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# Wind Turbine Energy for Telecom

“ A Sustainable Solution for the future”

A Presentation to



Mats Vilander, GM EMEA/SVP Global Telecom  
Cape Town, November 8, 2011



# Agenda

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- Introduction of Zephyr Corporation
- Products and Solutions
- Case study for a Telecom Site
- Reference Cases
- Summary



# What is the Requirements on Using Wind Energy as the Energy Source for Powering Mobile Sites

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- Sufficient wind speed
- Dimensioned as a system
- Measurable KPIs
- Long term cost effective solution
- Easy to install on existing tower structure
- Maintenance free
- Simplistic solution
- Modularity
- Future proof
- Remote monitored and controlled

# Introduction to Zephyr Corporation



- Zephyr Corporation, was established in 1997 – 14 years of experience in design, manufacture, and sales of small wind turbines.
- Our business activities is development, manufacturing, sales of small wind turbines
- All manufacturing and assembling is in Japan.
- Over 5000 deployed turbines.
- Member of AWEA (American Wind Energy Association) and EWEA (European Wind Energy Association).
- Over 150 sites with 10 operators.
- System design and commissioning with regional partners

# Value Proposition for a Network Mobile Operator

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- **Fully utilising the existing site space and infrastructure**
    - Site Space in tower not fully utilised
    - A light weight wind turbine can be used in the existing infrastructure, fully integrated into the site (max wind load of 105 Kgf@ 65 m/s)
    - Easy to install
    - Datacom with site controller
  - **OPEX Saver:**
    - Reduce up to 50% of the diesel consumption for existing remote rural sites, sometimes up to 100% of diesel (repeater sites)
    - Save O&M costs for diesel gen sites
  - **CAPEX Saver:** Reduce the usage of diesel up to 100% for new sites
  - **PR Value:** Taking green responsibility and being in forefront of renewable energy solutions
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# Some of our Reference Operator Deployments



Touch Maldives



"Sustainable Power for Telecom"

# The Airdolphin Portfolio

The Airdolphin turbine comes in 3 voltages, each rated at 1 kW output at 12 m/s (26.8 mph):



**Airdolphin Mark Zero 24 VDC**  
**Weight: 18 Kg**



**Airdolphin Pro 48 VDC**  
**Weight 18 Kg**

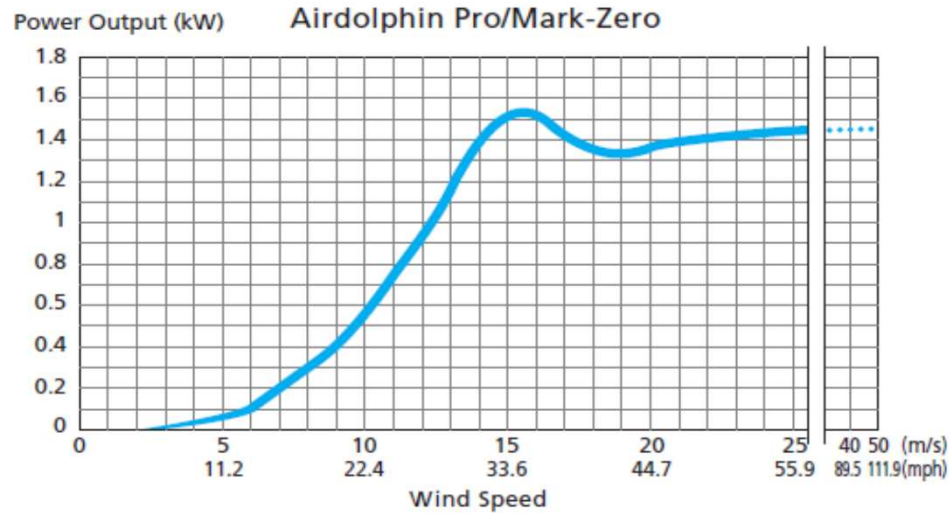


**Airdolphin GTO 250VDC**  
**Weight 20 Kg**



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# Airdolphin Power Output (PRO/Mark Zero)



