

solarwind
Powered by Nature

**DECARBONIZING TELECOMS:
OUR POINT OF VIEW & SOLUTIONS**



COMPANY OVERVIEW



WHO WE ARE

We supply equipment and technologies from world manufacturers in the field of renewable energy sources.
We carry out installations of any complexity and configuration.

WIND TECHNOLOGY

Installation of low-power wind turbines, directly on communication towers and not far from them. Connection of the central power supply to the communication infrastructure.

HYBRID CAPABILITY

Our unique capability is bringing hybridized wind, solar PV and battery storage solutions to some of the most challenging rural environments

MOBILE SUSTAINABILITY

Our mobile renewable energy solutions provide 100% clean energy to remote locations and have the ability to deliver resilient and reliable energy to millions of people

SERVICE

Our service and installation team has extensive experience in the field of renewable energy and provides delivery and maintenance of the project.

FOCUS AREAS



USE OF RENEWABLE ENERGY IN HARD TO ACCESS PLACES

Where the consumer needs access to affordable, reliable and sustainable energy



DISPLACING FOSSIL FUEL GENERATION IN REMOTE LOCATIONS

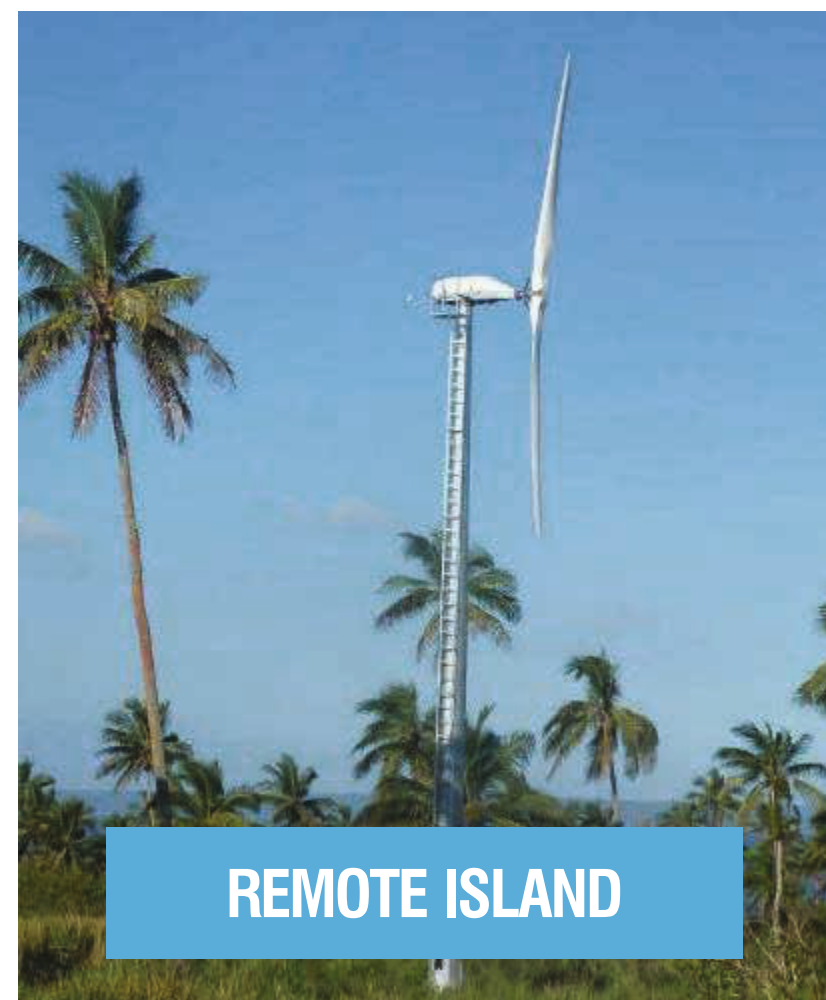
Where the fuel cost is significantly higher than grid power and has a harmful environmental footprint



PROVIDING CLEAN ENERGY FOR COMMERCIALY DRIVEN MARKETS

Where companies see the benefits economically and environmentally from utilizing renewable energy

