HARA INDUSTRIES PVT. LTD
Plot No. 5A, IDA Phase I, Cherlapally, Hyderabad – 500 051.
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(Company Covered Under MSMED Act 2006)

Date: 13-02-2017

To,
Shri UK Srivastava,
Principal Advisor (NSL)
Telecom Regulatory Authority of India,
New Delhi

Sub: Comments on Consultation Paper On Approach towards Sustain able Telecommunications

Dear Sir,

We are herewith submitting our comments on Consultation Paper on Approach towards Sustain able Telecommunications.

Topic: Energy efficiency in Telecom networks

3.9. What are the options available for renewable energy solutions which may be harnessed to their maximum potential to power the telecom sector? Please comment with justification.

As mentioned in the consultation paper there are several options including, solar, small-wind, small-wind hybrid systems. We will discuss the small wind and wind-solar hybrid options.

Availability of MNRE approved Wind Turbines

Small wind turbines range from 1kw rated capacity to 10kw rated capacity. MNRE has empanelled a list of seven small wind turbine manufacturers that can be used for telecom tower applications (http://niwe.res.in/assets/Docu/14th_List_of_empanelment_of_SWT.pdf).

Usage of Small wind turbines – world wide experience

Small wind turbines can be used to 1) partially replace the usage of diesel generator when wind resource is available, and 2) for smaller telecom loads in rural areas it is possible to completely replace the usage of diesel generator with a single or multiple 10kW wind turbines.

We have a partnership with Bergey Windpower, USA, and they have installed several hundred small wind turbines with multiple telecom operators in many countries. Attached please find a presentation on usage of small wind in the telecom market. There are other manufacturers who have similar installations all over the world. Bergey' turbines have been installed

1) To partially offset DG usage,

2) To completely run on 100% renewables, or

3) To run the telecom site on renewables 90-95% of time with DG acting as a backup solution.

Small wind- solar hybrid

In addition, small-wind solar hybrid is an ideal solution for telecom towers since solar and wind are complimentary to each other. When there is no sun of if there is rain, wind turbine will run, and when wind is low, typically there is abundant sunshine. A correctly sized wind-solar hybrid system can reduce the diesel consumption by 90-95% and with an adequate battery bank, the wind-solar hybrid solution can be used to power the site with DG acting as a backup. As general rule-of-thumb, a solar wind system will be sufficient to reduce 90-95% diesel consumption for 1/3 of rated capacity i.e., a 14kW wind-solar hybrid system (10kW Wind, 4kW Solar) would be sufficient to power a telecom load of 4-6kW similarly a 5kW wind-solar hybrid system (1-3kW Wind + 3kW Solar) would be sufficient to power a telecom load of 1-2kW.

Small Wind and Solar System (SWES) for Telecom Towers

We can divide the small wind turbines into two distinct categories based on their rated capacity – first category 1-3kW, second category 4-10kW. These small turbines can be combined with Solar PV systems.

Installing 1-3kW Wind Turbines on Telecom Towers

The most common approach is to install a smaller wind turbines (1-3kW) on existing telecom tower. In the beginning, telecom towers were designed for single tenancy (i.e., one operator) and later on due to cost pressures, the designs were optimized to reduce weight. Some of these towers are being currently strengthened to carry additional antennas for other telecom operators. Given this scenario, it may or may not be possible to install small wind turbines even after strengthening of existing single tenancy towers.

Later on, when tower infrastructure companies came into existence, towers have been designed for multiple tenancy i.e., higher load carrying capacity. Such towers, can be strengthened to take the additional load of first category of small wind turbines (1-3kW).

R&D Project on Tower Strengthening by IIT Hyderabad and Hara Industries, sponsored by MNRE

There are no existing guidelines to enable the tower operators for strengthening of telecom towers to support small wind turbines (1-3kW). MNRE has sponsored a research project with IIT Hyderabad a lead institute and our company as industry partner to design, test, strengthen and install a 3kW small wind turbine on an existing telecom tower. Guidelines

will be issued for telecom tower operators to design and implement strengthening solutions for telecom towers to carry 1-3kW wind turbines.

Installing 4-10 kW Wind Turbines on Telecom Towers

Most multi tenancy telecom towers required about 4-5kW of power which can only be met with a 12-15kW solar wind-hybrid solution (8-10kW Wind plus 4-5kW Solar). 8-10kW Wind turbines cannot be installed on existing telecom towers because of their weight and thrust loads they impart on the towers. The experience world over shows that an 8-10kW turbines are installed on separate towers other than the telecom tower. Since 8-10kW turbines eliminate the usage of diesel by 90-95% (Data shown in attached presentation for installation in Kenya), such wind-solar systems are still viable despite the additional cost of a separate tower.

3.13. For effective implementation of RET/Energy efficient solutions in telecom sector, how can the industry be supported? Should incentives be provided to licensees (TSPs)? If yes, what should be the milestone? Please comment with justification.

Incentives already exist for telecom operators to invest in small-wind solar hybrid systems and details are given below. These incentives should be extended and modified to include RESCOs as beneficiaries of subsidy. Subsidy should be increased for solutions that help save more than 90% of diesel consumption with energy generated from renewable such as 12-14kW wind-solar hybrid systems.

Subsidy from MNRE for installing SWES systems in Telecom Sector.

MNRE has announced a subsidy of Rs. 1 Lakh/kW for use of wind-solar hybrid systems specifically for telecom towers. In addition, for this FY alone there is a provision for accelerated depreciation of 80% for small wind turbines. This policy can be found here (http://mnre.gov.in/file-manager/offgrid-wind-scheme/modifications-in-SWES-scheme.pdf). The subsidy is a result of DOTs effort to improve the telecom services in the NE states.