## Airdolphin Pro/Mark-Zero (Z-1000-48/Z-1000-24) Energy Production

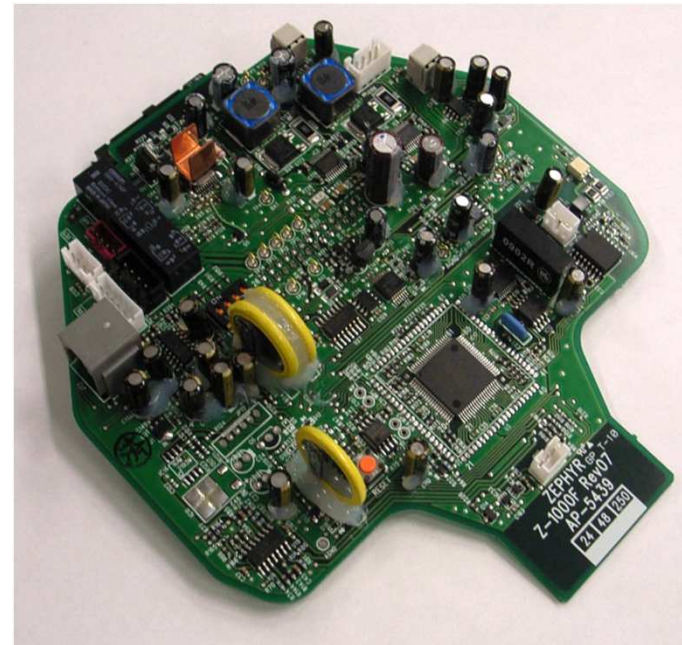
Avg. Wind Speed m/s (mph)	Per Day (Wh)	Per Month (kWh)	Per Year (kWh)
2 (4.5)	150	5	50
3 (6.7)	720	20	260
4 (8.9)	1,800	50	660
5 (11.2)	3,440	100	1,260
6 (13.4)	5,620	170	2,050
7 (15.6)	8,150	240	2,970
8 (17.9)	10,770	320	3,930
9 (20.1)	13,280	400	4,850
10 (22.4)	15,590	470	5,690