WORLD EXPERIENCE IN THE USE OF RENEWABLE ENERGY



Clean decentralized energy in Tonga



Providing access to electricity in Ghana



Wind-to water in Kenya



Reducing diesel consumption in telecoms industry in Chile



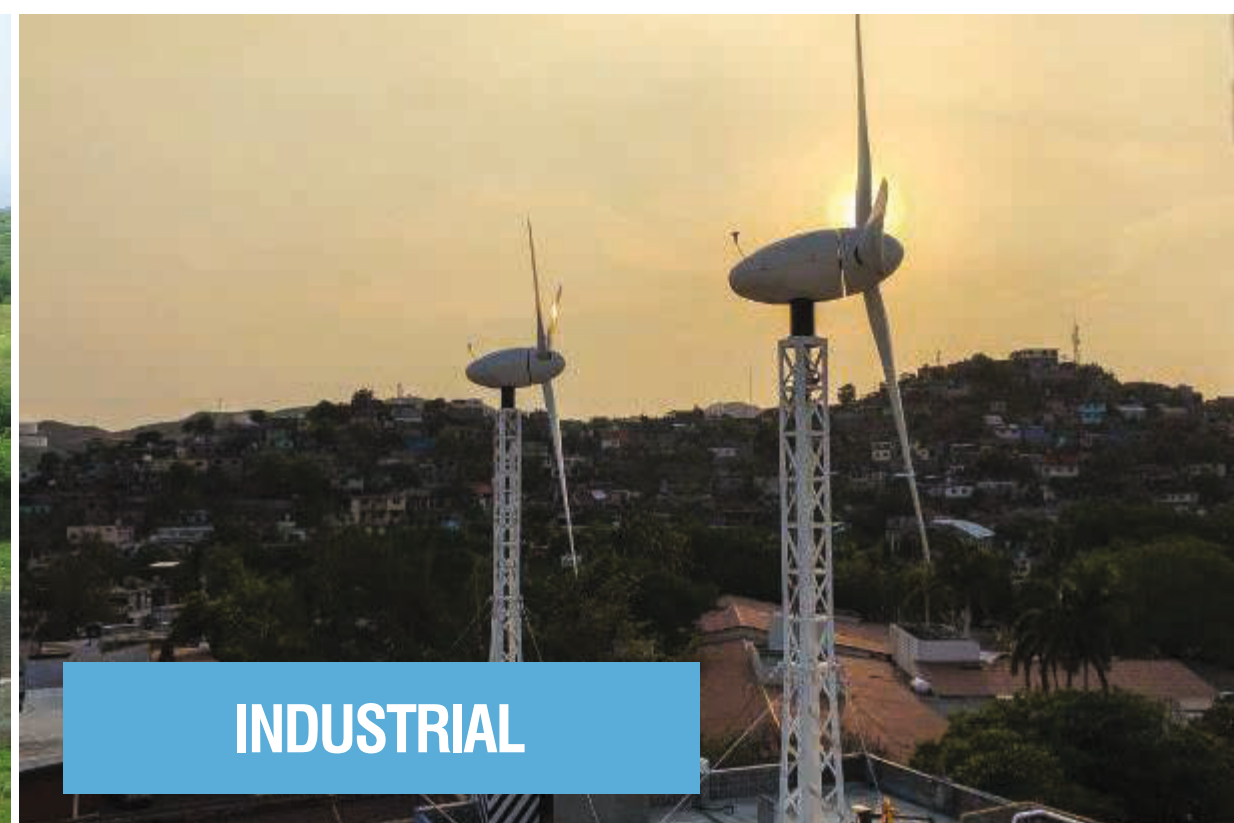
Off-grid wind energy in the Caribbean



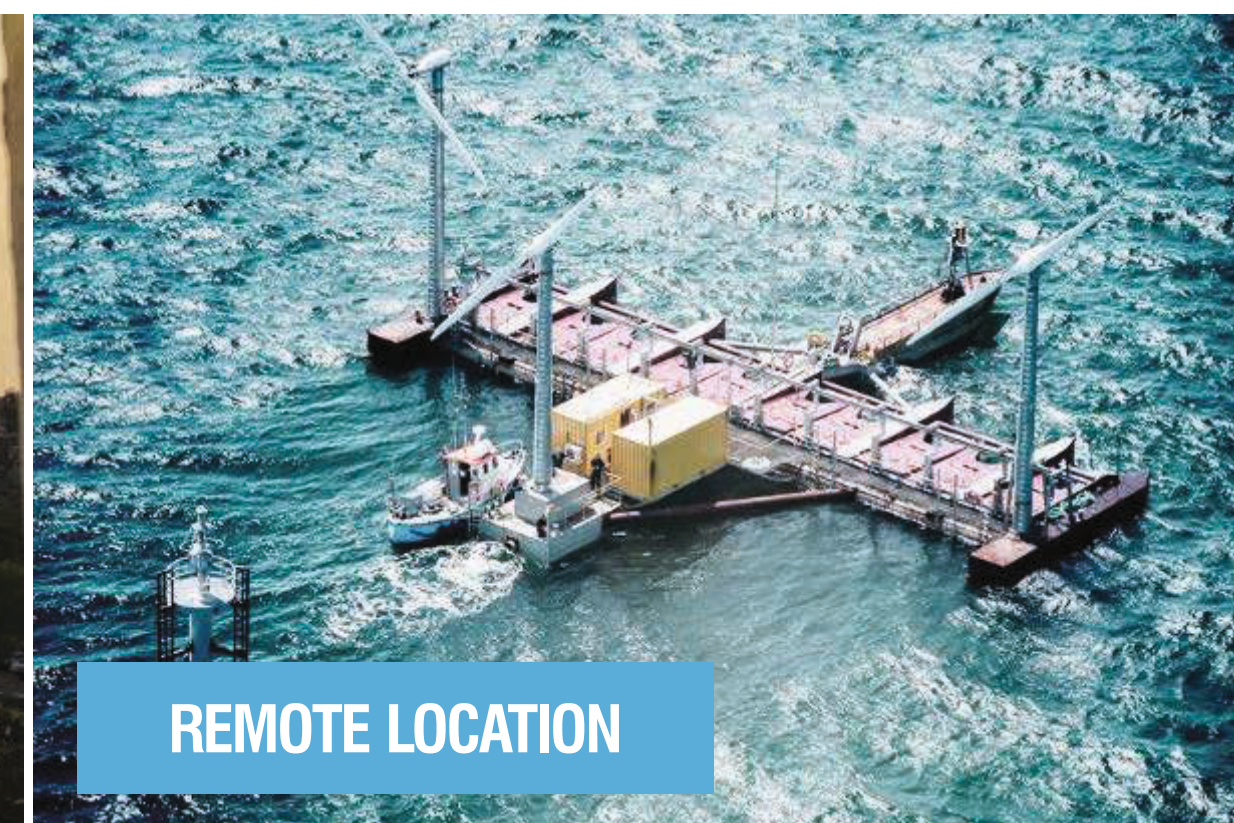
Providing clean renewable energy in Spain



Access to off-grid energy for 700 people who did not have previously have access in Cape Verde



Decarbonizing industrial facilities in Mexico with a rooftop installation



Providing power to a wave energy generation plant at sea



Providing decentralized renewable energy to a remote pipeline monitoring station in Spain

 Focus area for discussion

TELECOM SECTOR



WE UNDERSTAND THE TELECOM CHALLENGES

The Telecoms industry is under a lot of pressure to deliver more with leaner carbon footprint and cost structure



GREATER POWER NEED & AVAILABILITY

- The **fast-evolving pace of network technology** will need increased power requirements (5G)
- **Power availability in cell sites is a huge KPI** that cannot rely on one sole source of energy



LEANER COST STRUCTURE

- **A scale up** in the telecoms network will only be possible with an **efficient cost structure**
- **Energy can represent up to 50% of OPEX in a cell site**, particularly for those off-grid remote locations



ACCESS TO CLEAN POWER

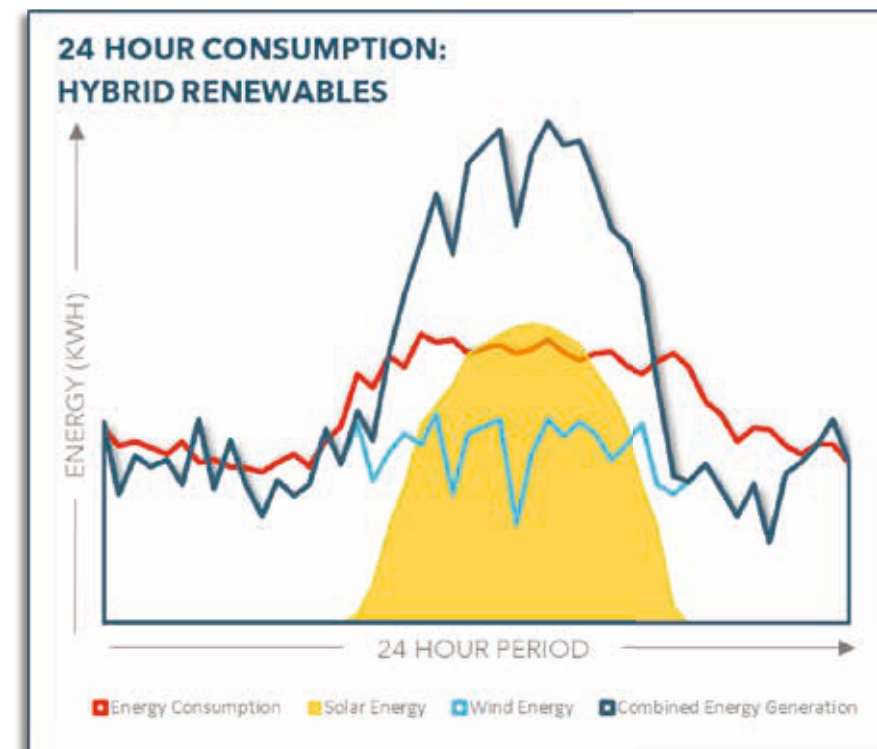
- The development of the telecom industry cannot be supported by large carbon footprints
- **Sustainability must be at the core** of the telecommunications **value chain**



SITE SPACE CONSTRAINT

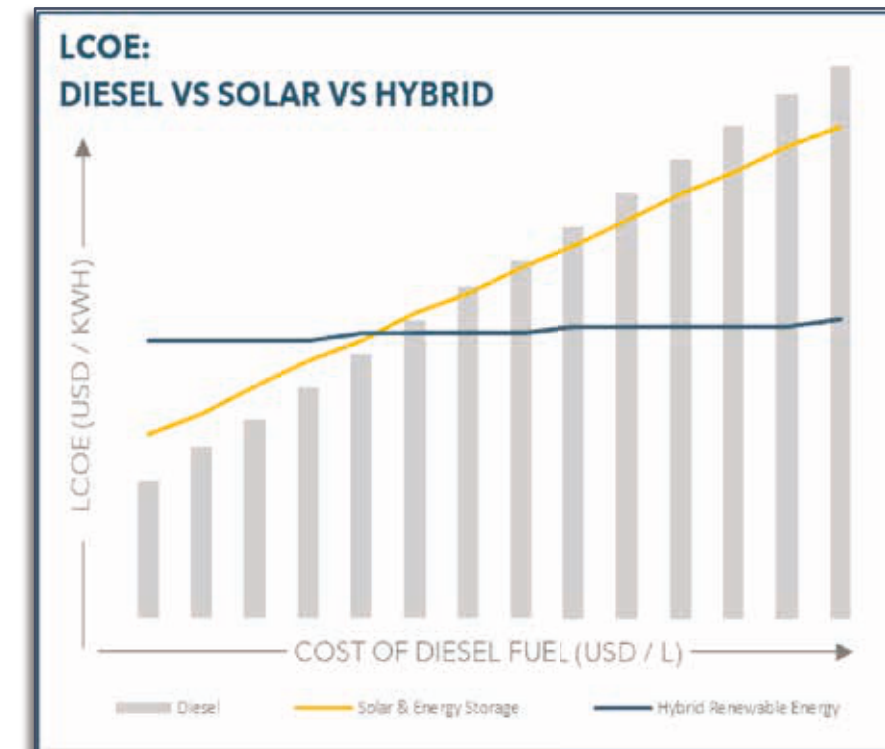
- **Telecom sites have space restrictions** that need to be considered when adding new technology
- Additional power requirements will need to **deliver more with limited space footprints**