Shri V. Umashankar, Joint Secretary, Ministry of Communication & IT , Dept of Telecommunications vide letter no 59-01/2013-SU.IV dated 22nd April,2013 addressed to Shri Rajeev Agarwal, Secretary, TRAI has requested to study regarding gap and investment required for formulation of a Telecom Plan for NE states including the state of Sikkim. TRAI has submitted its Report entitled "Recommendations on Improving Telecommunications Services in the North Eastern states- An Investment Plan on 26th September, 2013. Chapter XII on Summary of Recommendations may please be refereed. Recommendations related to Renewable power are given below:

Recommendation No- 12.11--- DoT should take up the issue of providing subsidy for installation of solar power units at telecom towers (BTS and repeater) with the Ministry of New and Renewable Energy (MNRE).

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Subsequent to this request, MNRE has announced a subsidy program from use of Small Wind-Solar hybrid for telecom towers on 15.01.0216.

3.14. What methodology can be proposed for setting new Renewable energy targets in the telecom sector? What should be the timeframe for achieving these targets? Please comment with justification.

Renewable Energy Targets can be addressed in four steps:

1) There are a few thousands of telecom towers sites which completely rely on DG set to power the sites. Since these sites are running mostly on diesel, reducing the diesel usage using renewable energy will make most financial sense for the tower operators. The payback period of such sites will also be significantly shorter. The renewable energy target should focus on sites which are completely off-grid. Such sites should be mandated to run on renewable energy for at least 80-100% of their energy needs, within a span of three years.

2) All new telecom tower sites that are being planned where there is no access to grid should be mandated to incorporate renewable energy. The justification being, diesel usage by telecom operators is already significant and preventing the additional consumption of diesel from new off-grid telecom sites is a prudent step. In addition, if renewable energy is mandated for new off-grid telecom sites, the sites can be planned to have adequate place for solar panels and towers can be designed to carry both wind turbines and telecom antennas for multiple tenancies.

3) Telecom sites which have significant usage of diesel generator sets due to lack of grid power for more than 12 hours a day (40% of the sites including off-grid sites) and have sufficient wind and solar resources should be mandated to use renewable energy to make these sites virtually 'diesel free.' The timeline for this step should be 5 years give the large number of sites involved.

4) For rest of the sites, telecom operators should be encouraged to make the sites 'diesel free' through energy management, increased battery banks, and addition of net metered renewable energy. Timeline for the rest of the sites can be 5 years.

The first three steps should be mandated by law since the earlier DOT issued target on use of renewables in telecom towers have never been met because the targets were not binding.

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Please feel free to contact me regarding any questions or clarifications on the above mentioned comments.

Sincerely

Srinivas Aluri
Director
Hara Industries Private Limited
9246566273

30 Years Supplying Wind Power for Remote Telecom Sites

Mike Bergey
Bergey Windpower

GSMA GPM Working Group Meeting, Lagos, Nigeria
January 29, 2014

BERGEY WINDPOWER

Bergey Windpower Co.

The World Leader in Small Wind

- 37 year old, U.S. based, manufacturer of small high-reliability wind turbines
- Over 9,000 installations, in over 100 countries
- Pioneered “sophisticated simplicity” turbine architecture and numerous component technologies
- Turbines have only 4 moving parts, require no scheduled maintenance, and have demonstrated 20+ years with 100% availability and zero O&M costs – unique in wind industry
- Longest warranties in industry
- Financial strength and stability

BERGEY WINDPOWER

Ruggedness & Reliability

The BWC Difference

- **BWC located in Oklahoma's "Tornado Alley" – winds can hit > 200 mph**
- **Provides severe testing conditions**

Home damage, 1994 tornado, Norman, OK

Tornado damage within ¼ mile of Bergey Windpower

Wood penetrating steel enclosure on turbine tower, May 3rd, 1999 Moore, OK tornado

BERGEY WINDPOWER

Bergey Products

1 kW
2.5m Dia.

6 kW
6m Dia.

10 kW
7m Dia.

Towers: Multiple styles, 60 – 160 ft.