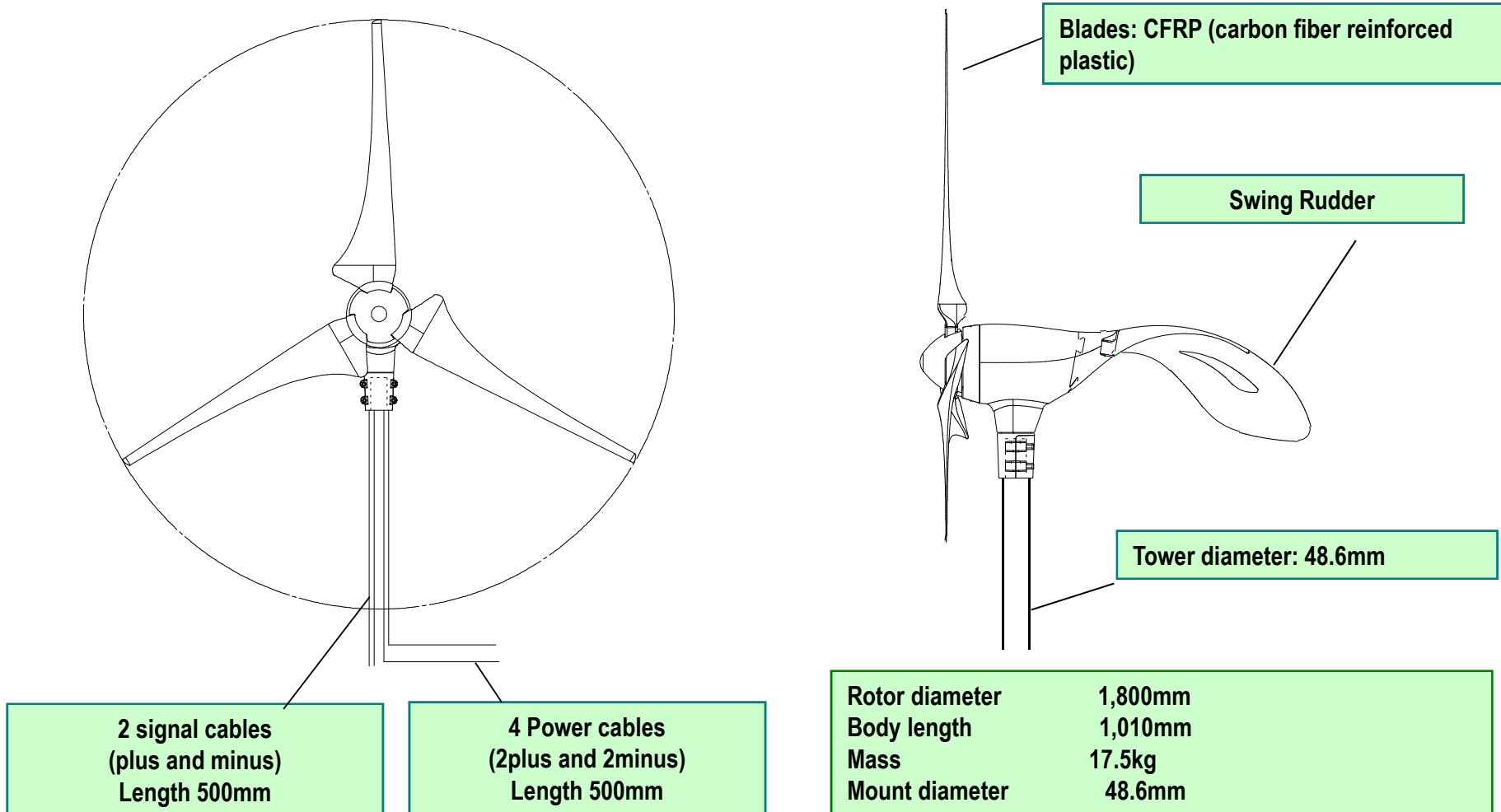


# Differentiation Factors

- Low Mass/energy---18 g per 1 Watt
- Compact---Diameter of 1,8 m and 18 kg
- Markets lowest cut-in wind speed (2,5 m/s)
- Normal operations up to 50 m/s, withstands up to 65 m/s
- Easy to install
- No Maintenance
- AC/DC Inverter built in
- Remotely control
- A microprocessor that monitors and controls rpm, charging and torque.
- 3.5 months CO2 payback
- 5 years warranty, over 15 years life expectancy



# Airdolphin Drawing



# Key Uniqueness

## 1) Super light-weight design

Overall mass is only 18 kg. Mass per 1 watt output is amazing 18 grams. Typical LWTs have 150+ grams/W.

## 2) Rigid carbon-fiber blades

Adopted carbon-fiber blades for the first time in the industry. They are extremely light-weight but rigid. Using aerodynamic design that delivers non-stop operation from very low, mid and up to storming high wind speeds for optimum torque throughout and responding instantaneously