OUR TECHNOLOGY TACKLES THESE CHALLENGES



MAXIMUM DIVERSIFIED ENERGY OUTPUT

- We use solar PV, wind and battery storage to harvest the maximum available site energy
- A diversified energy portfolio on a telecom site will reduce the risk of a power outage



OPEX REDUCTIONS

- O&M costs are kept at a minimum with renewable energy and reduced DG back-ip power
- Hybridizing solar PV-wind-battery storage can balance and control OPEX costs



CLEAN & SUSTAINABLE ENERGY

- Our renewable energy solutions aim to displace fossil fuels from a telecom site
- Demanding power consumptions can be sustainably met without increasing Co2 emissions



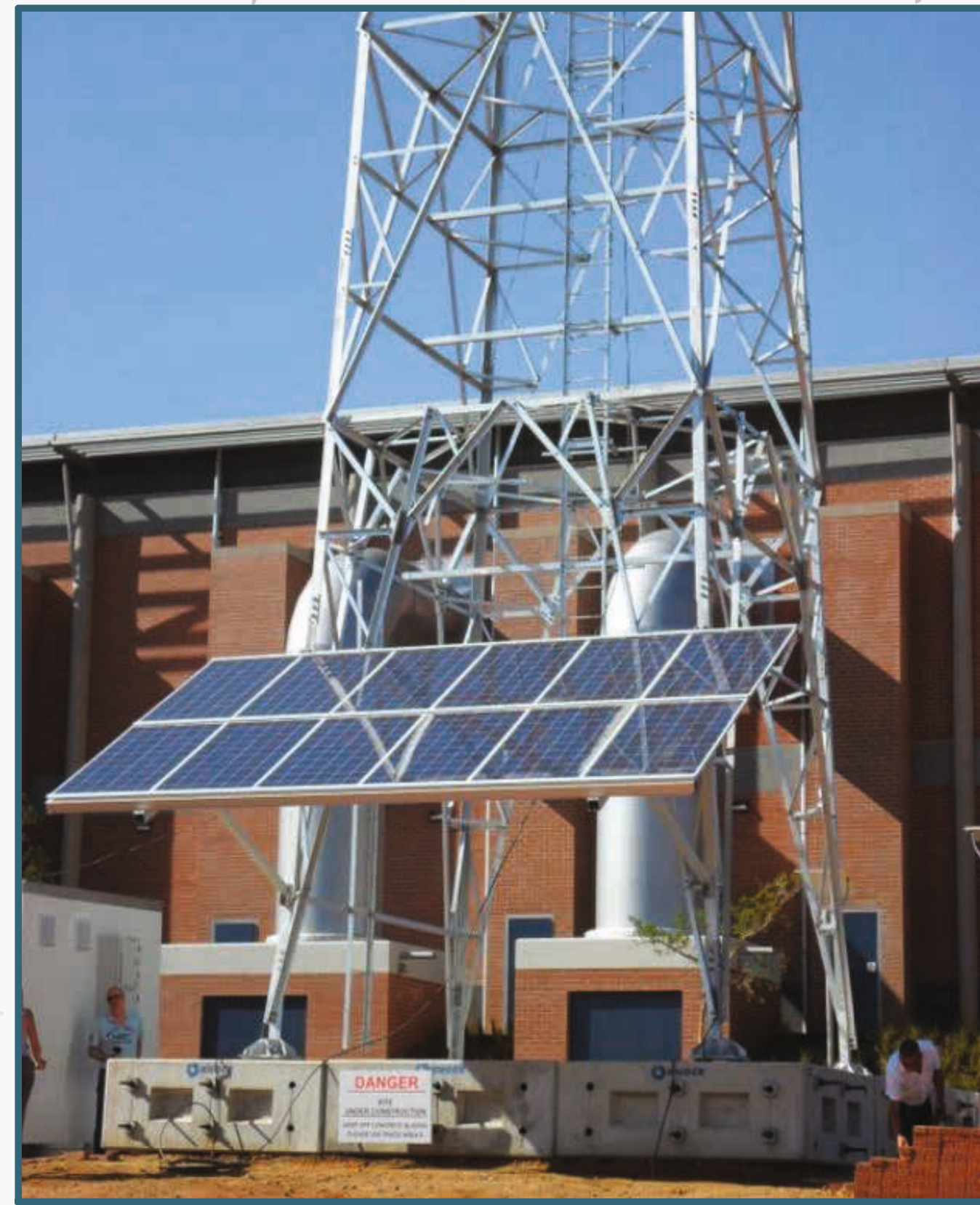
OPTIMIZED SPACE SOLUTIONS

- Wind technology and optimized solar PV design can reduce the horizontal footprint
- Hybridizing wind and solar means solar and battery technology can be downsized

OUR TELECOM SOLUTIONS



WIND TECHNOLOGY



SOLAR PV



HYBRID RENEWABLES

ALL SOLUTIONS ARE AVAILABLE FOR ON-GRID & OFF-GRID CELL SITES

OVER 1000 INSTALLS IN TELECOMS WORLDWIDE

HYBRID RENEWABLES IN THE TELECOM SECTOR

Over 1000+ installations in the telecom industry provide reliable power to off-grid cell sites

Our hybrid wind-solar technology can power mobile operators' large off-grid cell sites with clean energy that displaces diesel, reduces and predicts operating costs, and improves site reliability.



Recognized by industry leaders TowerXchange as the solution to decarbonize the telecom sector

