



SD WIND ENERGY

# GUIDE TO OFF-GRID SYSTEMS



2019



About Us	2
Introduction	3
Worldwide Installations	4
Technical Specification (SD3 & SD6)	6
Sizing & Load Demand	8
Case Study: Agricultural/Domestic	10
Case Study: Remote Island Community	12
Case Study: Telecommunications	14
Case Study: Rural Electrification	16
Case Study: Cold Climate	18
Case Study: Offshore Oil & Gas	20
Case Study: Coastal Marine	22
Battery Sizing & Selection	24
Charge Controller & Example Schematic	25
Hydraulic Towers	26
Foundations	27
Additional System Components	28
Manufacturing	29

## About Us

SD Wind Energy is a global market leader in the design, manufacture, supply and installation of small scale wind turbines and off-grid energy systems.

First established in 1980, our product range is the result of over 30 years' research, development and innovation. SD Wind Energy offers unrivalled wind power solutions the world over - with over 5,000 installations in over 70 countries and on every continent.

Whether for business solutions, domestic applications, offshore developments, community power stations or remote stand alone systems, our track record is unrivalled.

## A Unique Delta Rotor Design

Our small wind turbines regulate their own speed. As the wind gets stronger, the blades pitch and cone to protect the rotor and ensure a high output even in the fiercest storms, unlike alternative turbines which need to be put on brake to protect themselves.

This unique downwind technology is what sets us apart from the rest and ensures customers achieve maximum energy yield at all times.

SD Wind Energy has been supplying small wind turbines around the globe with many of our early systems now entering their third decade of operation.

**17%** of the global population are without mains electricity.  
*That's over 1.26 billion people!*

# INTRODUCTION TO OFF-GRID SYSTEMS

## Off-Grid Power Solutions

17% of the global population is currently without electricity - that's over 1.26 billion people!

For some this is a lifestyle decision, opting to live beyond the grid for electricity. For the majority this is not through choice.

Approximately 87% without electricity live in rural or remote areas, or locations with low population. It's in these locations where the provision of national grids isn't possible, whether due to technical challenges, high cost or a lack of local government investment.

SD Wind Energy provides reliable, efficient and affordable off-grid energy solutions through our small scale wind turbines, often combined as hybrid systems with Solar PV or back-up diesel generators, all of which offers a solution to the challenges of generating power off mains.

Our solutions are compatible for integration into existing off-grid systems that may require additional power expansion or as an alternative clean technology to replace high polluting and expensive to operate diesel gensets.

Off-grid systems are adaptable, can be expanded easily to accommodate change in use or load demand and can provide uninterrupted power 24/7.

The requirement for power demand will differ from site to site and one size does not fit all when it comes to designing an off-grid system, which is why our 'Guide to Off-Grid Systems' has been created to help you understand the various options available, the key technical considerations and to demonstrate the wide range of existing off-grid customers, system sizes and configurations already providing robust, reliable off-grid power around the globe.

If you need help in designing the most appropriate off-grid energy solution for your needs, contact our expert team today!



### Stand Alone

Wind turbine is the sole source of power, connected to a battery to provide constant supply of energy.



### Hybrid

Wind turbine integrated with Solar PV panels and/or a diesel generator to provide uninterrupted power 24/7.



### Mini-Grid

Multiple wind turbines and alternative renewable technologies interconnected to create a distributed energy network.



### Smart Grid

A mini-grid that prioritises energy demand control and allocates energy to users based on real time availability.

# SD WIND ENERGY OFF-GRID INSTALLATIONS AROUND THE WORLD



**RURAL DOMESTIC**  
Alaska  
3 x SD6 wind turbines installed to power a house and business in cold temperatures.



**RURAL DOMESTIC**  
England  
The hybrid system including 2 x SD6 wind turbines, provides the full electrical, hot water and heating demand of the small holding and business premises.

30+  
YEARS  
OPERATION  
AROUND  
THE GLOBE



**TELECOM BASE STATION**  
Namibia

The base station serves telecommunication power to around 1,500 people living in the village of Dorbadis and to farming communities over 30km away. The hybrid energy solution ensures that the base station provides clean, green and continuous energy day and night.



**RURAL ELECTRIFICATION**  
Falkland Islands  
90% of rural electricity generated in the Falklands comes from SD3 and SD6 wind turbines. Operating since 1992.



**REMOTE COMMUNITY**  
Isle of Eigg

Isle of Eigg's electricity was powered by diesel generators until they installed 4 x SD6 - This is part of a Wind, Solar & Hydro Hybrid Grid.



**OFFSHORE**  
North Sea

The SD3EX wind turbine provides reliable power to unmanned gas platforms in the North Sea. ATEX approved.



**VISITOR CENTRE**

**Korea**  
2 SD6 units installed in 2007 as part of hybrid package along with Solar PV Panels. The system is used to power the visitor centre.



**TELECOM BASE STATION**  
Saudi Arabia

The installation of wind turbines provided a cost-effective alternative to a diesel generator that would have involved subsequent costly refuelling trips and regular maintenance.



**GAS LABORATORY**

**Japan**  
2 x SD6 turbines generating power for Tokyo Gas Laboratory in Yokohama.



**TELECOM BASE STATION**  
Rabi Island Fiji

The only wind turbine on the island. The SD turbine is producing far more than the expected annual energy output thanks to the great wind regime on the site.



**RESEARCH STATION**  
Antarctica

9 x SD6 generating power for a remote access research centre.