Custom Inverters & battery chargers

BERGEY WINDPOWER

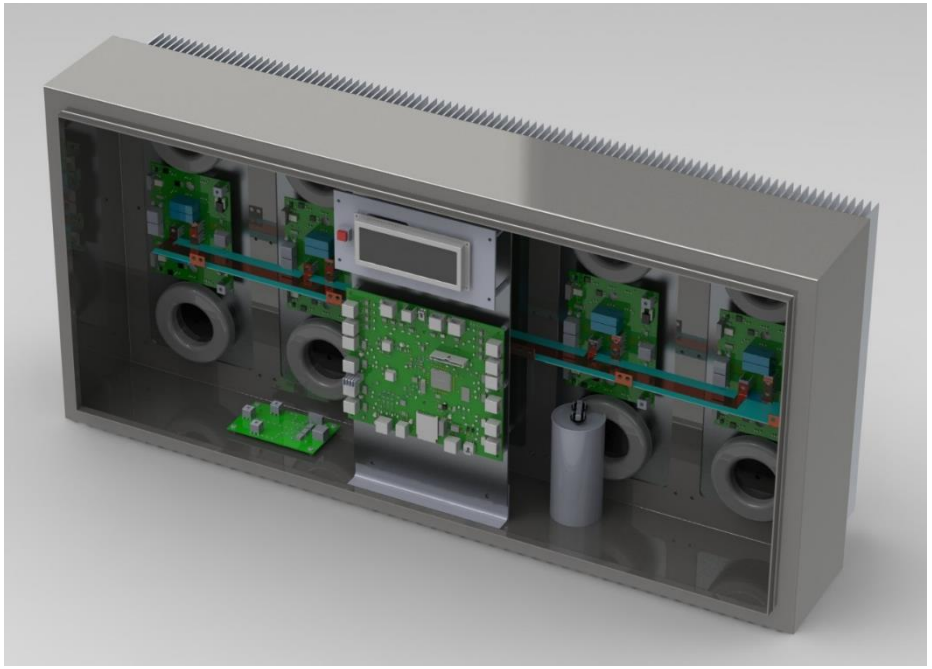
10 kW Bergey Excel 10

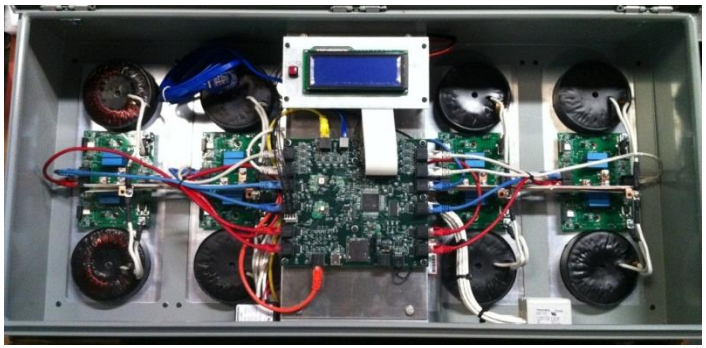
- Well sized for 1 – 3 kW telecom loads
- Over 2,500 Installed
- Leading Worldwide Product in the 5 – 15 kW Size Range
- Certified in US, UK, and Japan
- 10 year turbine warranty

BERGEY WINDPOWER

VCS II - Advanced Battery Charger

- Unique Buck-type, 200A, 48 VDC battery charge controller
- 8 Interleaved DC-DC converters– very low ripple current
- Lowers cut-in wind speed from 4.5 m/s to 2.2 m/s and increases peak power from 7.5 kW to 11 kW
- Increases energy by > 20%
- CAN bus communications, remote monitoring and control; integrated DAS





BERGEY WINDPOWER

WindCAD

- Internet-based Turbine Performance & Financial Modeling
- Worldwide wind resource database by 3Tier
- Efficient site evaluation and input to HOMER model
- Free to Bergey dealers & partners

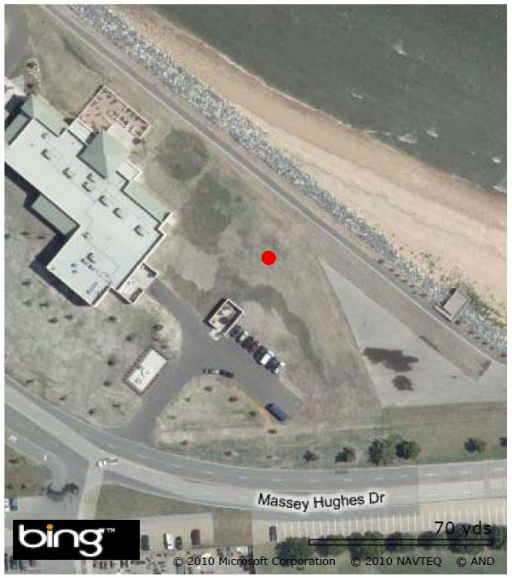
BERGEY WINDPOWER

Bergey WindCad Performance & Economics Evaluation Tool

Powered by New Roots Energy

Bergey Windpower Co. | (405) 364-4212 | 2200 Industrial Blvd, Norman OK 73069

Turbine Production:



Turbine Selection	Bergey Excel 10kW
Nameplate Capacity [kW]	10.0
Rotor Diameter [m]	7.0
Site Location:	
36.9557° latitude	
-76.317353° longitude	
Average Wind Speed [mph]	10.07
Tower Height [ft]	100.0
Altitude [ft]	100.0
Weibull K	2.0
Wind Shear	0.18
Turbulence Factor [%]	5.0
Average Output Power [kW]	1.0
Daily Energy Output [kWh]	24.7
Monthly Energy Output [kWh]	752.7
Annual Energy Output [kWh]	9,032.9
Hub Average Wind Speed [mph]	10.1
Air Density Coefficient	1.0
Operating Time [%]	78.5

Telecom Experience Since 1984

Gem State Utilities, Duncan Mountain, Idaho

- **Equipment:** BWC 7.5 kW Wind Turbine, 2 kW Solar, ~ 60 kWh Battery Bank, 15 kW Diesel
- **Performance:** ~ 40 kWh / Day at 120 VDC
- **Customer:** PP&L / OnSite Energy
- **Installation:** October 1984
- **Results:** PP&L initially installed three brands of wind turbines. After a 5-year test period, in which the BWC turbine was 100% available without maintenance, the other two brands were removed. The BWC turbine still powers the site.