MAJOR INSTALLATIONS

s&intec



Telefonica

telecom

SISTEMAS AVANZADOS
telecom
evante



 **vodafone**



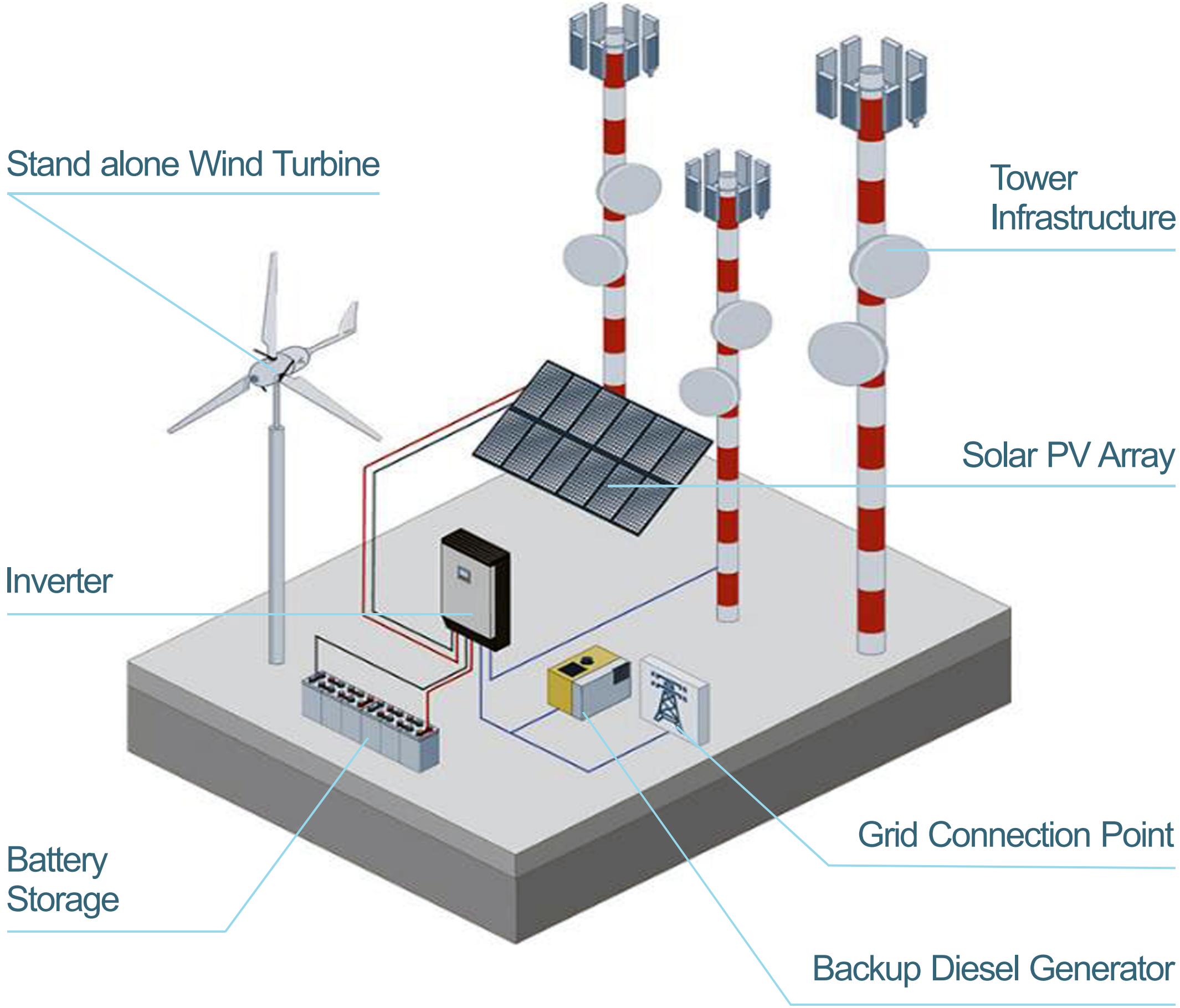
WINERCÓN[®]
ENERGÍA CONTROLADA DEL MEDITERRÁNEO



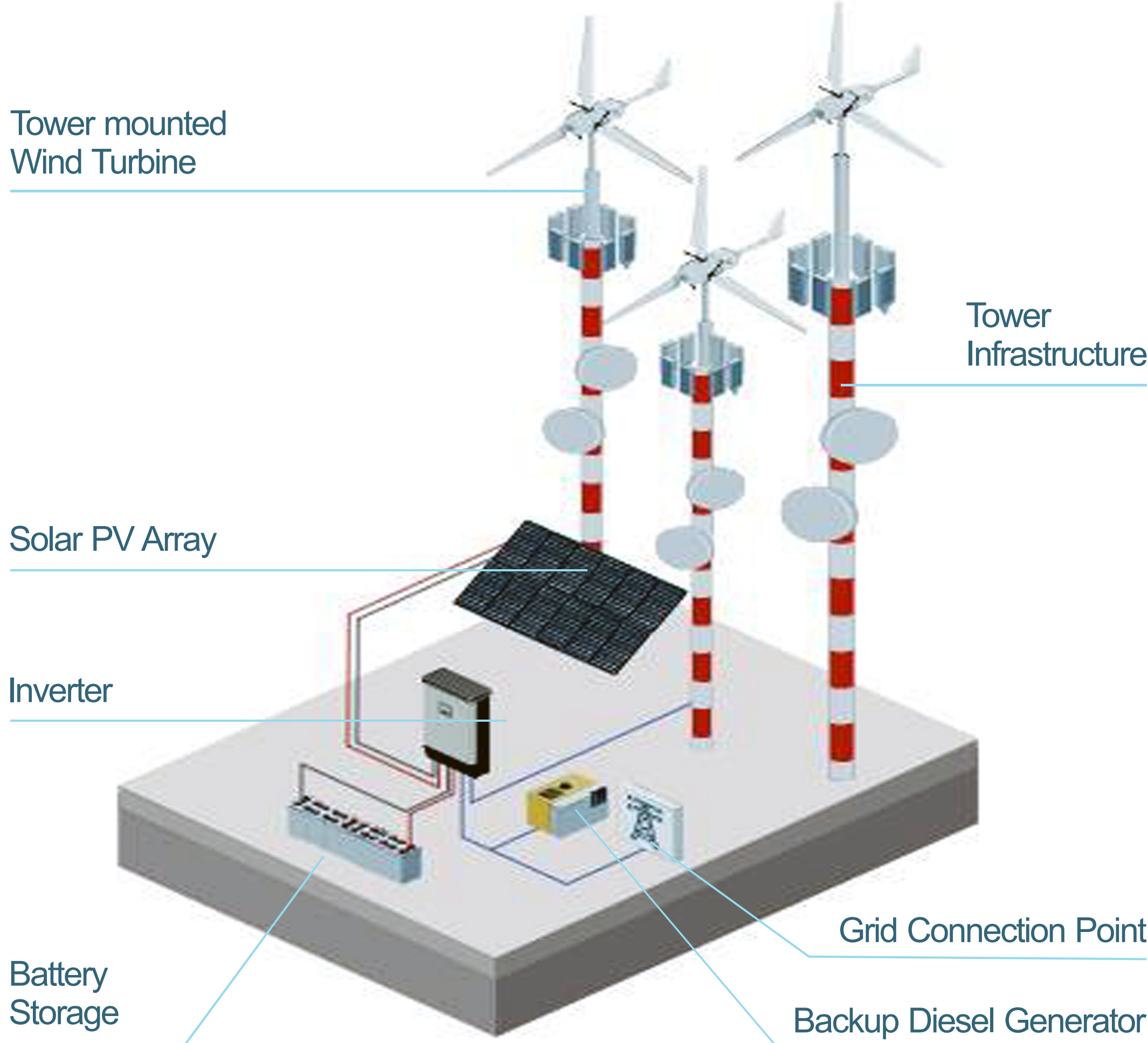
 **SAITIM**
saitim energy s.l.

HYBRID RENEWABLES FOR TELECOMS

SOLARWIND HYBRID SYSTEMS DESIGN FOR CELL SITES



OFF-TOWER SOLUTION



ON-TOWER SOLUTION

SOLARWIND HYBRID SYSTEMS DESIGN FOR CELL SITES



OFF-TOWER SOLUTION



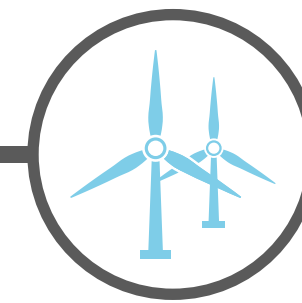
ON-TOWER SOLUTION

DIESEL DISPLACEMENT PROGRAM

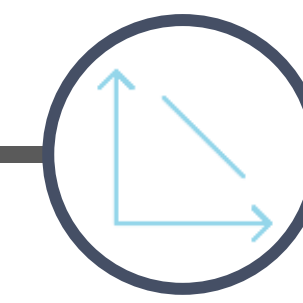
DIESEL DISPLACEMENT PROGRAM



TRIAL



PILOT



ROLL OUT

Program Phase

Goal

- Proof of concept / trial for product confidence across multiple locations

- Sign first Commercial Contracts with successful POCs from Trial Phase

- Roll-out across all selected sites
- Prioritize quick win cell sites with largest reductions uncovered in Pilot Phase