# TECHNICAL PRODUCT SPECIFICATIONS



SELF REGULATING



NO GEAR BOX



MINIMAL VISUAL IMPACT



ANTI OVER-SPEED CONTROL





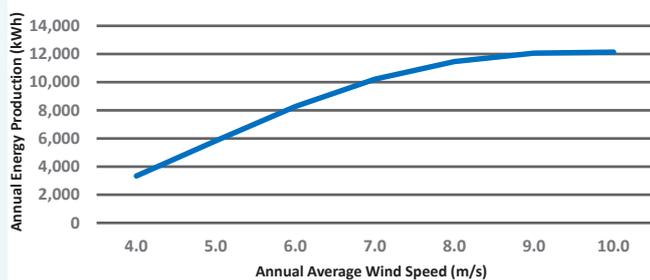
## SD3 PRODUCT SPECIFICATION

Peak Power	3.2kW
Applications	Telecoms, Offshore Oil & Gas Platforms, Remote Islands, Domestic
Solutions	Battery Charge, 24V, 48V, 120V, 300V
Architecture	Downwind, 3 Bladed, Self Regulating
Rotor	3.9m Diameter (maximum 300 RPM)
Blade Material	Glass Thermoplastic Composite
Generator	Brushless Direct Drive Permanent Magnet
Tower Height Options	6m / 9m / 15m Taperfit Monopole - Hydraulic
Tower Specification	Class 1 Rated / Galvanised Steel
Foundation Options	Pad / Root / Rock Anchor
Cut In Speed	2.5m/s
Cut Out Speed	None - Continuous Operation
Survival Wind Speed	Designed to Class 1 (70m/s)
Warranty	5-Year
Cold Climate Options	Available on Request
Colour Options	Light Grey (RAL7035) Black (RAL9005)

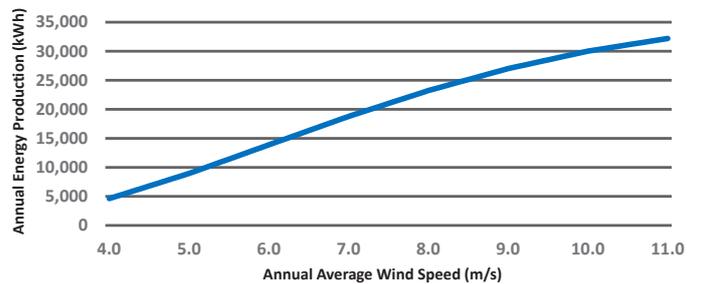
## SD6 PRODUCT SPECIFICATION

Peak Power	6kW
Applications	Small Holdings, Commercial, Telecoms, Public Sector, Remote Islands
Solutions	Battery Charge, 48V, 120V, 300V
Architecture	Downwind, 3 Bladed, Self Regulating
Rotor	5.6m Diameter (maximum 200 RPM)
Blade Material	Glass Thermoplastic Composite
Generator	Brushless Direct Drive Permanent Magnet
Tower Options	9m / 15m / 20m Taperfit Monopole - Hydraulic
Tower Specification	Class 1 Rated / Galvanised Steel
Foundation Options	Pad / Root / Rock Anchor
Cut In Speed	2.5m/s
Cut Out Speed	None - Continuous Operation
Survival Wind Speed	Designed to Class 1 (70m/s)
Warranty	5-Year
Cold Climate Options	Available on Request
Colour Options	Light Grey (RAL7035) Black (RAL9005)