BERGEY WINDPOWER

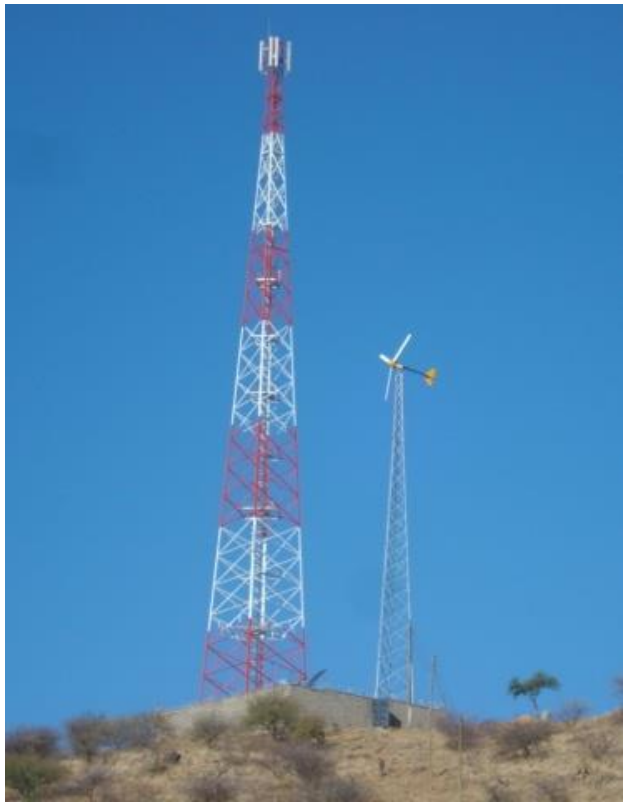
Bergey Wind/Diesel Powered Cell Sites

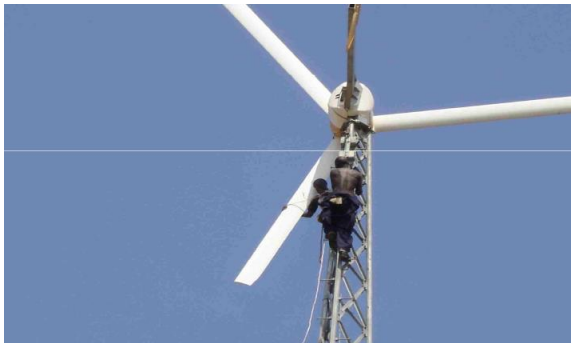
Haiti

Chile

South Africa

> 50 Sites in Kenya





Award Winning Projects

- Bergey turbines used in leading, award winning, Green Telecom projects
  - Smart Communications, Philippines, 78 sites
    2009 GSMA Green Telecom Award
  - Winafrique Technologies, vendor for Safaricom & Orange, Kenya, 52 sites
    2009 AfricaCom Green Telecom Award

BERGEY WINDPOWER

GLOBAL MOBILE AWARDS 2009
WINNER

AWARDS
AfricaCom
Winner
Green Telecoms Award
2009
Cape Town Convention Centre, South Africa

Wind for Telecom

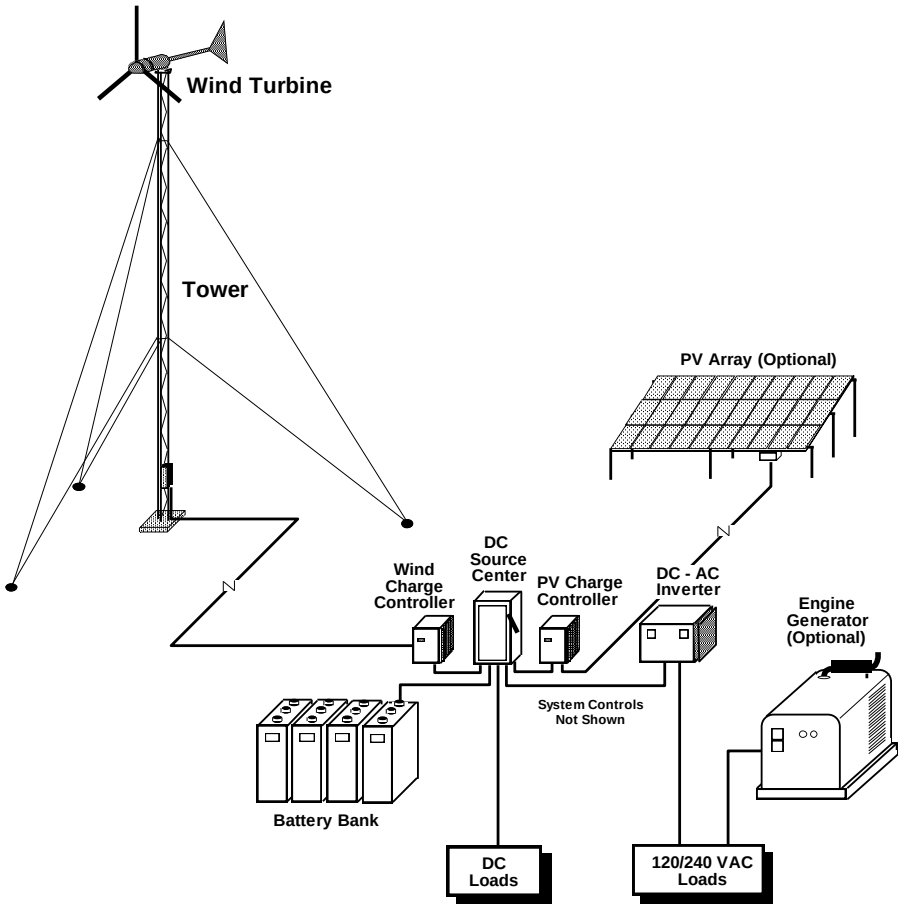
- Good broadcast sites often have good wind resources due to their elevation and exposure
- Wind energy costs sensitive to wind resource
- Not all sites will have sufficient wind resources
- Reliability of wind products varies widely
- Need tall towers, 24 – 37m

BERGEY WINDPOWER

Wind/Solar/Diesel Hybrid Systems

The Green Way to Power BTS

- **Provides 24/7 Power with Diesel Run Times Reduced to ~ 10 - 25%**
- **Renewables Typically Supply 50 - 90% of Energy**
- **“DC-Bus” Architecture is same as “Cycle-Charge Diesel” Systems, but with Renewables Added**