## 3) Silent disruptor blades

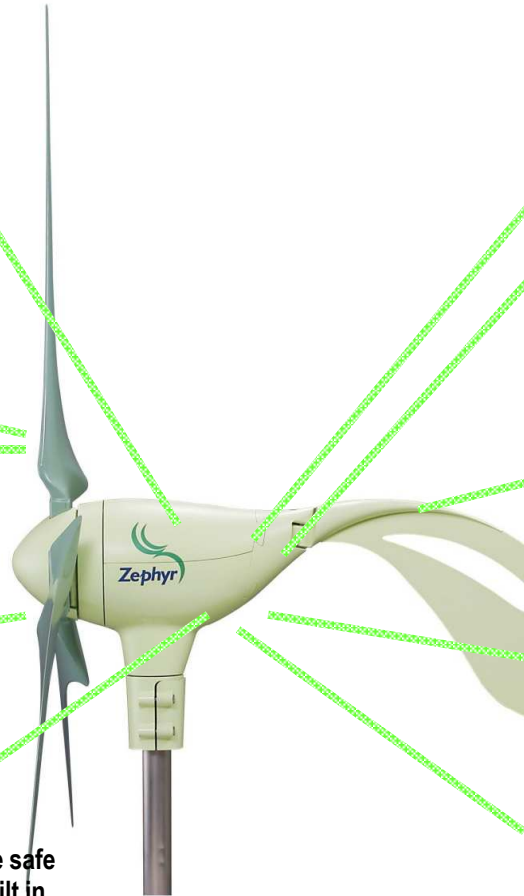
Inspired by owl's wings, fine ribs are formed on the back of the blades to streamline the air flow thereby reducing acoustic noise to extremely low levels of 32dB. (patented)

## 4) Power-assisted startup

In the absence of wind, blades are forced to turn for 10 sec. that increase chances of capturing even breeze levels of wind. (patented)

## 5) Power management system

For capturing maximum energy available and to ensure safe operation, Zephyr proprietary algorithms have been built in. They enable non-stop operation under a very wide range of wind speeds. Fail-safe systems functions against various troubles such as blackouts. Power management adopts to connection to PV inverters.



## 6) Sophisticated styling

Charming bionic styling won Japan Good Design Award in 2005. The streamlined, functional *forme* is composed of arbitrary free curves of futuristic image.

## 7) Powerful turbine generators

A 4 kW (max) 3-phase brushless synchro-nous generator using dense wire-winding structure as used in the motors for HV cars. "NEOMAX" neodymium magnet adopted realizes high efficiency and firm braking.

## 8) Swing-ladder system tail fins

Inspired by the movement of a tail fin of fish swimming upstream, this unique hinged tail catches instantaneous changes in wind direction for maximum power generation. (patented)

## 9) Screw-less interlocking body structure of the nacelles

The housing components interlock each other as found in Japan's traditional wood craft. By reducing bolts, nuts & screws, this offers mechanical reliability as well as eliminating need for repair due to structures.

## 10) Zephyr communication system

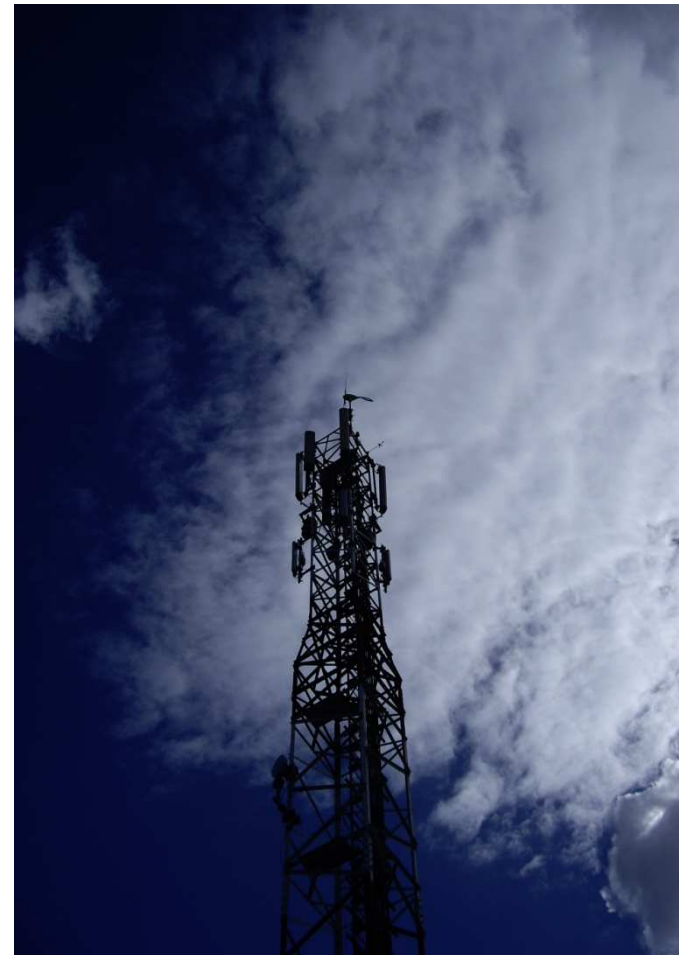
Using an optional remote monitoring device, SWT can connect to the Internet. Data (energy production, etc.) retrieval and SWT controls (on/off, mode selection) can be achieved from remote locations.