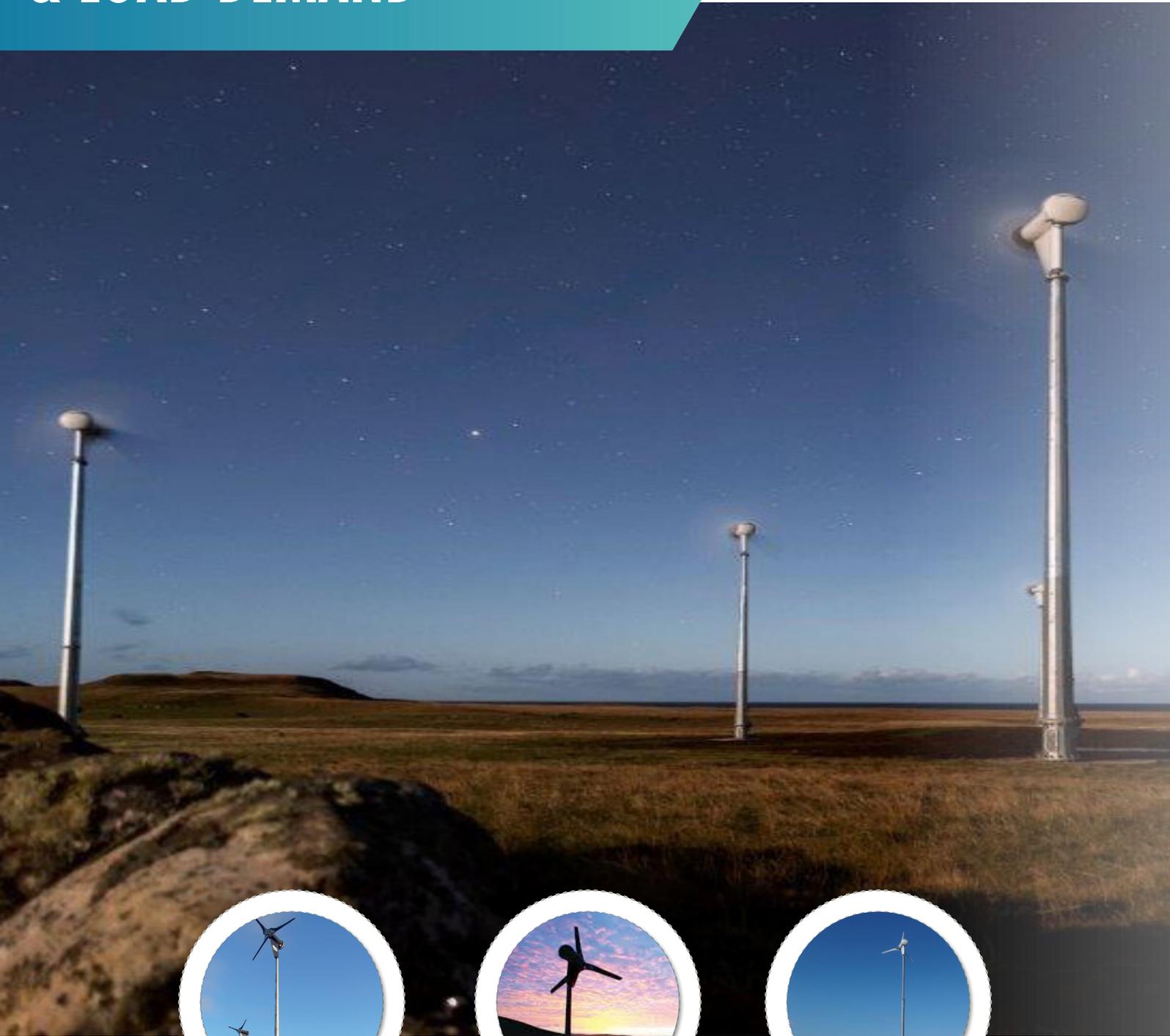
## SD3 ANNUAL ENERGY PRODUCTION



## SD6 ANNUAL ENERGY PRODUCTION

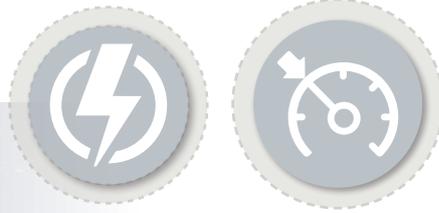


# SYSTEM SIZING & LOAD DEMAND



Wind Energy operates through both the day-time and at night-time when **power demand** is often at its highest. Consider the **benefits of Wind Power** over Solar PV during the **hours of darkness!**

# CUSTOMISED SYSTEMS TO MEET LOAD DEMAND



## SIZING YOUR SYSTEM

There are many factors to consider when it comes to designing an off-grid system. SD recommends that Load Demand is the first consideration to review and understand before deciding which system type is best for your project needs.

Understanding load demand, when peak demand is required, environmental considerations and the rate of battery discharge will help you establish the size of system you require.

The power and energy consumption of the loads is of significant importance in off-grid systems.

The main points to consider:

1. **Which electrical loads are to be supplied by the off-grid system?**
2. **How high will the energy consumption be per day or annually?**
3. **What will be the maximum peak power requirement in a day?**

SD has a number of sizing calculators to assist with the design stage and our team of experts are on hand to advise which method is the best to suit your application.

Once the load demand and system rating has been established, SD will then recommend if a stand-alone, hybrid or mini-grid system is the most practical to your demands and also the operating voltage of your system.

Depending on your geographic location and availability of space, we will also recommend whether supporting technologies such as Solar PV or a back-up diesel generator should be integrated within your system to help compliment the wind turbine or provide back up.

Our expert team can help you choose which **system size and type** is best to suit your **load demand** and provide uninterrupted power supply **24/7**.



# AGRICULTURAL DOMESTIC HYBRID POWER SYSTEM

YORKSHIRE, ENGLAND

COMMISSIONED - 1992



95%

ANNUAL ENERGY PRODUCED  
BY THE WIND TURBINES



24/7

UNINTERRUPTED  
OFF-GRID POWER SUPPLY



## SYSTEM TYPE: Wind & Diesel Hybrid

### THE CHALLENGE

A smallholding and business premises that is located in rural Yorkshire, England, is a great example of living off-grid. When the owners purchased and developed the property to become their new home and business premises, the property was not connected to the national grid. This was due to the rural location of the property which is in one of the highest points in the Yorkshire countryside.

The owners originally enquired about connecting the property to the national grid, however, due to the excessive costs of obtaining a grid supply they quickly decided to seek an alternative.

### THE SOLUTION

The location has a good wind resource, is well exposed and has plenty of space, so the obvious solution was to install a small scale wind turbine. In 1992, the owners installed their first wind turbine as part of a hybrid system with a diesel generator as back up.

As the power demand of the property increased within the business and office premises, the system has been expanded to cover this demand and now has 2 x SD6 wind turbines, back up diesel generator and battery bank. When the battery is fully charged, any surplus energy produced from the wind turbines is diverted into hot water storage with a unique diversion control system. This ensures all of the renewable energy produced is utilised across the domestic premises, office and outbuildings.

### COMPARISON ANNUAL RUNNING COSTS

To power this application without the off-grid system would have an annual average cost of:

£5,375.00      Annual running cost if powered solely on diesel  
 £3,422.25\*\*    Annual running cost if electricity was purchased from grid

\*at 0.25p per kWh of energy produced by a diesel generator

\*\*at an electricity purchase rate of 0.15p per kWh

### SYSTEM BENEFITS

Turbines annual average output	21,500kWh
Diesel annual average output	1,315kWh
Annual energy used for hot water & heating	13,980kWh
Annual energy used for electricity	8,835kWh
Annual energy produced by the wind turbines	95%
Annual energy produced by the diesel generator	5%

### SYSTEM SPECIFICATION

SD6 (300V) x 2 (12kW)  
 SMA Mini-Grid Inverters  
 Rectifier Protection Controller  
 Battery Bank 720 AMPH  
 10kVA 3 Cylinder Diesel Generator  
 EWP Hot Water Diversion Control

### KEY COMPONENTS



WIND TURBINE



CONTROLLER



INVERTER



HOT WATER  
DIVERSION



BACK UP  
DIESEL GENERATOR



GRID INVERTER



BATTERY BANK

# REMOTE ISLAND COMMUNITY MINI-GRID SYSTEM

ISLE OF CANNA, SCOTLAND

COMMISSIONED - 2018



**98%**  
REDUCTION IN DIESEL  
CONSUMPTION



**100%**  
COMMUNITY POWER  
AVAILABILITY



## SYSTEM TYPE: Wind, Solar & Diesel Hybrid

### THE CHALLENGE

For almost 20 years, the Islands of Canna and Sanday's 18 residents have had to rely on three diesel generators for power, as the islands are not connected to the National Grid.