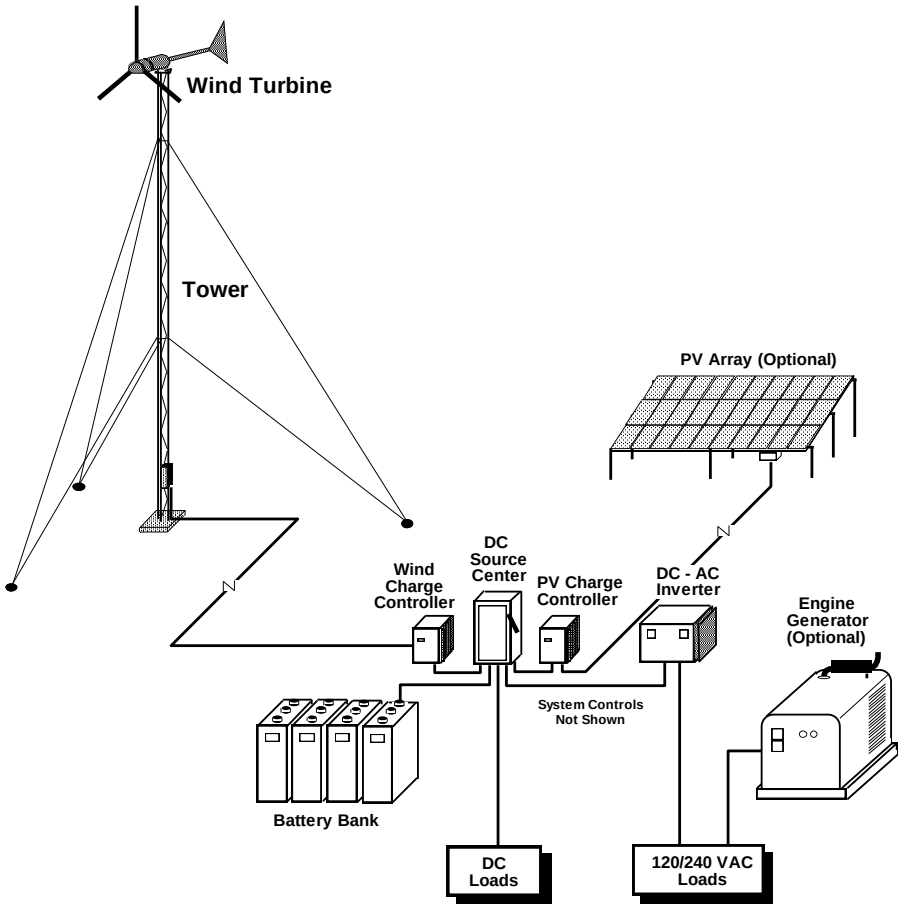


BERGEY WINDPOWER

Wind/Solar/Diesel Hybrid Systems

The Green Way to Power BTS

- One or More DC Wind Turbines & Solar Arrays
- 1 - 3 Days of Battery Storage
- Back-up Diesel Generator for Low Wind / Solar Periods
- Advanced “Consumer” Inverters for AC, Diesel Starting, and Diesel Battery Charging



BERGEY WINDPOWER

Typical Project Metrics

- **Equipment:** BWC 7.5 kW Wind Turbine, 2 kW Solar, ~ 60 kWh Battery Bank, 15 kW Diesel, Controls, & Monitoring
- **Load:** 1.5 kW BTS, plus DC Aircons
- **Performance:** 80% Annual Fuel Savings
- **Cost:** $110,000
- **OPEX Savings:** ~ $25,000/year, fuel & diesel O&M
- **Green Attributes:** Saves 600 tons of greenhouse gases and 3.6 tones of air pollutants over 30 year life