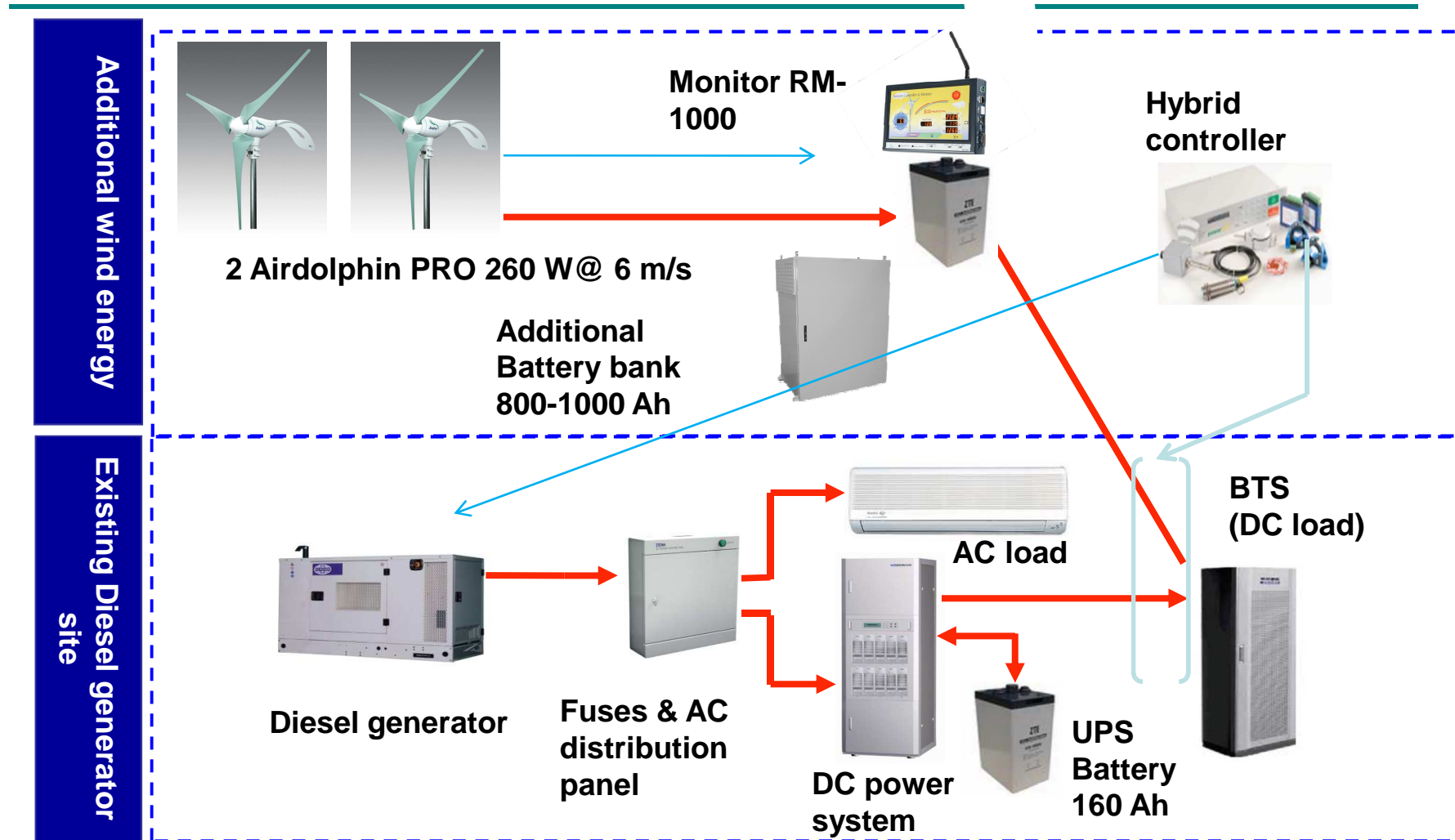
# Building a Renewable Energy Site With Wind