Powering the local community was challenging and expensive as well as being damaging to the sensitive environment due to the pollution from the diesel generators. This is a common problem in remote island communities that strive to preserve the natural environment in which they live which is often a haven for rare wild-life and sensitive vegetation.

The costs to maintain the communities power demand was excessive as well as problematic in respect of transportation of diesel and the on-going running costs of these generators.

### THE SOLUTION

The community has established its own enterprise, Canna Renewable Energy and Electrification Ltd (CREEL) to own and operate a new mini-grid. Electricity will be provided to residents after which profits from the power generated will be used to cover operation and maintenance costs and reduce bills for local homes and businesses. The mini-grid comprises of 6 x SD6 Small Wind Turbines and a 34.56kWp PV System.

*"We're delighted that our energy project is now completed and the turbines are making good use of this winter's Atlantic gales. As well as minimising the noise and pollution from the generators, the new scheme gives us the capacity to build additional houses on Canna, so that new families can make their home on this beautiful island"*

CREEL Director Geraldine MacKinnon

*The new system is expected to **substitute the use of over 36,000 litres of diesel fuel each year, equivalent to 96.6 tonnes of carbon dioxide emissions.***

### SYSTEM SPECIFICATION

SD6 (300V) x 6 (36kW)  
Solar PV Panels (34kWp)  
SMA Mini-Grid Inverters  
Rectifier Protection Controller  
Battery Bank (225kWh Usable)  
60kW Back Up Diesel Generator

### KEY COMPONENTS



WIND TURBINE



CONTROLLER



INVERTER



SOLAR PV SYSTEM



BACK UP DIESEL GENERATOR



GRID INVERTER



BATTERY BANK

# TELECOMS HYBRID POWER SYSTEM

SAUDI ARABIA

COMMISSIONED - 2005



**12,000kWh**  
AVERAGE ANNUAL OUTPUT  
FROM SD6 WIND TURBINE



**£19,000**  
ANNUAL SAVINGS  
COMPARED TO DIESEL

## SYSTEM TYPE: Wind & Solar Hybrid

24/7  
POWER  
SUPPLY



### THE CHALLENGE

Saudi Aramco required an additional energy source to power its RS10 telecom base station in Saudi Arabia. The base station was solely powered by solar photovoltaic (PV) panels; however, an additional energy source was required to provide extra power to supplement an increased load.

The base station is in a remote location and is miles from a grid connection. It provides a service to the public and therefore, cannot be shut down for long periods of time.

The extreme climate in Saudi Arabia also demands an energy solution that works in all weather conditions.

### THE SOLUTION

To meet all the above requirements, the company opted for a battery charge SD6 wind turbine. The hybrid solution improved the availability, performance and reliability of the power supplied.

The extra energy production capabilities will also allow for an increase in load in the future, without the need for any additional energy source.

The installation of the wind turbine provided a cost-effective alternative to a diesel generator that would have involved subsequent costly refuelling trips and regular maintenance. As the turbine and solar panels are producing more than required, the base station always has a backup of energy.

The SD6 wind turbine was successfully installed in January 2005 as a battery charging configuration and has been 100% operational since. The turbine produces on average 12,000kWh of electricity annually which currently exceeds the base station's requirements.

### SYSTEM SPECIFICATION

SD6 (48V)  
Solar PV Panels (6kWp)  
Charge controller  
Battery Bank 1690AMPH

### KEY COMPONENTS



WIND TURBINE



CONTROLLER



SOLAR PV  
SYSTEM



BATTERY BANK

The SD6 wind turbine was successfully installed in January 2005 as a battery charging configuration and has been **100% operational** since.



# RURAL ELECTRIFICATION STAND ALONE & MINI-GRIDS

THE FALKLAND ISLANDS, SOUTH ATLANTIC  
FIRST TURBINE COMMISSIONED - 1992



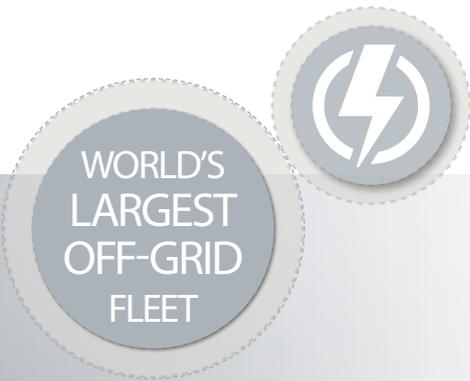
90%

ELECTRICITY REQUIREMENTS  
SUPPLIED BY WIND TURBINES



130

SD WIND TURBINES  
INSTALLED ON THE ISLANDS TO DATE



# SYSTEM TYPES: Stand-alone + Wind & Solar Hybrids

## THE CHALLENGE

March 1992 and an initiative to support the uptake of Off-Grid Renewable Energy has just been initiated in one of the most remote areas of the world - The Falkland Islands, South Atlantic which has a population of over 2900. Falkland Islands Development Corporation (FIDC) had a vision to introduce renewable energy to support the economic growth within the rural community but more importantly to ensure rural life on the islands could continue. Residents on the Islands relied solely on diesel generators for power as there was no grid network available. The cost of transporting the diesel was unsustainable and damaging to the sensitive environment.

## THE SOLUTION

The potential for harnessing 'small scale' wind power was realised with a 50% grant made available with funding through FIDC. The initial concept tried a number of manufacturers, many of which were not capable of withstanding the harsh weather regimes on the islands. After a 12 month pilot trial, FIDC opted for a reliable, robust and easily maintainable wind turbine, the SD3. These are available on tower heights from 6m to 20m.

Since 1992 SD continues to supply the 3kW and 6kW Small Turbines, most of which are stand-alone systems in 24V, 48V and 300V configurations and have recently introduced micro-grids, designed to power remote entire communities. These systems have integrated multiple 6kW turbines, utilising battery storage.