Duration

- 3 - 6 months

- TBC

- TBC

Inputs

- Trial period agreement based on series of agreed KPIs

- Business case based on POC successful results
- Tailored system design based on POC performance

- Business case based on POC successful results
- Tailored system design based on POC performance

Outputs

- Reports monitoring system performance during trial phase (KPIs) considering local conditions
- Trial Phase lessons learned

- Pilot Phase lessons learned

- Industrialize the Solarwind value chain to deliver projects under quality standards

HYBRID RENEWABLES CASE STUDY

CASE STUDY: SOLAR - WIND HYBRID SYSTEM (1/2)

Wind + Solar PV complement each other very well with power generation through the different times & season of the day and year

PROJECT DETAILS

LOCATION: South-East Spain Cellsite

DESCRIPTION: With radiofrequency antennas, GSM antennas and radio emitters

OBJECTIVE: Reduce the dependency on diesel fuel and logistics costs



ENERGY RESOURCE SUMMARY

RENEWABLE SOURCE	ENERGY PRODUCTION
WIND	4,470 kWh / year
SOLAR	2,635 kWh / year
COMBINED	7,095 kWh / year

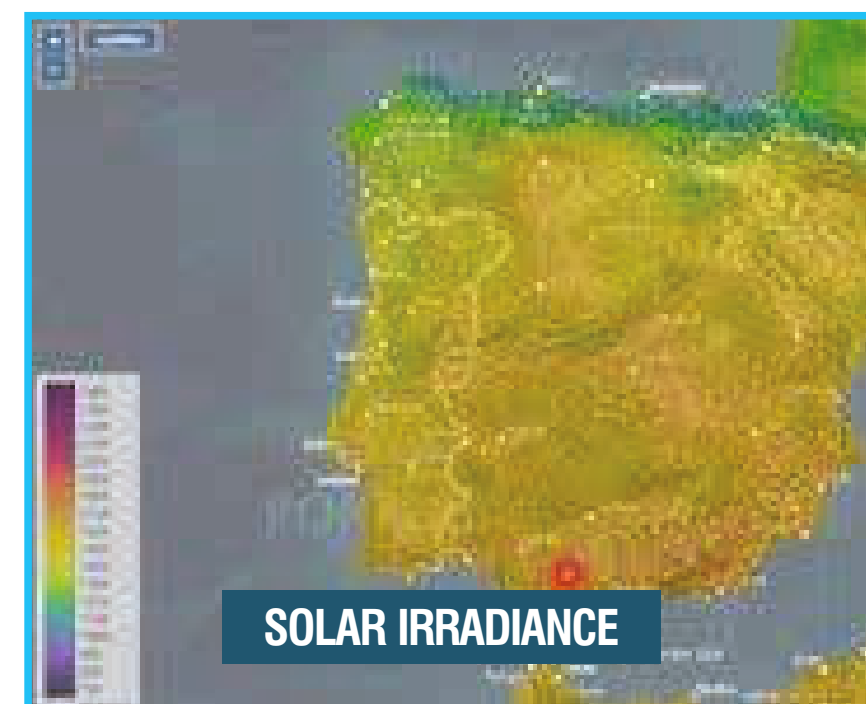
ENERGY RESOURCE ASSESSMENT

WIND RESOURCE ASSESSMENT



MODEL	E-3 HAWT		TERRAIN ROUGHNESS		RUGGED TERRAIN								
RATED POWER	1.9kW		MAX POWER		3 kW								
TOWER HEIGHT	10 m		SWEPT AREA		11.34 m ²								
MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVE.
WIND SPEED (m/s)	5.8	6.0	5.8	5.7	5.4	5.2	5.1	4.7	5.0	5.2	5.7	6.1	5.5
ENERGY PRODUCTION DAY (kWh)	14.6	16.0	14.6	13.7	11.6	10.2	9.7	7.7	9.1	10.3	13.3	16.3	12.3
ENERGY PRODUCTION MONTH (kWh)	451	453	453	411	359	306	300	240	274	318	400	505	373

SOLAR RESOURCE ASSESSMENT



No. of PANELS	15		INSTALL TYPE		2.25 kWp								
PANEL RATED POWER	150 Wp		AVERAGE TEMPERATURE		15°								
SPECIFIC PHOTOVOLTAIC POWER OUTPUT	1,586 kWh/kWp		OPTIMAL TEMPERATURE		31°								
MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVE.
ENERGY PRODUCTION DAY (kWh)	3.6	5.4	6.7	8.7	9.6	11.4	11.2	9.7	7.7	5.2	4.2	3.2	7.2
ENERGY PRODUCTION MONTH (kWh)	113	153	206	260	298	343	347	302	228	160	126	100	220

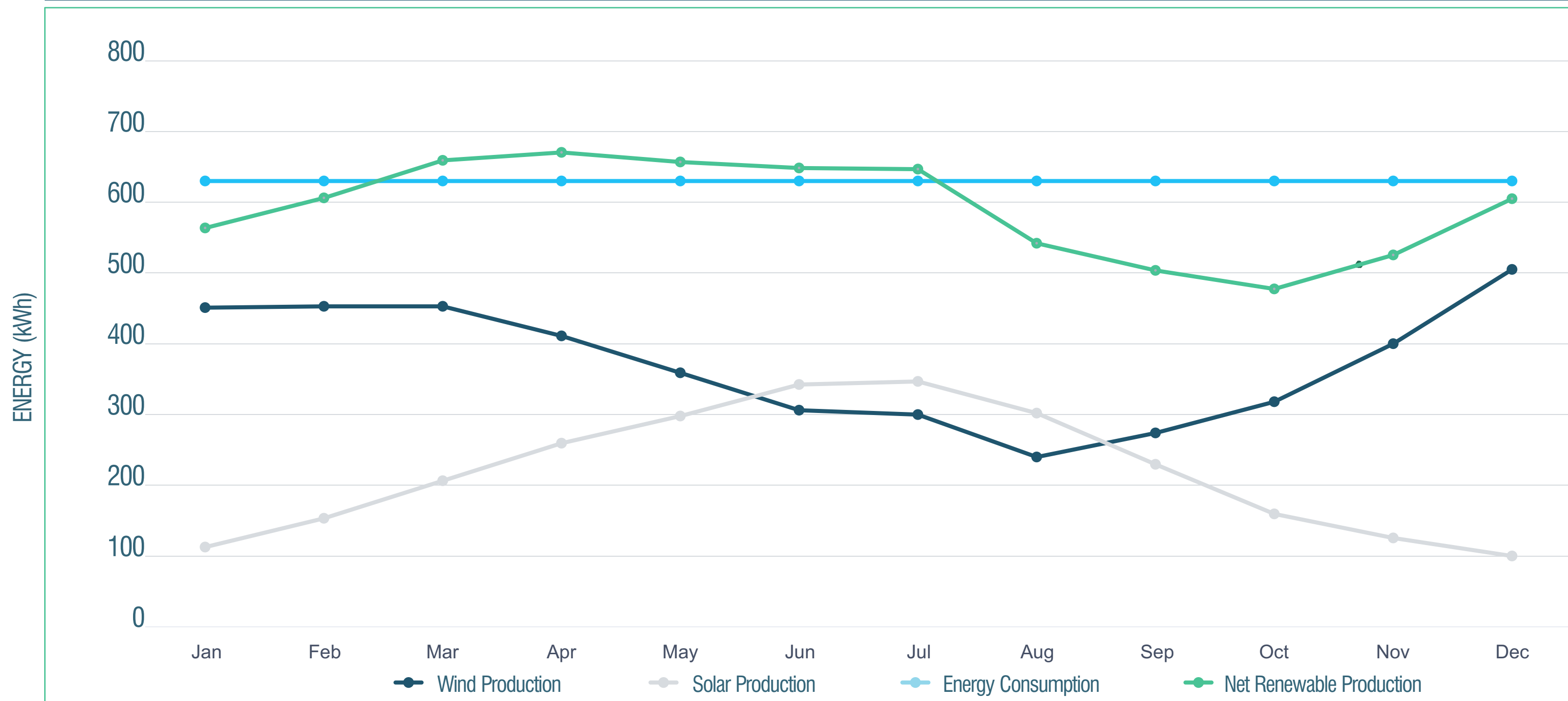
Wind speed maps at 10m AGL. Tabulated values have been height and roughness corrected to turbine hub height and shows the combined output for the total amount of proposed turbines

