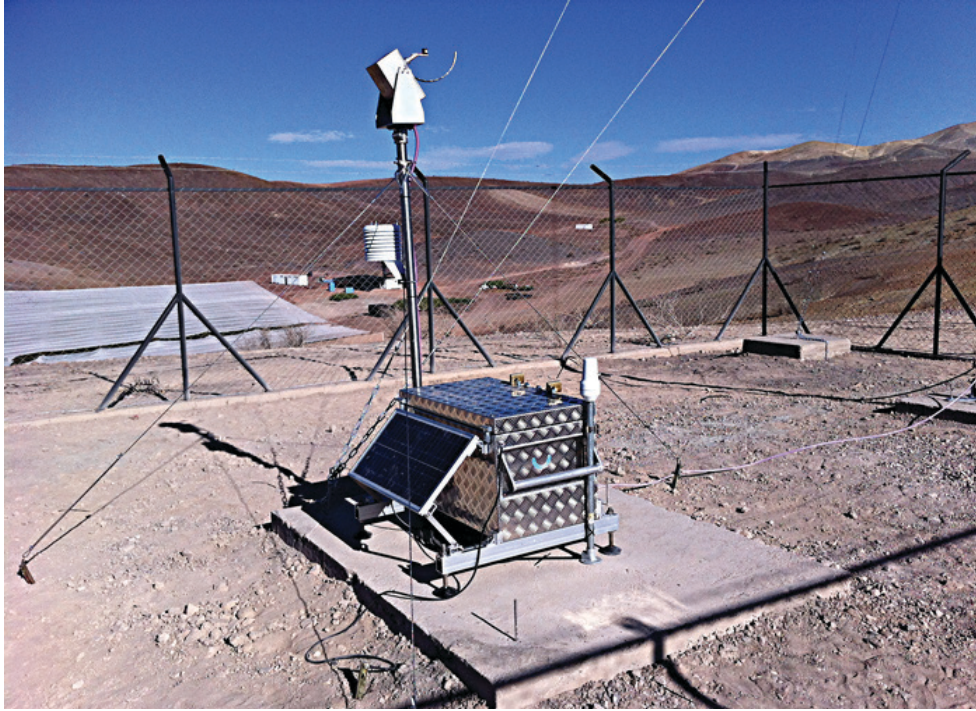
Station data can either be collected by the client or can be managed through our highly secure cloud data management service. This offers integrated data quality checks, web based data access 24/7 and options for text or email alerts for a nominal monthly fee.

Applications

	Measurements	Hardware	Description
Photovoltaic Solar Technology monitoring	Global Horizontal Irradiance (GHI), Plane-of-Array Irradiance (POA), diffuse radiation, Diffuse Horizontal Irradiance (DIFF), Plane-of-Array Irradiance (POA), back-of-panel temperature.	Dataloggers: » CR800/850 » CR1000 » CR6 » CR3000	Datalogger based systems for monitoring solar irradiance, power output, panel soiling, standard met measurements and more.
Concentrated Solar Technology (CST) monitoring		Sensors: » Pyranometer » Pyrliometer installed on Sun Tracker » Surface mount thermistor » General met sensors: wind set, temperature & relative humidity, barometric pressure, rain gauge. » Visibility » Ceilometer	Systems offer: » SCADA Protocols (Modbus, DNP3, and others) » One Second Measurement, Data Delivery and Storage » Wireless SCADA Connectivity » Ethernet Connectivity » Cellular Connectivity » Fault Detection and Reporting » AC and/or Autonomous DC Power Supply
Solar Energy Forecasting & Resource Assessment	Wind speed & direction, air temperature, relative humidity, barometric pressure, precipitation, solar position.		
Operational Performance Monitoring	DC current & voltage (string and/or module), short circuit current, module soiling, surface moisture.	Peripherals » Wide range of communications options » Power Options » Mounting Options	
Soiling Monitoring	Visibility, electric field, cloud height.		

Case Study: Chile Solar-Energy Assessment

Rugged Campbell Scientific dataloggers enable reliable data connectivity in the desert



Case Study Summary

Application:

Assessing site suitability for solar thermal power plants

Location:

Chile

Participating Organisations:

Solar Millennium AG

Contributors:

Jeff Martin, Wireless Innovation Ltd

Measured Parameters:

Solar radiation, wind speed, wind direction, temperature, precipitation

Solar energy resource assessment projects are critical to the successful siting of solar thermal power plants. Before a plant is developed, the environment of the plant's intended location must be studied in detail to ensure that the site will continue to deliver a consistent and reliable source of solar power. If it is determined that a site cannot harness a continuous and sufficient solar-energy supply, another site must be selected and researched.