90% of the rural population now has 24-hour power thanks to SD Small Wind Turbines. With over 130 turbines on the islands, SD has what is believed to be the largest off-grid turbine fleet in the world. Our success in the Falklands is a great example of what can be achieved with Rural Electrification.

## SYSTEMS UTILISED

- SD3 (24V) Small Wind Turbine
- SD3 (48V) Small Wind Turbine
- SD6 (48V) Small Wind Turbine
- SD6 (300V) Small wind Turbine

## KEY COMPONENTS



WIND TURBINE



CONTROLLER



INVERTER



GRID INVERTER



BATTERY BANK

**24/7 uninterrupted power supply**

90% electricity demand supplied to rural community

**Low maintenance costs**



# COLD CLIMATE (-40 DEGREES) SMART MICRO-GRID

PRINCESS ELIZABETH RESEARCH STATION, ANTARCTICA

COMMISSIONED - 2008



**1st**  
ZERO EMISSIONS POLAR  
RESEARCH STATION



**-40°C**  
OPERATING TEMPERATURE  
CAPABILITY

## SYSTEM TYPE: Smart Micro-Grid

POWER  
SUPPLY  
DOWN TO  
-40°C



### THE CHALLENGE

In such a remote region of the world, the costs of powering a scientific research facility with diesel generators was simply not an option. This was not only due to the challenging logistics of diesel transportation but most importantly, to allow the scientific research facility to achieve a Zero Emissions status which was fundamental to its existence.

Two of the most omnipresent features of Antarctic weather (during the Austral summer) are the wind and the sun. Two renewable sources that provide free energy to the “zero emission” Princess Elisabeth Antarctica.

While the sun never sets in Antarctica for one half of the year, it never rises for the other half. This means that in order to function properly during the Antarctic winter, the Princess Elisabeth Station needed a second source of energy that would be available all winter long.

Coupled with the challenges of extreme winds and periods of no sunshine, the project required turbines that could withstand -40°C temperatures.

### THE SOLUTION

The katabatic winds on the Antarctic continent provided the answer to the issue, as the wind gusts from the plateau are as fierce in the winter as they are in the summer. With these factors in mind, the most obvious solution was SD Wind Energy.

9 x SD6 were installed due to their ability to withstand the two most extreme elements on Antarctica - high winds & cold climate. Ease of Installation and Low Maintenance were also key considerations in establishing the best fit for small scale wind and an alternative energy source.

A room full of lead-acid batteries enables the station to store energy for times when demand exceeds the current energy production.

### SYSTEM SPECIFICATION

SD6 x 9 (300V)  
Solar PV Panels  
Solar Thermal Panels  
SMA Mini-Grid Inverters  
Rectifier Protection Controller  
Battery Bank

### KEY COMPONENTS



WIND TURBINE



CONTROLLER



INVERTER



SOLAR PV  
SYSTEM



GRID INVERTER



BATTERY BANK



SOLAR THERMAL  
SYSTEM

Continuous power supply all year round

Energy generation in all weather conditions  
Operational down to -40°C

Zero CO<sub>2</sub> emissions energy system

# OFFSHORE ENVIRONMENTS MARINE & ATEX SOLUTIONS

CUTTER UNMANNED OIL & GAS PLATFORM, NORTH SEA

COMMISSIONED - 2006



**2-Year**  
INTERVAL FOR SERVICING  
REQUIREMENT



**96%**  
OPEX REDUCTION  
COMPARED TO DIESEL GENSETS



# SYSTEM TYPE: Wind & Solar Hybrid

## THE CHALLENGE

Unmanned Oil & Gas platforms require a source of energy to help power remote operations. In most cases these platforms are powered by diesel generators which require almost constant maintenance and are subject to excessive corrosion as a result of the inclement weather conditions experienced offshore.

All refuelling and maintenance trips to these platforms are via helicopter or sea vessel which incurs significant costs and has the added complexity of requiring favourable weather conditions to ensure safety is maintained at all times. These are all incredibly challenging elements in ensuring a power source is available and maintained to guarantee ongoing operations.

## THE SOLUTION

SD has delivered the world's first and only ATEX approved small wind turbine. Our unique design ensures low maintenance (every 24 months) therefore, reducing the requirement for mobilisation to these unmanned platforms.

With Zone 2 Certification our EX approved SD3 is helping to establish safety alongside innovation in the Oil & Gas sector and other Hazardous Environments.

The integration of the EX approved wind and solar PV hybrid system will allow for significant OPEX reduction by offsetting runtime of diesel generators which are expensive to operate and maintain whilst at the same time providing a tried and tested source of renewable energy. Recent installations have demonstrated a 96% OPEX reduction, further highlighting the capability of the SD range.

This specialist system has been operating successfully in the North Sea for over a decade and with an increasing portfolio around the world in the Oil & Gas sector, our ATEX approved solutions are now being recognised as the leading alternative to diesel generators in specialist sectors around the globe.

With the ability to reduce frequent visits via helicopter to these platforms some of these SD3EX installations have paid for themselves in less than 1 day when compared to diesel gensets.

**Servicing only required every 2 years**

**Reliable power supply in the harshest weather**

**Reduced running costs compared to diesel gensets**

## SYSTEM SPECIFICATION

- SD3EX (24V)
- EX-rated Solar PV Panels
- Enclosed Charge Controller
- 24V Battery Bank 3400 APMH
- Marinised Components
- INCONEL upgraded rotor control