ENERGY RESOURCE OUTCOMES

RESULTS

SITE SOLUTION	PV Capacity (kWp)	No. of TURBINES E - 3	SOLAR PRODUCTION (kWh / year)	WIND PRODUCTION (kWh / year)	TOTAL PRODUCTION SOLAR PV + WIND (kWh / year)	TOTAL DEMAND (kWh / year)
ENERGY GYBRID RENEWABLE SYSTEM	2.25	1	2,635	4,470	7,095	7,560

ENERGY DEMAND / SUPPLY ANALYSIS



RECOMMENDATION

Solarwind Hybrid Renewable System

7,095 kWh is the monthly average renewable energy production in the site

7,560 kWh is the monthly average energy demand in the site

Up to 94% of overall energy demand will be covered with the Solarwind Hybrid Renewable Energy System

Wind and solar energy are variable sources. Windshelf Energy therefore cannot accept responsibility for the actual wind and solar resource experienced at these sites and the resultant annual energy generation estimates, as they are subject to many factors beyond Windshelf Energy's control

CASE STUDY: SOLAR / WIND HYBRID SYSTEM (2/2)

DIESEL GENERATION



EXISTING INSTALLATION

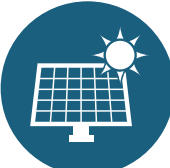
- Diesel Generator (10 kVa)
- Employed 10 hours / day by the developer



ECONOMIC COMPARISON

100%
Diesel
Consumption

SOLAR PV & BATTERY STORAGE



RENEWABLE SOLUTION 1

- Objective: Mini - grid system to be operating 24h while saving cost
- System to operate 24 hours / day while reducing diesel fuel consumption
- Phase 1: Introduction of solar PV + battery storage
 - Solar PV: 15 panels of 150W (2.25 kWp)
 - Energy Storage: 39 kWh Capacity, 19.5 kWh Depth of Discharge



ECONOMIC COMPARISON

-35% cost
reduction

HYBRID RENEWABLES



RENEWABLE SOLUTION 2

- Objective: Self-sufficient system with diesel reduction to strict minimum and maximum energy generation from renewable sources
- Phase 2: Solarwind horizontal axis wind turbine
 - Wind: Solarwind E-3 HAWT (1.9 kW)

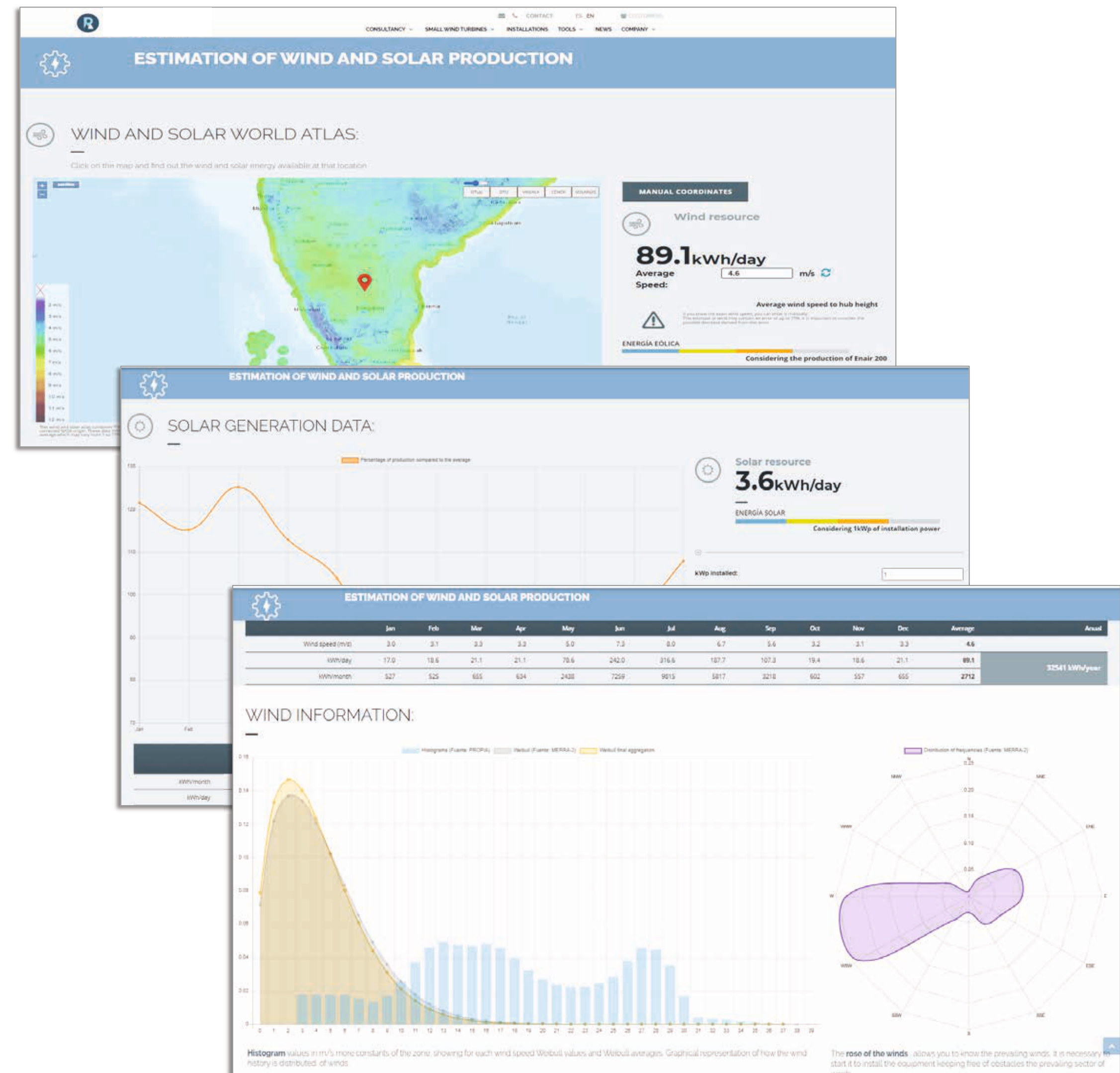


ECONOMIC COMPARISON

-90% cost
reduction

ENERGY RESOURCE ASSESSMENT TOOL

- House energy modelling tool uses data from the most relevant international sources:
 - **PVGIS** (Photovoltaic Geographical Information System)
 - **DTU** (Technical University of Denmark Wind Energy Research Center)
 - **MERRA - 2** (Modern - Era Retrospective Analysis for Research and Application by NASA`s Global Modeling and Assimilation Office)
 - **VAISALA** (10 - year WRF model from NCEP / NCAR 1997 - 2006)
 - **CENER** (National Renewable Energy Center in Spain)



An aerial photograph showing a white wind turbine and a telecommunication tower situated on a grassy hillside. The landscape below is a mix of green forests, golden-brown fields, and a winding river. In the foreground, there are large fields of corn and tilled brown earth. The sky is a pale blue with light clouds. The text 'TELECOM CASE STUDIES' is overlaid in white, bold, sans-serif font on the left side of the image.

TELECOM CASE STUDIES

ON / OFF - GRID CASE STUDY

DECARBONIZING TELECOMMUNICATION TOWERS FOR VODAFONE

Successfully have been delivered renewable energy for **Vodafone** at their telecommunication tower sites.