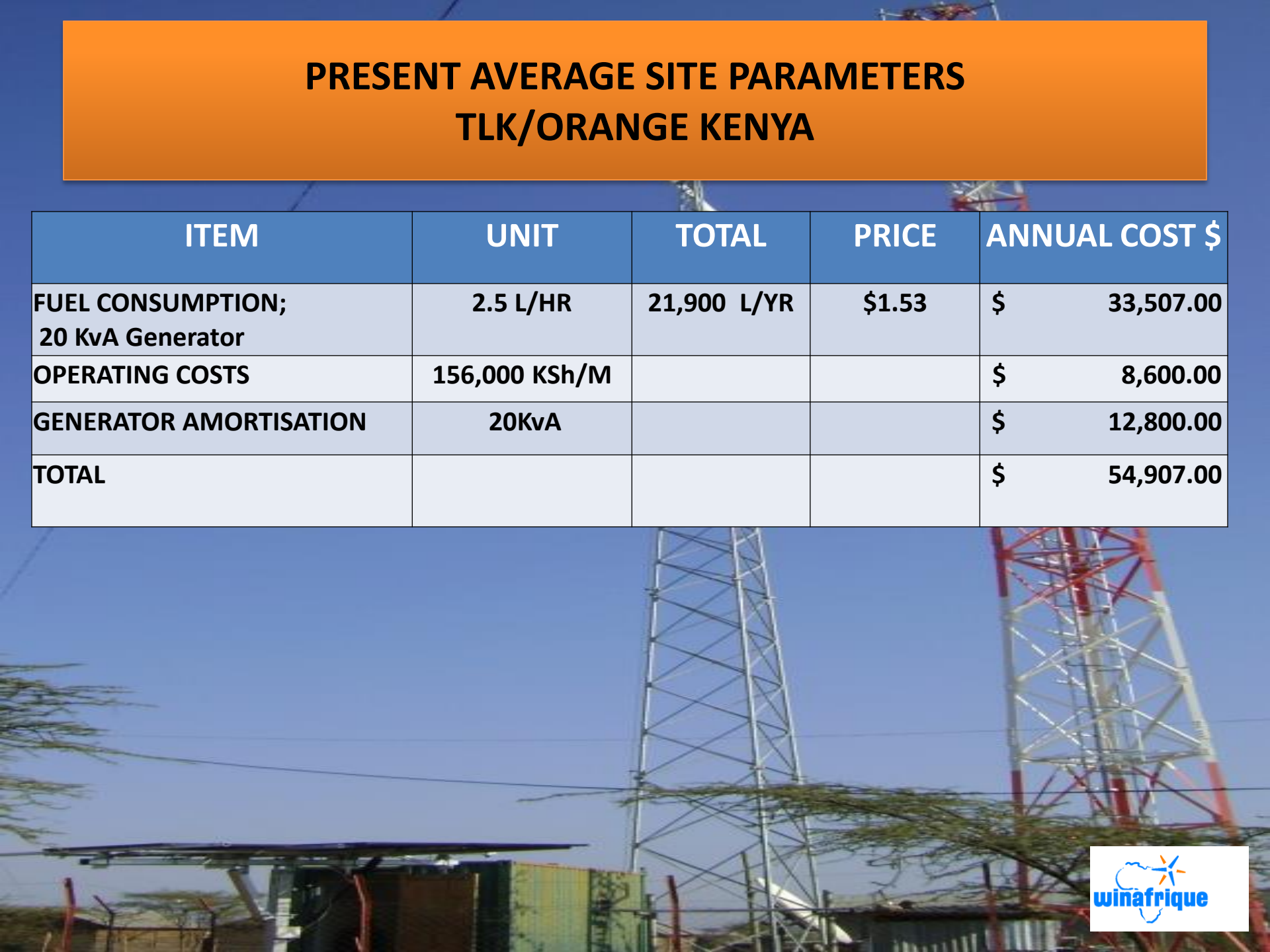
Safaricom
Masai Mara Game Reserve
Kenya

BERGEY WINDPOWER

Remote BTS Power OPEX Reduction
with
Wind Solar Diesel Hybrid Power Systems
May, 2010

PRESENT AVERAGE SITE PARAMETERS
TLK/ORANGE KENYA

ITEM	UNIT	TOTAL	PRICE	ANNUAL COST $
FUEL CONSUMPTION; 20 KvA Generator	2.5 L/HR	21,900 L/YR	$1.53	$ 33,507.00
OPERATING COSTS	156,000 KSh/M			$ 8,600.00
GENERATOR AMORTISATION	20KvA			$ 12,800.00
TOTAL				$ 54,907.00



ORANGE TKL TRAIL RESULTS

		Before Hybrid System				
		Generator Run		Diesel OPEX for TKL Two DEG (KShs/Hr); DEG consumes 2.5ltrs per hrs @KShs 112.50 per litre at site		
Orange TKL-WTL Wind Solar Hybrid Site	Trial Days	Hrs in Trial Days	Hrs Per Day in Trial Days	Diesel OPEX PER DAY for TKL Generator Site - Diesel Only (KShs.)	Diesel OPEX for TKL Generator - Diesel Only Trial Sites (KShs.)	Diesel Consumed @ 2.5ltrs per hrs (L)
Mt. Kulal	391.0	9,384	24	6,750.00	2,639,250.00	23,460.00
Pelekech	244.0	5,856	24	6,750.00	1,647,000.00	14,640.00
*Kakuma	230.0	5,520	24	6,750.00	1,552,500.00	13,800.00
Nakobothan	240.0	5,760	24	6,750.00	1,620,000.00	14,400.00
Lokichoggio	267.0	6,408	24	6,750.00	1,802,250.00	16,020.00
Maparasha	385.0	9,240	24	6,750.00	2,598,750.00	23,100.00
*Wind Turbine and Tower decommissioned and re-depoled to Lutarere				Total	11,859,750.00	105,420.00

ORANGE TKL TRAIL RESULTS; Total Diesel OPEX Savings(KShs)

		After Installation and Commissioning of Wind Solar Diesel Hybrid				
		Generator Run		WTL Wind Solar Diesel OPEX ; DEG consumes 3ltrs per hrs @KShs. 112.50 per liter at site		
Orange TKL-WTL Wind Solar Hybrid Site	Trial Days	Hrs in Trial Days	Hrs Per Day in Trial Days	Wind Solar Diesel OPEX PER DAY for TKL Trial Sites (KShs.)	Wind Solar Diesel OPEX for TKL Trial Sites (KShs.)	Wind Solar Diesel OPEX Savings (KShs)
Mt. Kulal	391.0	14.8	0.04	12.77	4,995.00	2,634,255.00
Pelekech	244.0	635.7	2.61	879.30	214,548.75	1,432,451.25
*Kakuma	230.0	245.9	1.07	360.83	82,991.25	1,469,508.75
Nakobothan	240.0	733.0	3.05	1,030.78	247,387.50	1,372,612.50
Lokichoggio	267.0	1348.1	5.05	1,704.06	454,983.75	1,347,266.25
Maparasha	385.0	350.0	0.91	306.82	118,125.00	2,480,625.00
				Total Wind Solar Diesel OPEX	1,123,031.25	
					Total Diesel OPEX Savings(KShs)	10,736,718.75

ORANGE TKL TRAIL RESULTS; Total Diesel Savings(Liters)

Orange TKL-WTL Wind Solar Hybrid Site	Trial Days	Wind Solar Diesel Saved (L)
Mt. Kulal	391.0	23,421.68
Pelekech	244.0	12,002.11
*Kakuma	230.0	12,717.51
Nakobothan	240.0	11,307.66
Lokichoggio	267.0	10,907.82
Maparasha	385.0	22,179.55
Total Wind Solar Diesel Savings(L)		92,536.31