Solar energy resource assessment projects were conducted in many different territories by Solar Millennium AG, a global project developer for solar thermal power plants. The developer's task entailed gathering radiation and climatological data to assess the suitability of particular locations. Their assessment task was complicated because the sites that Solar Millennium had to research and test were often in remote and inaccessible desert locations. Any equipment used to gather the data had to be rugged enough to withstand the harsh, remote environments. In addition, because it was impractical and hazardous to retrieve the data manually from these locations, the equipment needed to have low-maintenance requirements, and the data needed to be remotely retrievable through a reliable and secure connection.

One location that Solar Millennium researched was in the Atacama Desert in Chile. For this solar energy resource assessment project, a variety of sensors were used: pyranometers, anemometers, wind direction vanes, temperature sensors with radiation shields, and tipping bucket rain gauges.

To supply the necessary wireless communication solution, Solar Millennium contracted with Wireless Innovation. Wireless Innovation is a global provider of satellite solutions to the telemetry marketplace, has worked extensively in the renewables market, and has experience providing communication solutions that integrate with Campbell Scientific dataloggers and LoggerNet software.

For the Atacama Desert project, Wireless Innovation designed and employed a communication solution that operated via the Iridium Low Earth Orbit (LEO) satellite network and a MiChroSat 2403 satellite modem. The Iridium satellite network provides complete coverage of the earth, enabling communication services to and from remote areas where other forms of reliable communication are not available or feasible. The MiChroSat 2403 modem allows datalogging solutions to be deployed securely and reliably in remote and hostile locations where GPRS (general packet radio service) coverage is poor.

For their satellite data solution, Wireless Innovation integrated a number of Campbell Scientific CR1000 dataloggers into the Iridium network. The CR1000 dataloggers were rugged enough to withstand the harsh, remote environment of the Atacama Desert, offered low-maintenance requirements, and integrated seamlessly with the satellite solution. Data retrieval via email was aided by the use of Campbell's LoggerNet software. Consequently, Solar Millennium was supplied with the detailed radiation and climatological measurement data they needed for their site suitability assessments.

Monitoring Systems for Other Renewable Energy Methods

Geothermal

Campbell Scientific packages for geothermal resource assessment and energy monitoring can accurately and reliably measure direct-use plants. They monitor flow and temperature, and measure on-site meteorological parameters, ground-water level and temperature, thermal gradient profile, well casing temperature and integrity, and water quality and flow in open or closed systems. Each system can be customized for the plant's unique needs, and can integrate data into existing SCADA systems.

Advanced geothermal measurement systems provide independent turbine and pump performance monitoring with measurements that include: electrical current, voltage, wattage, power quality, stress, torque, electric field, lightning potential, vibration, strain, load, temperature, tilt, flow, and pressure.



Tidal & Hydro-Electric

Campbell Scientific systems are widely used in marine and waterway applications. A wide range of parameters can be monitored such as water level for tide or other water height measurement, wave height and frequency, turbidity, water temperature, flow and water quality including dissolved oxygen. Systems can be easily integrated into existing infrastructure and offer a wide range of communications options including SCADA, Ethernet or GSM/GPRS modems. Dataloggers offer both measurement and control functionality and can switch external devices such as motors, valves or relays based on time or event.

A full array of hydro-meteorological parameters can be measured including temperature and humidity, barometric pressure, wind speed and direction and precipitation.

Systems can be powered via AC connection but are sufficiently power efficient that, in most locations, they can be operated using solar panels with battery back-up.



Measurement Examples:

Dissolved Oxygen Monitoring

Dissolved oxygen is a major consideration in water quality. Hydro-power dams and other facilities can dramatically reduce the level of dissolved oxygen of water as it passes through the facility which can impact on wildlife downstream. The CS512, above, is a dissolved oxygen sensor that connects to any Campbell Scientific datalogger.

Vibrating Wire Gauge Monitoring

Vibrating wire technology is implemented in a range of sensors including pressure, temperature, cracks, movement, stress and strain - all important in geothermal and hydro-electric power plants. Campbell Scientific's patented VSPECT spectral analysis technology provides a high resolution measurement solution virtually free from noise errors.



Measurement Solutions for Renewable Energy Applications



For further information call our **renewables team** on +44 (0)1509 828888
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