## KEY COMPONENTS



WIND TURBINE



CONTROLLER



SOLAR PV SYSTEM



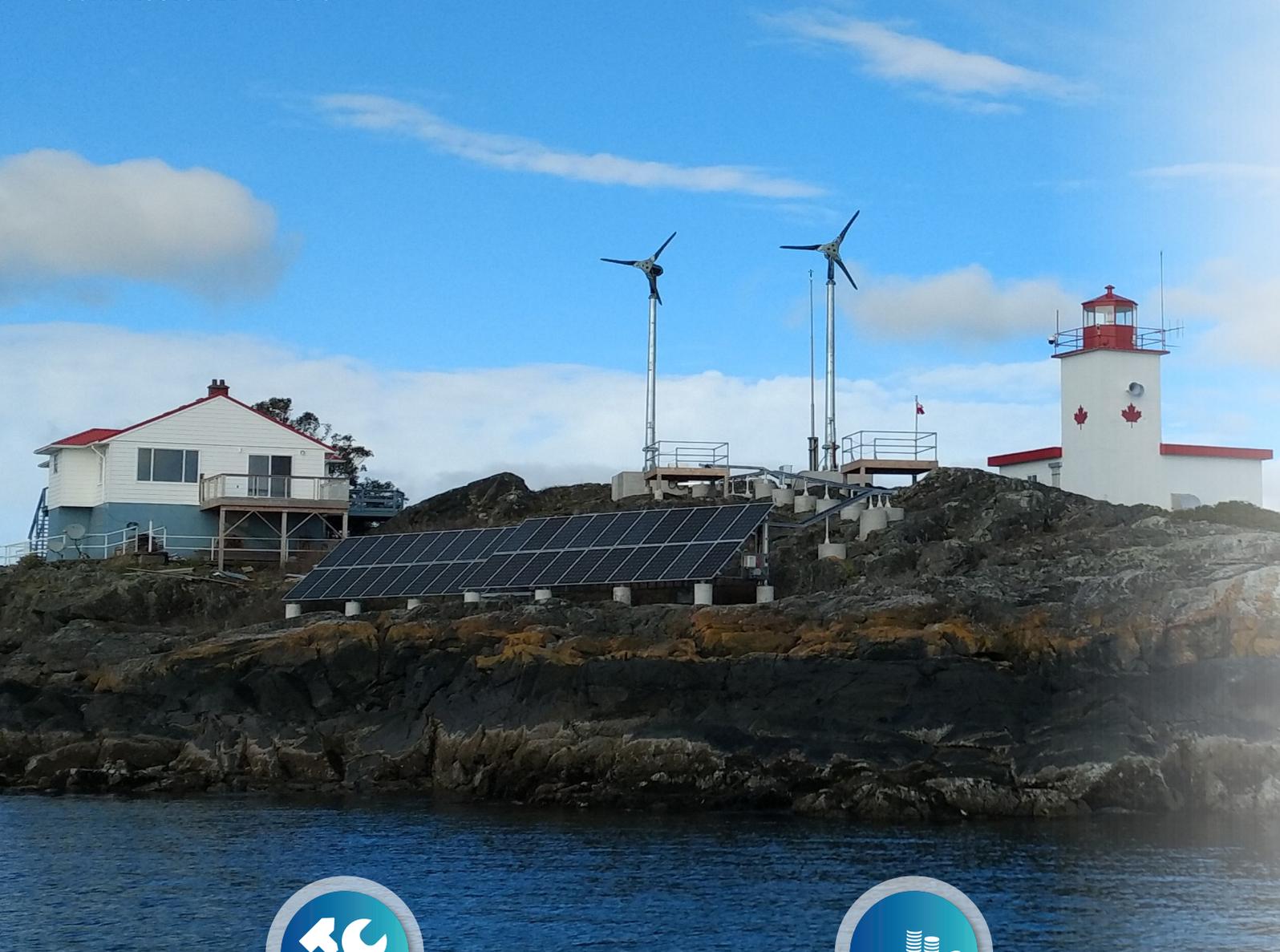
BATTERY BANK



# COASTAL MARINE HYBRID POWER SYSTEM

MERRY ISLAND LIGHTHOUSE, CANADA

COMMISSIONED - 2018



**Ease of Installation**

IN CHALLENGING  
WEATHER REGIMES



**>\$30,000**

ANNUAL REDUCTION  
IN DIESEL COSTS



# SYSTEM TYPE: Wind & Solar Hybrid

## THE CHALLENGE

Fisheries & Oceans Canada and the Canadian Coast Guard have undertaken an upgrade to the power generation systems for Merry Island, Entrance Island, Cape Scott and Boat Bluff Light-stations. Previously all of these light-stations were powered using two 27-35kW diesel generators. The organisation is responsible for Canada's economic, ecological and scientific interests in oceans and inland waters which is why a robust and sustainable alternative to diesel was required. The protection of the coastal environment was paramount to the decision to find alternative means of powering these important lighthouses.

One of these flagship installations is on Merry Island lighthouse, which is associated with marine transportation safety in a major artery for commercial ship traffic in and out of Vancouver. Owing to the role played by the lighthouse in the security of shipping lanes, its contribution to the development of Vancouver and Canada's West Coast is of inestimable value.

## THE SOLUTION

The new small scale SD3 Wind Turbines were selected by the Fisheries & Oceans Canada and the Canadian Coast Guard due to their ability to withstand extreme gusts, variable climatic conditions and offer low cost servicing. The SD3 Systems will produce on average 14,000kWh each annually and help to off-set \$20,000-\$30,000 in diesel costs which is the core objective of the energy strategy for the Canadian Coast Guard. If this were connected to the BC Hydro Grid it would offset approximately \$7000 annually.

A modular renewable system was designed which included adding an inverter system, a battery bank, a solar panel array, SD Wind 3kW wind turbines and automation to remotely monitor the system. The system has eliminated the need for diesel fuel consumption as the site's primary power source.

All these light-stations are staffed federal heritage sites located in close proximity to Vancouver Island in British Columbia, Canada aiding mariners from the Pacific Ocean to the Strait of Juan de Fuca and the Inside passage. Each site generally includes 3 residences, a light tower, a helipad, a storage shed, fuel storage and distribution system, an engine room, a power plant and fog alarm, a tool shed and a workshop. Most light-stations are located in areas with extreme weather conditions. This provides a unique set of challenges to build and maintain these renewable systems. It is important to ensure these systems are robust enough to withstand the test of time and have minimal maintenance. SD Wind 3kW turbines have performed very well over the winter storms.