Wind Solar Hybrid Trial On 6 TKL Orange Sites

KPI

Daily Generator Run Hrs Average 4hrs per day

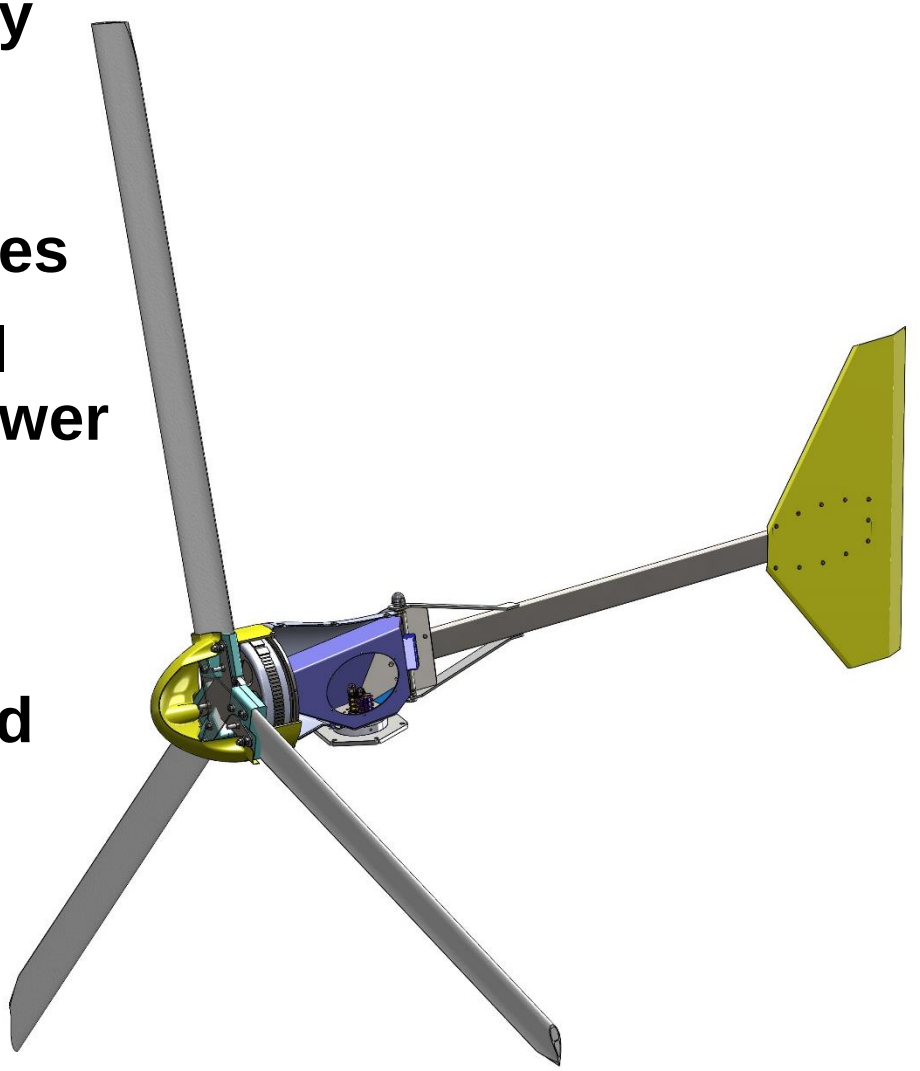
Lessons Learned

- Wind pilots were successful in 2006-2011 period, but green momentum was lost in recession … oil prices and ARPU
- Showing 2-3 year payback is tough
- Wind extends battery life – fewer deep cycles, variable charging rates & regular full charging
- Wind has footprint and equipment theft advantage over solar, but has lost cost advantage except in windy areas and higher latitudes
- Very few existing towers can hold wind turbine sized for the site load
- Importance of financial stability of turbine manufacturer and local reseller
- Low towers, vertical-axis turbines, and cheap wind turbines (mostly Chinese) should be avoided

BERGEY WINDPOWER

Technology Path – Wind Turbine

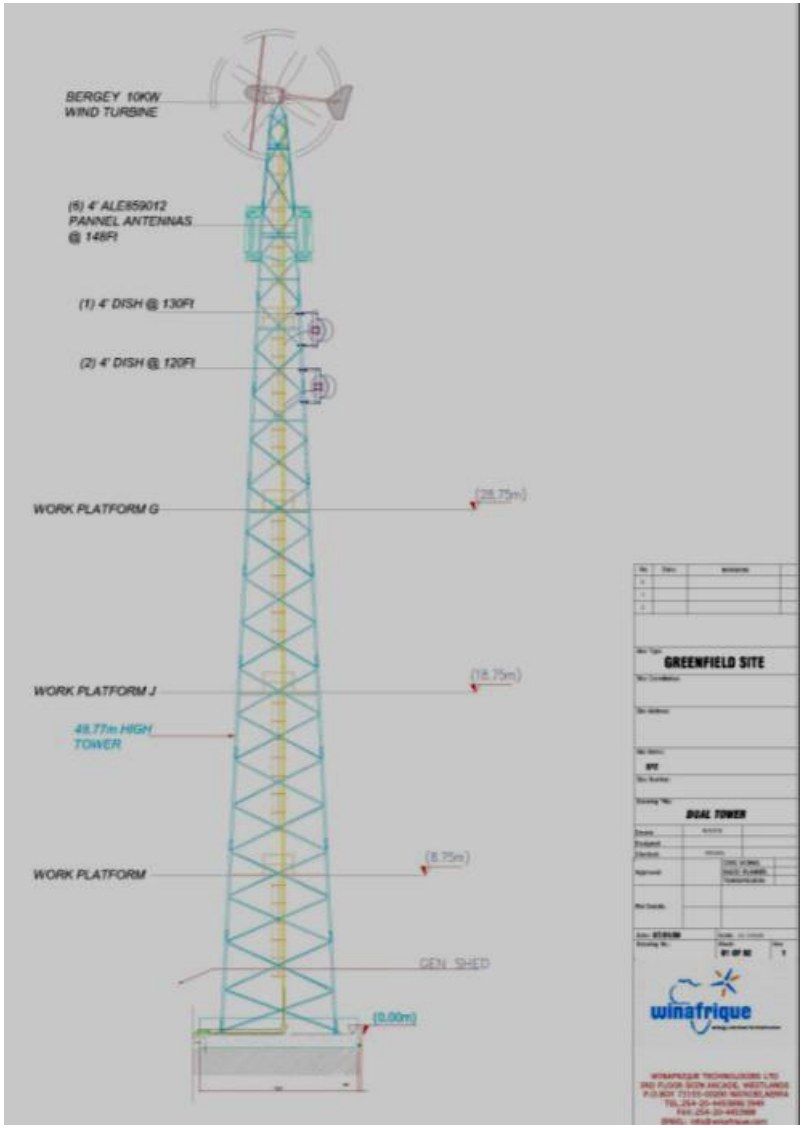
- Plunge in solar prices is a real challenge to wind industry
- LCEC must be reduced ~50% to regain cost advantage at low wind sites
- Larger rotors with control over speed, power and tower loading … advanced aerodynamic design
- Maintain mechanical simplicity, robustness and very low operating costs
- MPPT-like chargers



