A Presentation to the GSMA, GPM meeting in Doha, Qatar, April 18 2012

Mats Vilander
General Manager, SVP Global Telecom

Agenda

1. Wind turbine solutions for telecom sites
2. Drivers for adding wind
3. Case studies for a Telecom Site
    1. Adding wind
    2. New site

Telecom references

orange · vodacom · make the connection mic · T-Mobile · TURKCELL · airtel

vip Sve zbog vas · VIETTEL TELECOM · NTT docomo · SYRIATEL · Vodafone

etisalat · Touch Maldives

Value Proposition for Mobile Operators

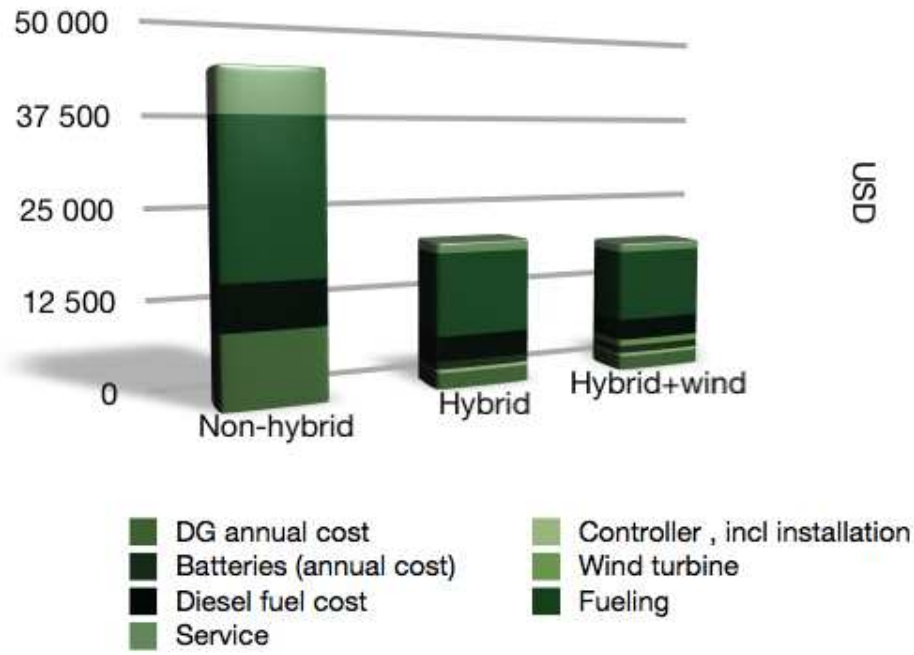
- Fully utilising the existing site space and infrastructure
  - Site Space in tower not fully utilised
  - A light weight wind turbine can be used in the existing infrastructure, fully integrated into the site (max wind-load on 105 Kg f at 65 m/s)
  - Easy to install