## SYSTEM SPECIFICATION

SD3EX (24V)  
Solar PV Panels  
Charge Controller  
24V Battery Bank 3400 AMPH  
Marinised Components

## KEY COMPONENTS



WIND TURBINE



CONTROLLER



SOLAR PV SYSTEM



BATTERY BANK



# BATTERY SIZING & SELECTION

As with most forms of technology, one size does not fit all and in the case of a battery system, where they are being used and most importantly the rate of expected discharge are the most important factors to consider when selecting the best battery for your installation.

## BATTERY SIZING

A battery has two main specifications: voltage and capacity. Multiplying these two values will calculate the watt-hours of energy storage.

Adding cells in series will allow you to build up to 12, 24, 48, 120 or any voltage.

Capacity is measured in Amp hours (Ah). A string of 800Ah cells makes a 800Ah battery. More amp hours can be gained by connecting more strings in parallel.

Your system designer will apply these basic principles when designing your off-grid system.

## CHOOSING YOUR BATTERY

There are typically two main types of battery that are used on renewable energy off grid systems - Lead Acid Battery (Gel Cell) and Lithium Ion Battery.

Alternative new designs are reaching the market and SD advises that all specifications should be considered depending on your location,

## GEL CELL BATTERY

A key factor to consider with a Gel Cell Battery is the deeper the battery gets discharged on a daily basis, the less cycles it will achieve through its expected lifespan. How to eliminate this concern and ensure you are getting the maximum number of cycles and efficiency from the battery is to size the battery system so that your average daily demand never takes the discharge below 50%. Where you are using a gel cell Battery on a grid inverter system, the inverter will ensure the discharge rate is maintained not to drop below this threshold.

Gel cell remains the most cost effective as the capital investment is considerably cheaper than an alternative battery.

## LITHIUM ION BATTERY

The main benefit to Lithium Ion Batteries is their ability to discharge up to 100% of the stated capacity which makes them a better option for those who have a high or fast energy usage and the battery are likely to be discharged quickly.

An additional benefit is they are very low maintenance compared to an alternative battery; however, the additional upfront capital cost is higher. A Lithium Ion battery is lighter with less space required for housing.

## KEY FACTORS

There are various approaches to what has been described as the 'black art' of battery selection, sizing and design, although, there are some key considerations:

Is the battery fit for purpose and rated for its duties?

Does it have an adequate storage capacity and cycle life?

Is a sealed or vented battery more appropriate for the particular installation?

Will the battery be made up of series cells or parallel banks?

All of these elements will be considered by your system designer dependent on the needs of your application,



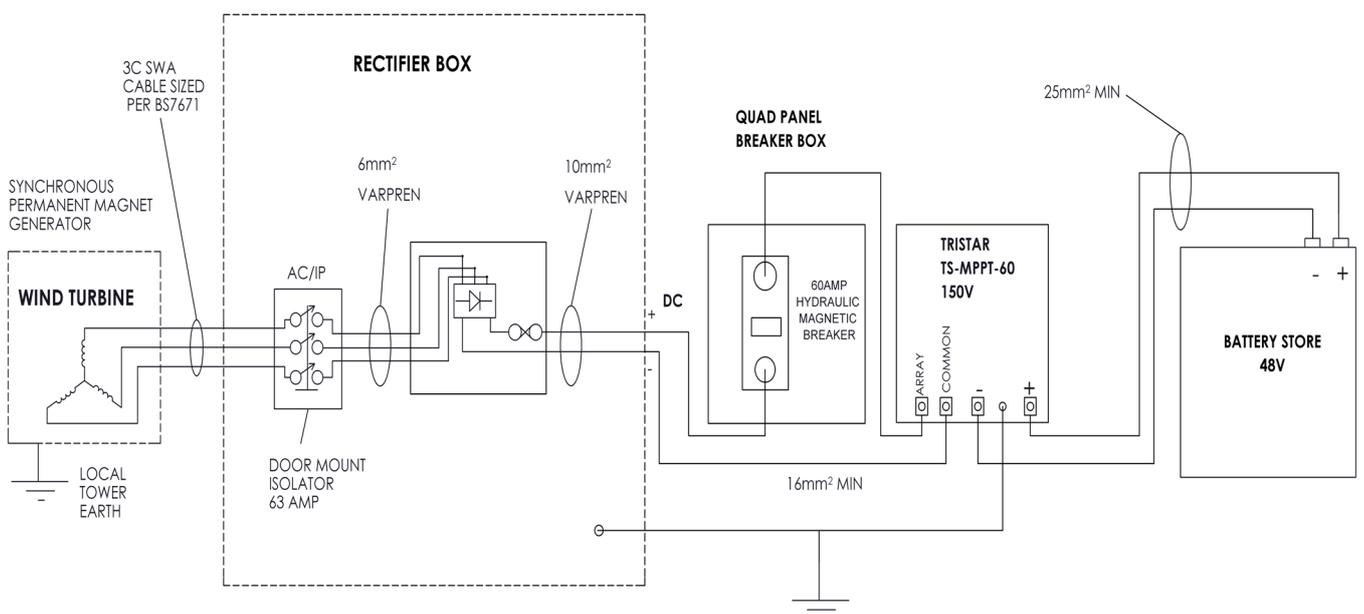
# CHARGE CONTROLLER & STAND-ALONE (EXAMPLE) SCHEMATIC

SD Wind Energy recommends the Morningstar TriStar MPPT controller with TrakStar Technology™ as an advanced maximum power point for off-grid systems. We have been operating with these systems across the globe for many years.

The controller provides the industry's highest peak efficiency of 99% and significantly less power loss compared to other MPPT controllers. The TriStar MPPT features a smart tracking algorithm that maximizes the energy harvest. This has been designed to optimise the power curve to match the SD turbine rotor design.