BERGEY WINDPOWER

Technology Path - System

- Single tower for turbine and antennas
  - saves ~ $30,000 with 43m tower and provides better performance
- Tall guyed towers – extra energy for community services
- Standardized, “value engineered”, electricals
- Export finance



BERGEY WINDPOWER

EXPORT-IMPORT BANK of the UNITED STATES

“Affordable Green Site” Program

- Technical: In-house project in cooperation with telco electronics & battery companies
- Standard kit with community services … including high value electrification / water supply services
- Business: Aimed at retrofits for BTS and community power – BTS as anchor customer under PPA
  - Partner with donor aid programs
- Business: For rollouts, green site at same CAPEX as dual-diesel

BERGEY WINDPOWER

Standardized Kit for Rural Services

- Focus on composing a package of energy systems to support vital community infrastructure
- Collaborative effort between Bergey Windpower and **University of Oklahoma Health Sciences Center College of Public Health** with formal end user survey/input
- End user involvement is most critical facet of project development

Example Elements May Include

Structural Components:

- Enhancing telecommunication infrastructure
- **Standard health services kit** design to meet energy requirements for remote locations, including but not limited to:
  - Dental
  - Medical services
  - Neonatal
  - Nutrition
  - Potable water
- School
- Lighting
  - Street lamps

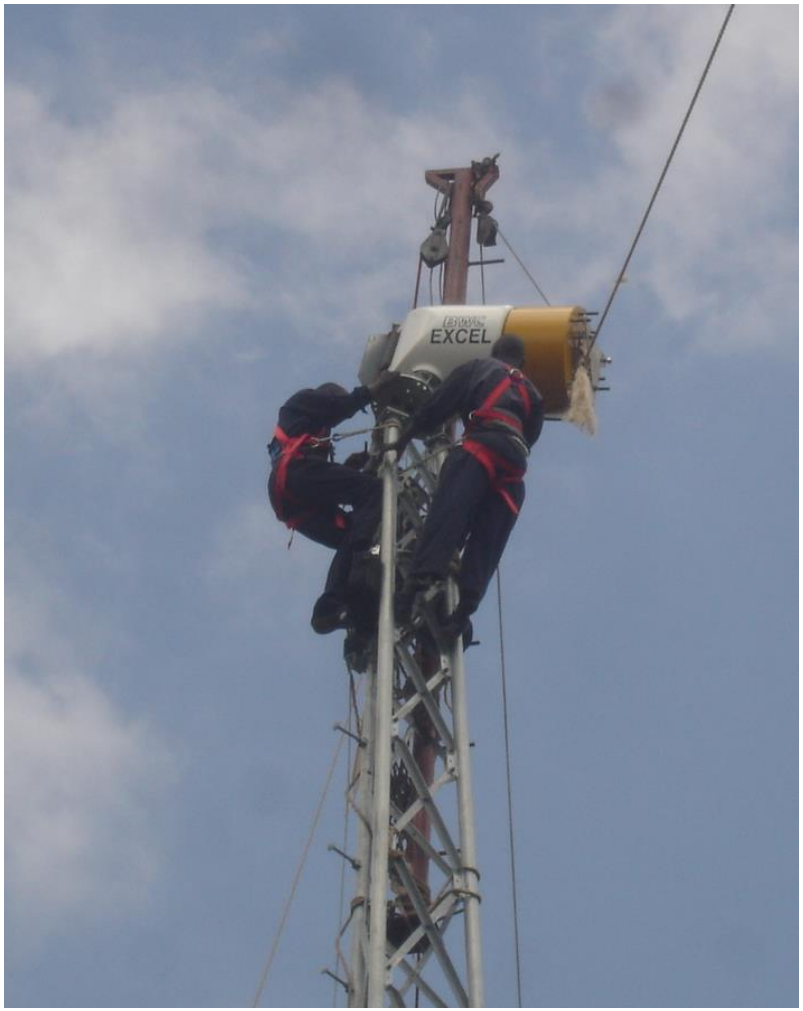
Support and Logistical Components:

- Systems staffing and training
- Geographical radius served
- Minimum and maximum per capita sizing

Need Government and Donor Agency Contacts to Aid in Needs Prioritization and Kit Design

Implementing Wind Energy

- **<u>Buy energy efficient equipment & cut thermal loads – Saves CAPEX!</u>**
- **Provide loads definition & locations to potential vendor(s)**
- **Budgetary estimates to determine feasibility, then formal quotations**
- **Trials Programs for Confidence Building and Staff Training**



BERGEY WINDPOWER

Your Green Power for Mobile Partner

BERGEY WINDPOWER

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