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- The Business Case for an existing site depends on a number of factors;
  - Average wind speed in the area/site
  - Height of the tower
  - Site load, max load during the day
    - Site design, No of TRX, Base station type, Transmission, A/C
  - Cost per Kwh from the Grid or total diesel costs
  - Battery capacity
  - Wind as a backup, or primary source, Solar elements
  - Accesibility of site
  - Total Cost of Ownership



# Add on wind to existing base station – generic design



# MTC Namibia



**Location:**  
Okapuka, Windhoek



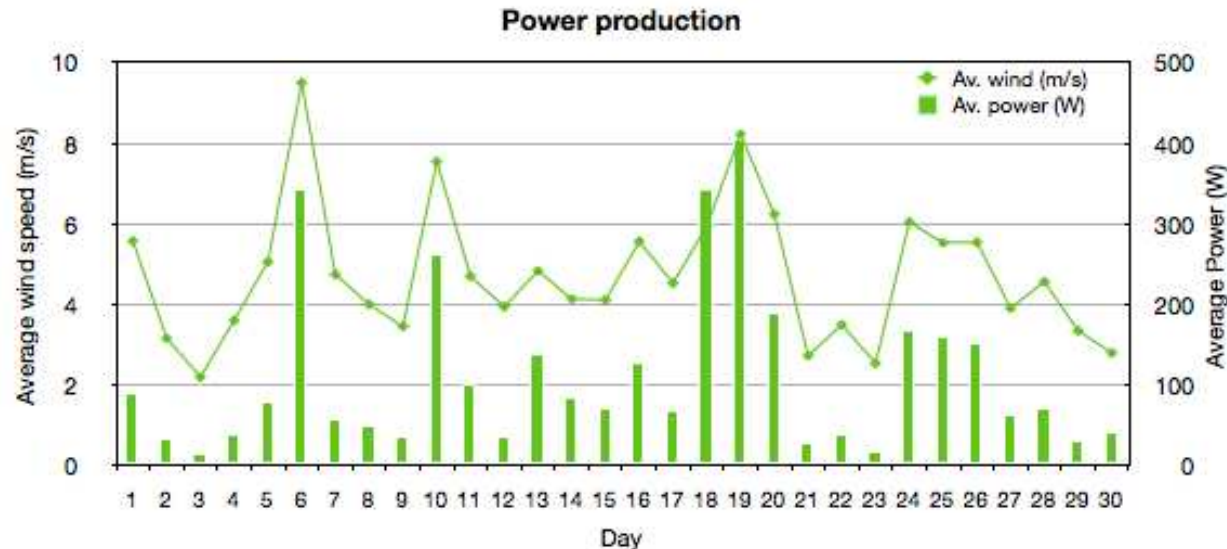
**Installation:**  
Existing telecom tower