- 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

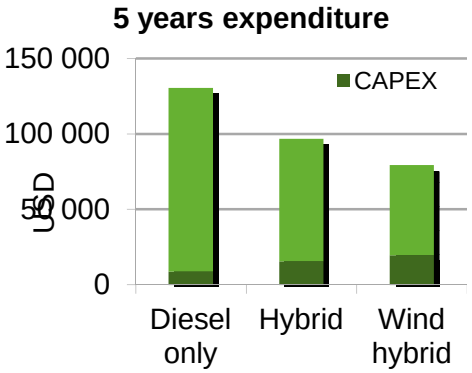
Operator Business Case

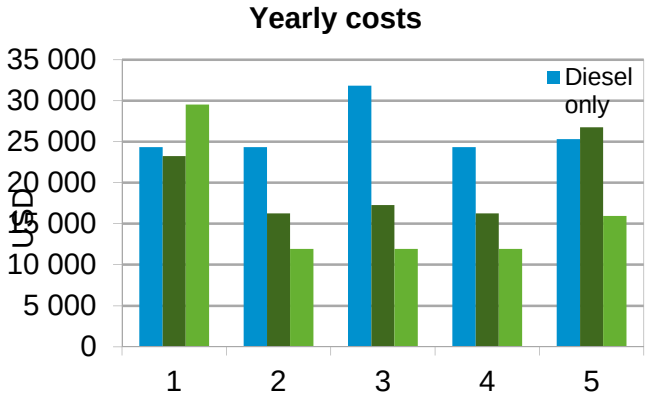
- Comparison of costs for three types of off-grid sites:
  - 100% diesel
  - Hybrid (DG + controller & batteries)
  - Hybrid (DG + controller & batteries + wind
- Assumptions
  - Site load: 2 kW
  - Wind turbines: 1
  - Average wind speed: 7 m/s
  - Diesel price: 0,3 USD/l
- Conclusion
  - Cost reduction of more than 50%
  - Annual saving of 24,000 USD for hybrid cases
  - Payback in less than 2 years

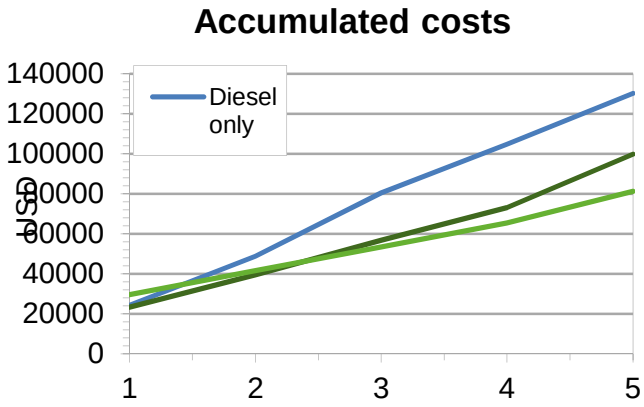


Business Case Hybrid Battery Diesel and Wind

Business case													
	Case	**Diesel only**	**Hybrid**	**Wind hybrid**		**Year**	**1**	**2**	**3**	**4**	**5**		
	CAPEX	8 500	13 500	24 100		Diesel only	24340	24340	31840	24340	25340		
	OPEX yearly	24 340	16 266	11 940		Hybrid	23 266	16 266	17 266	16 266	26 766		
	OPEX monthly					Wind hybrid	29 540	11 940	11 940	11 940	15 940		
						Accumulated						Savings	
	5 year expenditure					Diesel only	24340	48680	80520	104860	130200		
	CAPEX	8 750	15 500	19 600		Hybrid	23265,714	39 531	56 797	73 063	99 829	30 371	23%
	OPEX	121 700	81 329	59 699		Wind hybrid	29539,78	41 480	53 419	65 359	81 299	48 901	38%
	TOTAL	130 450	96 829	79 299									
	Saving		33 621	51 151									
			25,77%	39,21%									