There are delivered 43 projects for Vodafone through Spain.

Vodafone required different renewable solutions for their towers depending on if they were on-grid or off-grid.

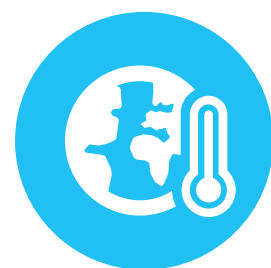
These projects are all hybrid solutions, comprised of either our E - 3 (3kW) or E - 5 (5kW) horizontal axis wind turbine, 185 W solar PV panels (typically 10 panels per system), a solar inverter and a battery storage system.

These energy sources compliment the energy generated from one another and reduce the reliance on the battery system. The batteries act as an energy buffer and allows energy to be delivered consistently through out the day

IMPACT OF PROJECT



800,000 kWh of energy produced / year



608 tons of CO₂ displaced / year



Equivalent of 60,000 L of saved diesel every year



Estimated \$190,060 USD off-set each year



OFF - GRID CASE STUDY

GENERATING CLEAN, RENEWABLE ENERGY FOR MTN IN SOUTH AFRICA

South Africa have pledged to have 26% of total energy from renewables by 2030. Currently, renewables only contribute to 7.6% of energy.

There are delivered 11 off-grid projects for MTN through out South Africa. MTN required a renewable solution as their towers are in an area of energy deprivation with no grid.

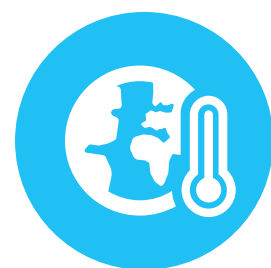
These projects were all hybrid solutions, comprised of our E-5 (5 kW) horizontal axis wind turbine, 185W solar PV panels (typically 10 panels per system), a solar inverter and battery storage.

These hybrid sources compliment the energy generated from each other and reduce the reliance on the battery system. The battery storage acts as an energy buffer and allows energy to be delivered consistently through out the day.

IMPACT OF PROJECT



220,000 kWh
of energy
produced / year



156 tons of CO₂
displaced / year



Equivalent of
12,280 L of
saved diesel
every year



Estimated
\$50,000 USD
off-set each
year



BAD GRID CASE STUDY

PROVIDING NETWORK SERVICE ACCESS TO CHILE WITH TELEFONICA

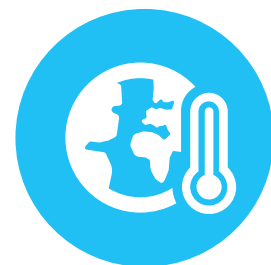
Latin America has set a target of 70% renewable energy by 2030. The telecoms industry can contribute very positively to this goal.

There are 70 installations in Chile for the global telecom's provider - Telefonica. These installations are helping Chile and Latin America, to achieve their ambitious target of generating 70% of their energy from renewables by 2030 - double of what the EU has pledged. These projects have been delivered for Telefonica's on-grid telecoms towers, where the energy supply is very intermittent. Every installation is a hybrid solution, 68 with our E-5 (5kW) and 2 with our E-3 (3kW) machines.

IMPACT OF PROJECT



1,400,000 kWh of energy produced / year



990 tons of CO₂ displaced / year



Equivalent of 97,235 L of saved diesel every year



Estimated \$309,000 USD off-set each year

Telefonica
telecom



OFF - GRID CASE STUDY

REVOLUTIONIZING THE TELECOM INDUSTRY IN ARGENTINA

Have been successfully installed hybrid renewable systems for remote telecoms in Argentina for **Sistemas Energeticos**.

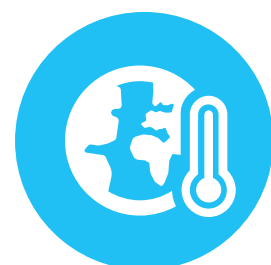
There are 14 hybrid installations for telecom`s provider **Sistemas Energeticos** located in La Gauchita, Argentina. Now plans to expand this initiative across the entire country and widely across Latin America. Argentina has been identified as a target market for renewable energy due to their ambitious sustainable energy goals and the strong renewable resources.

These hybrid renewable energy installations are able to utilise the clean, natural energy available and reduce reliance on diesel generation for these remote, off-grid towers.

IMPACT OF PROJECT



280,000 kWh
of energy
produced / year



198 tons of CO₂
displaced / year



Equivalent of
19,447 L of
saved diesel
every year



Estimated
\$61,880 USD
off-set each
year



ON - GRID CASE STUDY

PROVIDING ENERGY SUSTAINABILITY FOR THE GOVERNMENT OF ARAGON, SPAIN

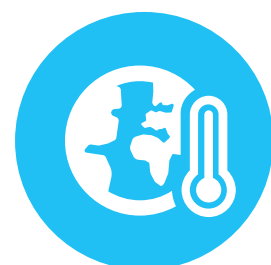
Several telecommunication projects are being implemented for the Government of Aragon

Assistance was provided to the Government of the Aragonese region to achieve its energy goals by providing residents and businesses with reliable network services. Tailor-made hybrid solutions based on renewable energy sources have been installed in the Aragonese region, especially in the provinces of Huesca and Zaragoza. These solutions provide continuous green energy to power telecom towers. In these rural areas, the signals are very weak or intermittent due to poor networks or the use of diesel for power.

IMPACT OF PROJECT



400,000 kWh
of energy
produced / year



283 tons of CO₂
displaced / year



Equivalent of
27,782 L of
saved diesel
every year



Estimated
\$88,400 USD
off-set each
year



OFF - GRID CASE STUDY

REDUCE DEPENDANCY ON DIESEL ENERGY IN ALICANTE

Telecom Levante installed a small renewable solution for a telecoms tower Font Rotja

The stability of power supply in Alicante was improved, which became a problem for the surrounding residents, who often experienced poor signal. This is an example of a bad-grid system that has been switched to a new system to allow better quality network services for the area. This same model can be applied for the entire region where network intermittency issues persist through out.

IMPACT OF PROJECT



106,125 kWh
of energy
produced / year



75 tons of CO₂
displaced / year



Equivalent of
7,375 L of
saved diesel
every year



Estimated
\$23,454 USD
off-set each
year

“Telecom Levante”
SISTEMAS AVANZADOS



ON - GRID CASE STUDY

ELIMINATING BAD GRID SYSTEMS IN VALENCIA

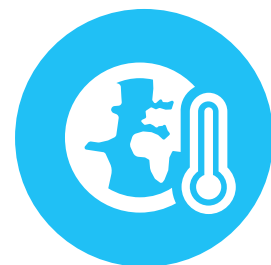
Valencia, Spain is revolutionizing the telecoms industry with their first installations of renewable energy powered telecom towers.

Have been installed 13 projects for **Winercon** in Valencia to generate clean energy from the natural resources available. All of these projects have been installed to help the weak on-grid network, which is susceptible to outages and power-cuts. Utilising renewable energy solution has allowed a more reliable flow of electricity to the telecommunication towers, delivering a stronger and more reliable network service.