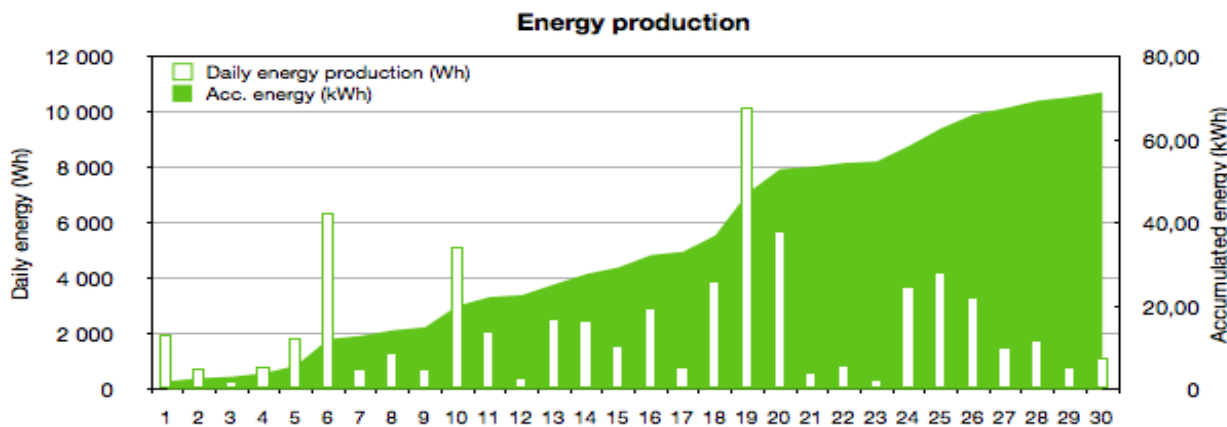
- MTC has performed a trial of Zephyr's Airdolphin PRO wind turbine, as a part of their efforts to reduce environmental impact from the network.
- The wind turbine is used as a complement to top-up batteries, since the solar panels do not provide enough energy due to seasonal variations.
- Technical solution:
  - Turbine: Airdolphin PRO (48 VDC)
  - Site: Telecom site
  - Power: Batteries , PV and wind
  - Use of existing batteries 1070 Ah @ 48 VDC
  - Load : typical 1200 W



# Results Wind Energy



- At MTC's trial site (Okapuka, just outside of Windhoek) good wind speeds of 2-9 m/s (daily average) were experienced during the 30 day trial period. The average wind speed for the trial duration was 4.7 m/s.



- In average, a daily energy production of 2.4 kWh was achieved. On the best day, 10.1 kWh was produced.

- Savings: 6 000 USD per year (50% reduction of site visits)