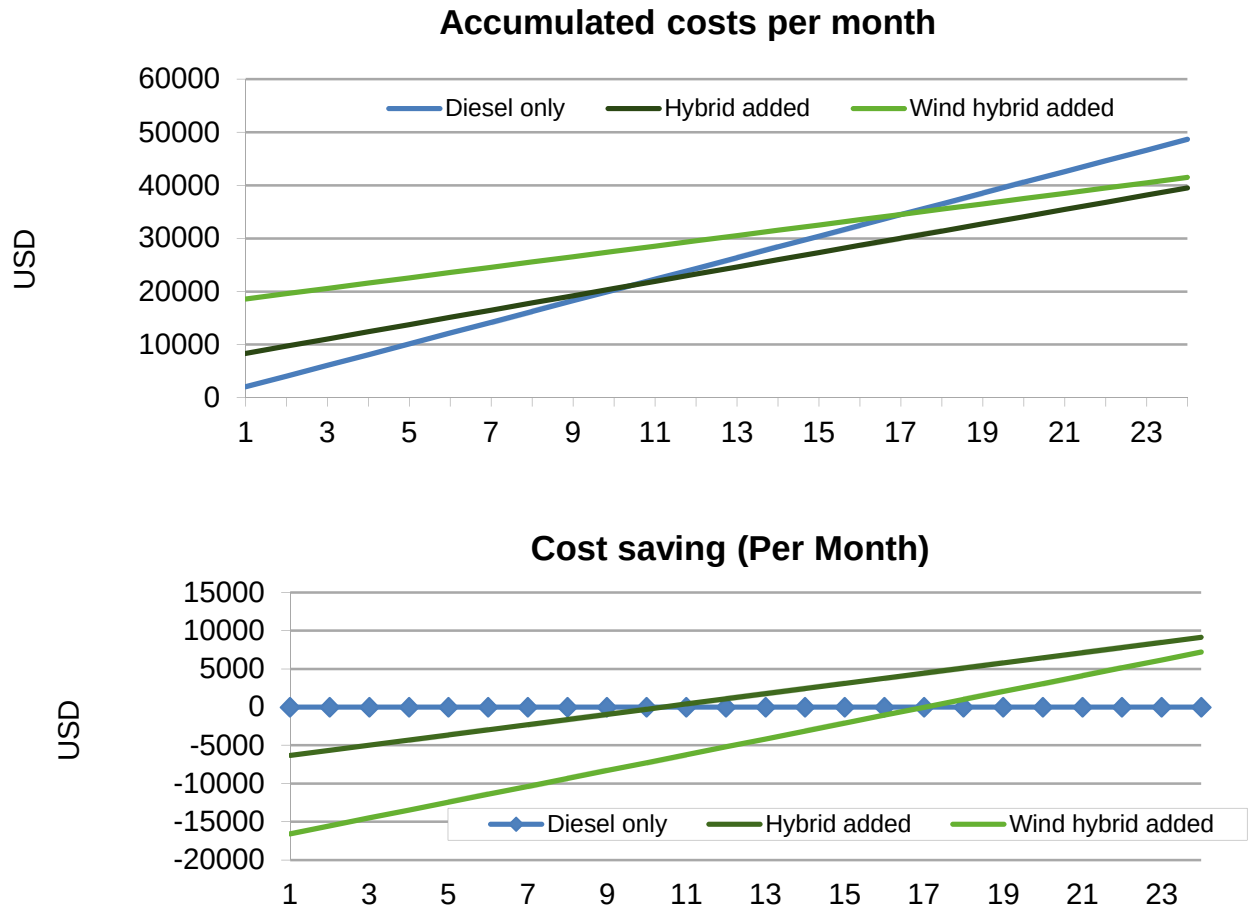






* Assumes 2 Wind turbines per site

Business Case Hybrid Battery Diesel and Wind



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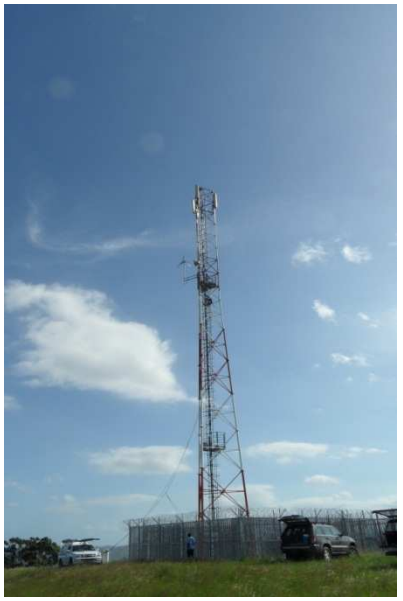
Vodacom South Africa

- The site was originally powered by a diesel generator and the SAM controller. In January 2012, the Airdolpin 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
  - Turbine: Airdolphin PRO (48 VDC)
  - Site: Telecom site
  - Power: Diesel, batteries and wind
  - Battery 720 Ah @ 48 Volt
  - Load 50 A DC