IMPACT OF PROJECT



260,000 kWh
of energy
produced / year



184 tons of CO₂
displaced / year



Equivalent of
18,058 L of
saved diesel
every year

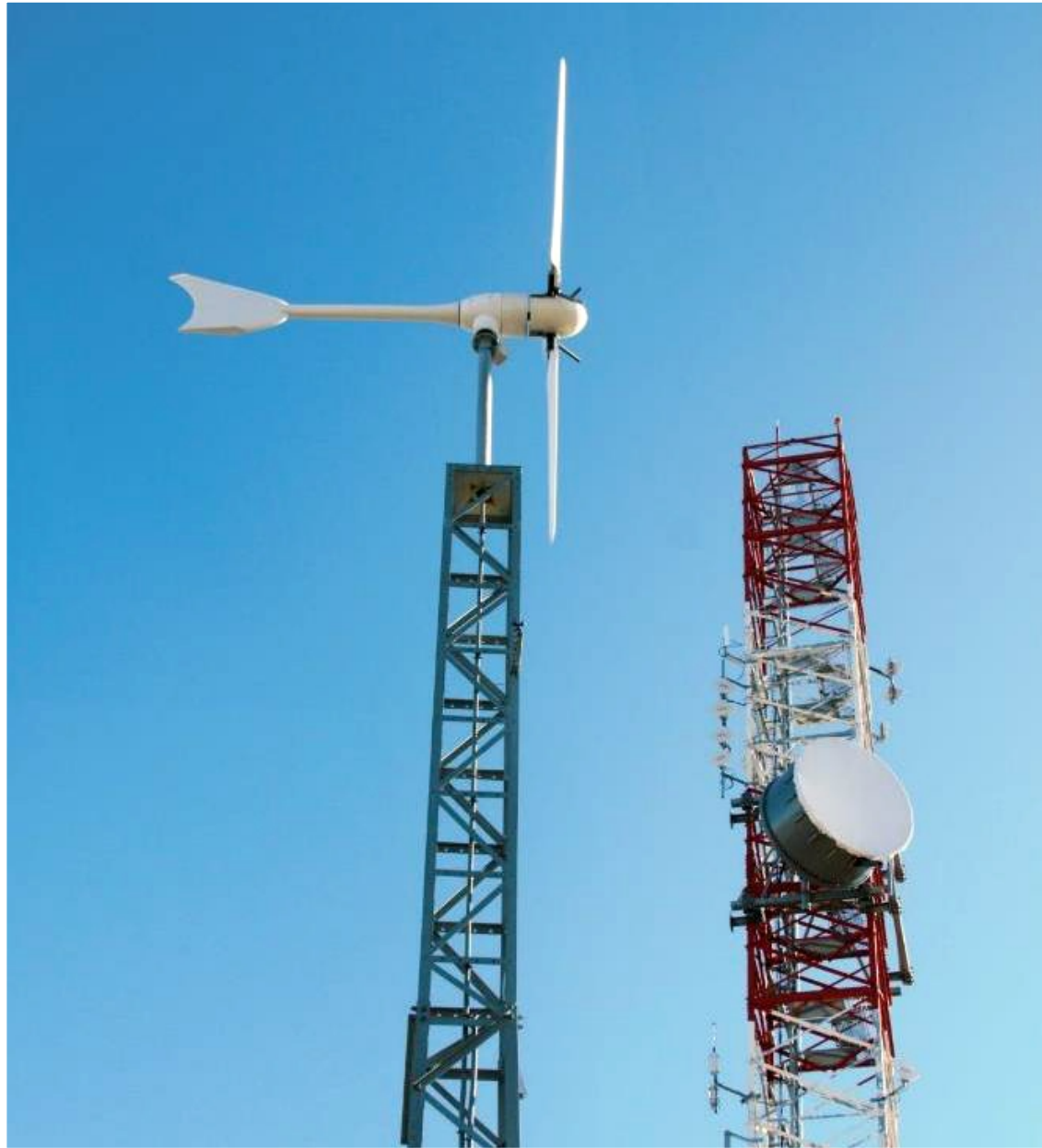


Estimated
\$58,000 USD
off-set each
year



TECHNICAL OFFER



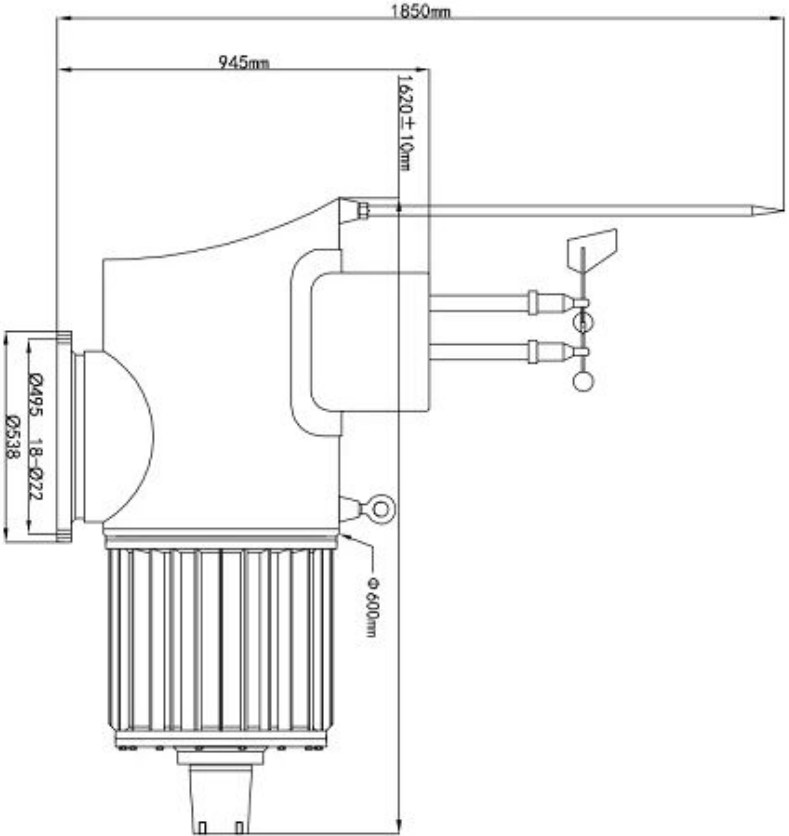
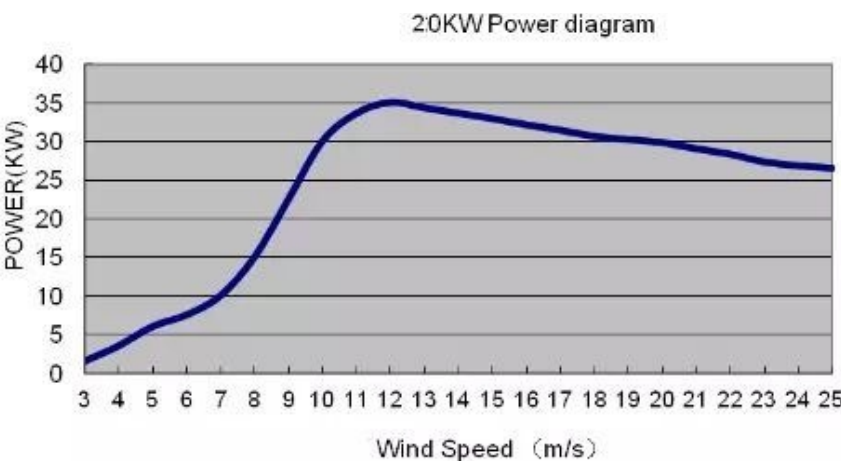


WIND TURBINE TECHNOLOGY

Product Details

WIND TURBINE

Model Number:	RX - 20KH3
Rated Watt:	20 kW
Max Watt:	25 kW
Rated Voltage:	220V / 240V / 380V
Start up wind speed:	4 m/s
Power:	20 kW
Blade length:	5.5 m
Material of the blades:	Fiberglass Reinforced Plastic
Rated rotor speed:	100 r/min
Rated speed:	10 m/s
Rated power:	20 kW
Max power:	25 kW
Work speed:	4 - 20 m/s
Security wind speed:	40 m/s
Height of guy cable tower:	30 m
Generator style:	3 - phase AC PM
Top quality except tower:	1400 kg
Output controller system:	Controller, inverter
Packaging delivery	
Selling units:	Single item
Single Package size:	182 x 82 x 109 cm
Single gross weight:	1400 kg
Package type:	Plywood case



THANK YOU