# Vodacom South Africa



**Location:**  
Tinana, Eastern Cape



**Installation:**  
Existing telecom tower

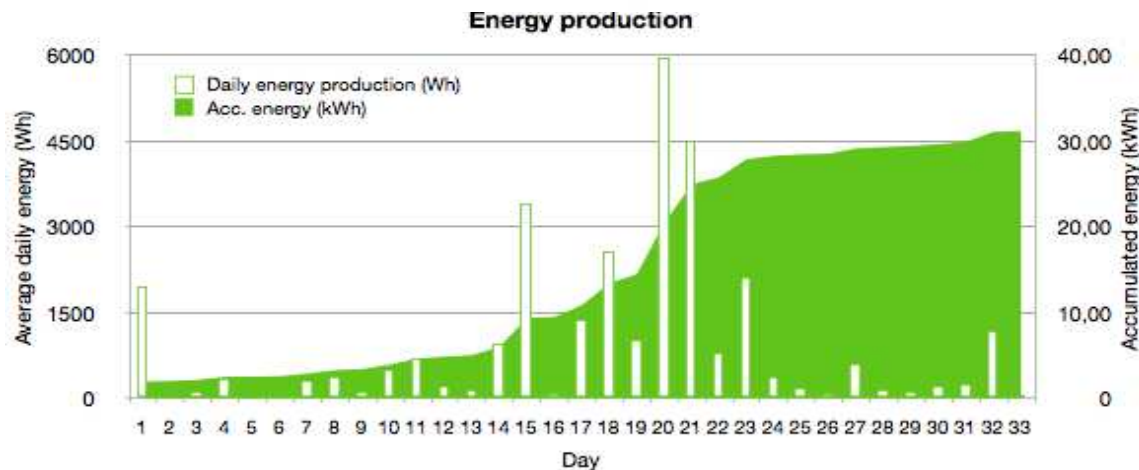
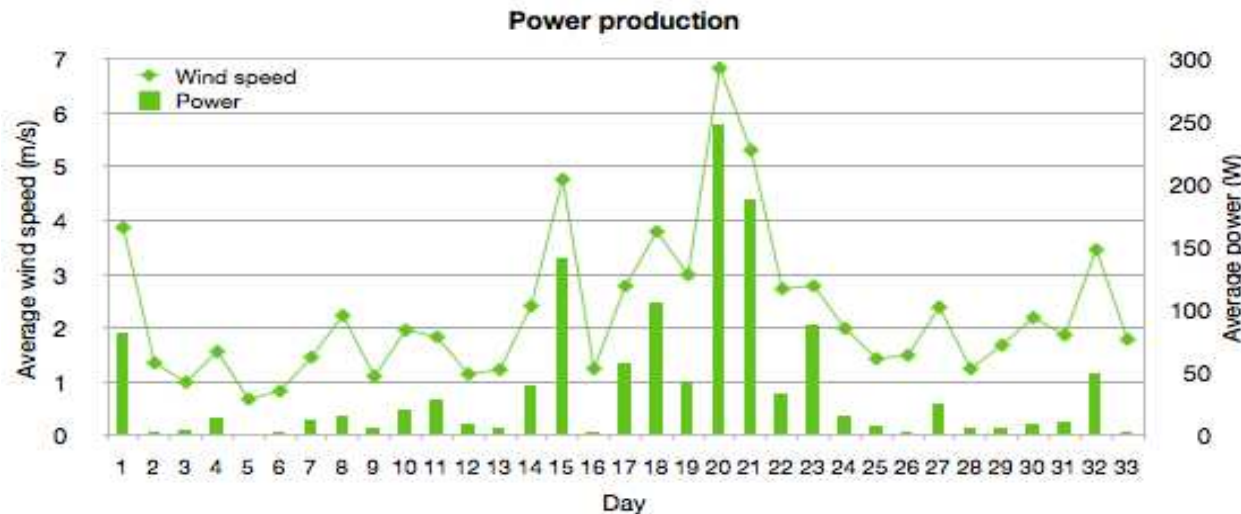


- Vodacom has performed a trial of Zephyr's Airdolphin PRO wind turbine, as a part of their efforts to reduce environmental impact from the network.
- The site was originally powered by a diesel generator and the NSN Green C controller. In April, the Airdolphin PRO wind turbine was added.
- The wind turbine is used on a hybrid site as a mean to charge batteries, thus reducing diesel consumption.
- Technical Solution:
  - Turbine: Airdolphin PRO (48 VDC)
  - Site: Telecom site
  - Power: Diesel, batteries and wind
  - Battery 720 Ah @ 48 Volt





# Results wind energy



- At Vodacom's trial site (Tinana, on Mt. Fletcher) wind speeds of 0.7-6.8 m/s (daily average) were experienced during the 33 day trial period. The average wind speed for the trial duration was 2.3 m/s.
- In average, a daily energy production of 0.9 kWh was achieved. On the best day, 6 kWh was produced.

# Summary

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- With proper wind will the Airdolpin PRO offer:
  - Complement to PV during low isolation periods
  - Valuable add on to diesel battery hybrid sites
  - Markets most efficient windturbine (Wh/kg)
- The Airdolphin PRO is tested and verified for Telecom application
- The typical pay off for adding wind is 2-3 years
- The typical off grid site can handle 1-2 turbines in the existing tower = cost efficient installation



# Dhiraguu, Maldives



Touch Maldives



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# Orange Madagascar



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