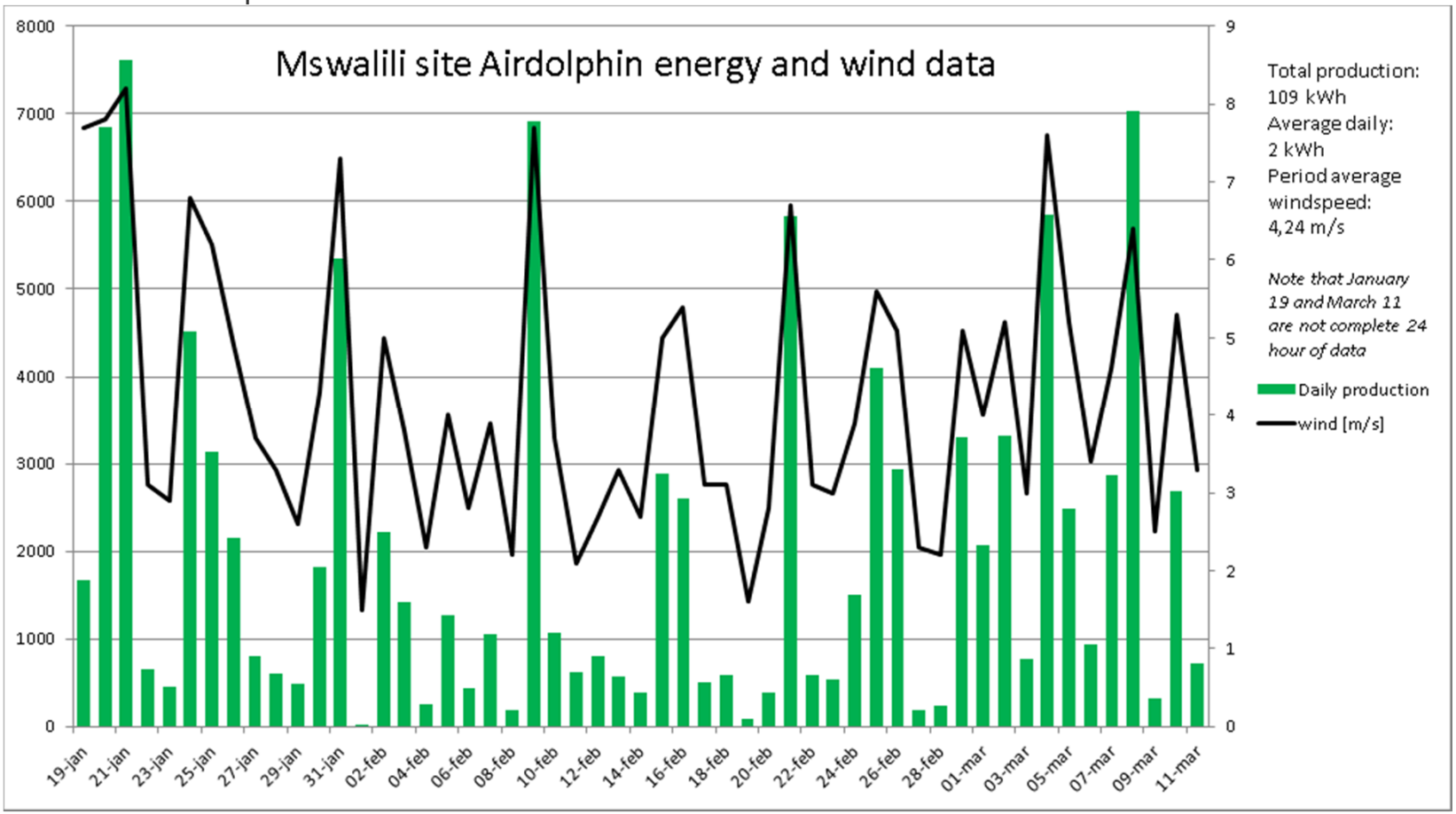
Location:
Mswailili, Eastern Cape

Installation:
Existing telecom tower



Available wind energy

- At Vodacom's site (Mswailili, outside Durban) wind speeds of 1,9-8,2 m/s (daily average) were experienced during the 53 day period. The average wind speed for the trial duration was 4,24 m/s.
- In average, a daily energy production of 2 kWh was achieved. On the best day, 7,6 kWh was produced.