## FEATURES & BENEFITS

- Maximises Energy Harvest
- Extremely High Reliability
- Very High Efficiency
- Extensive Networking
- Robust thermal design and no cooling fans
- Parallel circuit design provides less stress and longer life



Example of a Stand-Alone SD3 Battery Charge System utilising the Morning Star MPPT 60 Controller

# TOWERS

SD recognises the integrity of supporting structures is as critical as the wind turbines themselves, which is why our towers are designed and classified to the highest standard available.

With a full range of hydraulic masts available from 6m to 20 heights, the location of your project will establish which tower height is the most suitable for your application. SD recommends the highest tower height possible at your location, to ensure optimum outputs are achieved. As the wind speed increases with height, consideration should be made to ensure your wind turbine is free from surrounding obstructions and is well exposed to the prevailing wind direction.

Hydraulic towers offer many benefits with the most obvious being the raising and lowering of the turbine for servicing purposes is achieved over a shorter duration, therefore, minimising downtime for service inspections. The SD wind turbines on hydraulic masts can be lowered and raised in as little as 20 minutes which ensures the turbine can be serviced at ground level without the need for expensive cranes for both installation and servicing.



**20 min.**  
RAISING &  
LOWERING TIME



# FOUNDATIONS

SD offer a variety of foundation designs, each of which is available to support the integration of your turbine in all types of ground conditions.

Options available include:

## PAD FOUNDATION

The most commonly used at 3.5m x 3.5m with a 0.8m depth. Can be landscaped over once foundation has cured. Utilises a reinforcing cage.

Concrete Volume = 11.02m<sup>3</sup>

## ROOT FOUNDATION

Popular in rural locations which can achieve a depth up to 3m. Can be landscaped over once foundation has cured. Utilises a reinforcing cage.

Concrete Volume = 3.52m<sup>3</sup>

## GROUND MOUNTED (AFS)

Commonly used in locations where digging or transportation of concrete isn't possible. Also a practical solution for mobility and relocation if required such as humanitarian aid or disaster relief.

## ROCK ANCHOR

Can be designed to fit the needs of the application. Commonly used in areas of high rock density or mountainous regions.



Example images of the Ground mounted (AFS) foundation which is ideal for remote or temporary installations

# ADDITIONAL TECHNOLOGIES & COMPONENTS

In our 30+ years experience of designing and supplying off-grid systems around the world, we understand the needs of each application differ from one to another. Depending on the location, climatic conditions or customer needs, SD Wind Energy can tailor each package to include alternative renewable technologies, anemometry for wind speed measurement and data logging with customised dashboards for energy monitoring and reporting.

Our team have the expertise to advise on the considerations that will help to make your off-grid power project a reality and can call upon a host of renewable energy professionals around the world to support the delivery, installation and commissioning on your project.

## SOLAR PV

Solar Photovoltaics compliments Small Wind Turbines very well and in particular can offer a seasonal back up benefit for periods of no wind or for applications that require a full renewable hybrid solution – day and night.

SD can supply Solar PV panels as part of a Hybrid Solution, which can be designed into the off grid system at time of installation or as a retro-fit upgrade should energy demand increase at site. The recommended Solar PV panel will depend on your location and weather regime. Your system designer will advise the best solution at the point of enquiry.



## DIESEL GENERATORS

Whilst SD specialise in off grid systems as an alternative to diesel generators, in some cases a generator is required as a back-up power source to compliment a renewable off grid system, typically, for the rare occasions there has been no wind or where the battery has discharged beyond your load demand and until they have re-charged.

The integration of a diesel generator is to provide back-up which is only required on average 5% of the time when a hybrid system is sized appropriately to your load demand requirements.



## DATA LOGGING

SD can tailor data logging and energy monitoring to the specific needs of any project and specialise in the integration of remote telemetry for the purposes of energy management, recording performance outputs and wind speed etc.

Dashboards to record all elements of performance characteristics can be customised with alerts, charting data comparison. In addition, SD can integrate anemometry with our data logging systems to monitor wind speeds and direction for 100% viability of your systems performance.



# WORLD CLASS MANUFACTURING FACILITY

Since 1980 our team have been focused on delivering the very best in quality and innovation in small scale wind. From our engineering through to production, we are regarded amongst the most highly accredited businesses operating in the global wind industry.

Independently audited annually by the world's leading certification bodies, our team are dedicated to continually surpassing the highest standards in quality and certification.

As the world's only small wind turbine manufacturer who holds the stringent ATEX approval for the Oil & Gas industry, we understand the rigorous processes required to deliver market leading renewable energy products to our customers - whether for an agricultural farm or an unmanned Oil & Gas platform, each wind turbine that is manufactured at our head-quarters undergoes the same internal checks on quality and testing before being despatched to it's installation destination.



As the first small wind turbine manufacturer\* to achieve MCS (Micro-generation Certification Scheme) accreditation, we have lead the small wind industry at every stage of it's development over recent years, including installer certification.

At SD Wind Energy we are passionate about our business, our customers and our industry which is why we will continue to lead the sector in the advancement of standards and compliance and the delivery of market leading products and services across the globe.

We care about energy, we care about sustainability and we care about our customers. From our market leading product warranties, to the training and development of our global installer network, every element of delivering world class wind energy has been considered at SD Wind Energy.

\* (former company name Proven Energy)

PERFORMANCE . EXPERTISE . RELIABILITY



# GLOBAL LEADERS IN SMALL SCALE WIND





*“Small & Medium Wind Turbines (SMWT) are easy to integrate in (existing) mini-grids fed currently with diesel. Compared with diesel-only-fuelled systems, hybrid wind-diesel systems provide a more cost-effective, reliable and thereby sustainable solution to users. You can optimise the business case further in the longer term by combining Small Wind Turbines with solar technology”*

Marcus Wiemann, Executive Director (ARE) The Alliance for Rural Electrification



Alliance for  
Rural  
Electrification

*Shining a Light for Progress*

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