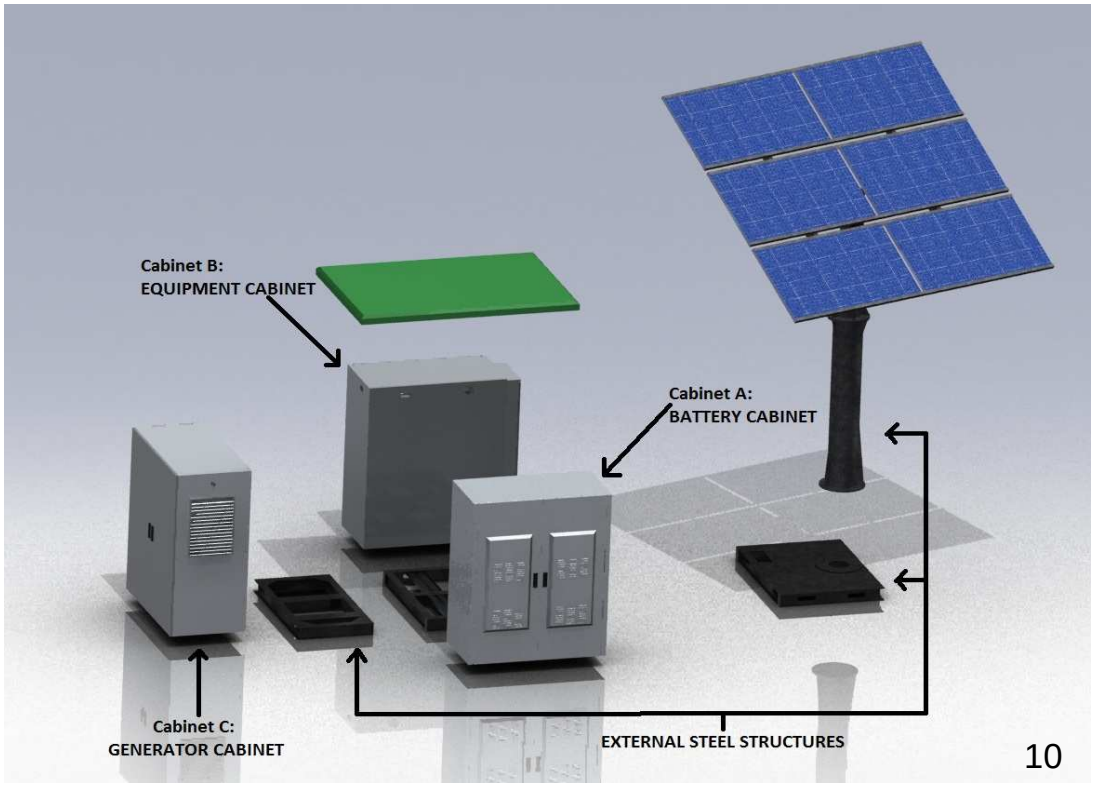


Example of complete Hybrid Battery Diesel site with Wind and Solar

The new Hybrid solution is a modular cabinet system that forms a complete solution.
The system is tailor-made to clients requirements.

The site solution configuration consists of the following :

- **External Steel Structures**
- **Cabinet A: Battery Cabinet**
- **Cabinet B: Equipment Cabinet**
- **Cabinet C: Generator Cabinet**
- **Sun tracking PV (size depending on load)**
- **Windturbine in Telecom tower (1-4 units)**



Installation outside Capetown

Terzobix installation video.avi

Summary

- With proper wind (min 5 M/S in average wind speed, the wind turbine will:
  - Complement to PV during low insolation periods
  - Valuable add on to diesel battery hybrid sites
  - Markets most efficient wind turbine (Wh/kg)
- The Airdolphin PRO is tested and verified for Telecom application
- The typical pay off for adding wind is 1-2 years
- The typical off grid site can handle 1-2 turbines in the existing tower = cost efficient installation

Thank you

Orange Madagascar