# WIND FARM OF SANTO ANTÃO

## The First IPP in Cabo Verde

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# Brief Summary

I - First IPP in Cabo Verde running since April 2011;

II - Functioning of the Wind Farm;

III - Technical Impact at the Diesel Power Plant;

IV - Financial and Environmental Impact

# Project Concept

- Addressed to Islands with small electrical systems;
- Island of Santo Antão with around 26.000 inhabitants, 11.000 electricity consumers, average load of about 1.000 kW + 700 Kw;
- Project on two steps with 2 x 250 kW each;
- Total investment of about 1.000.000 Euros of which:
  - 50% from Government of The Netherlands (Grant);
  - 25,5% from Dutch partner Green Energy Services;
  - 24,5% from Capverdean  partner Electric, Lda;
- License as Independent Producer issued by Ministry of Energy;
- Power Purchase Agreement with the Public Utility ELECTRA.

# Production and Availability of The Wind Farm

**Table 1 – Production and Availability on Year 2013**

| | Production (kW.h) | Running Hours | Average Production /Running Hours | Capacity Factor (Full Load Hours) | Wind Turbine and Grid Availability |
|---|---|---|---|---|---|
| WT 1 | 756.579 | 7.226 | 105 | 34,5% 3.026 hours | 82,5 % |
| WT 2 | 769.638 | 7.077 | 109 | 35,1% 3.079 hours | 80,8% |

# Monthly Production

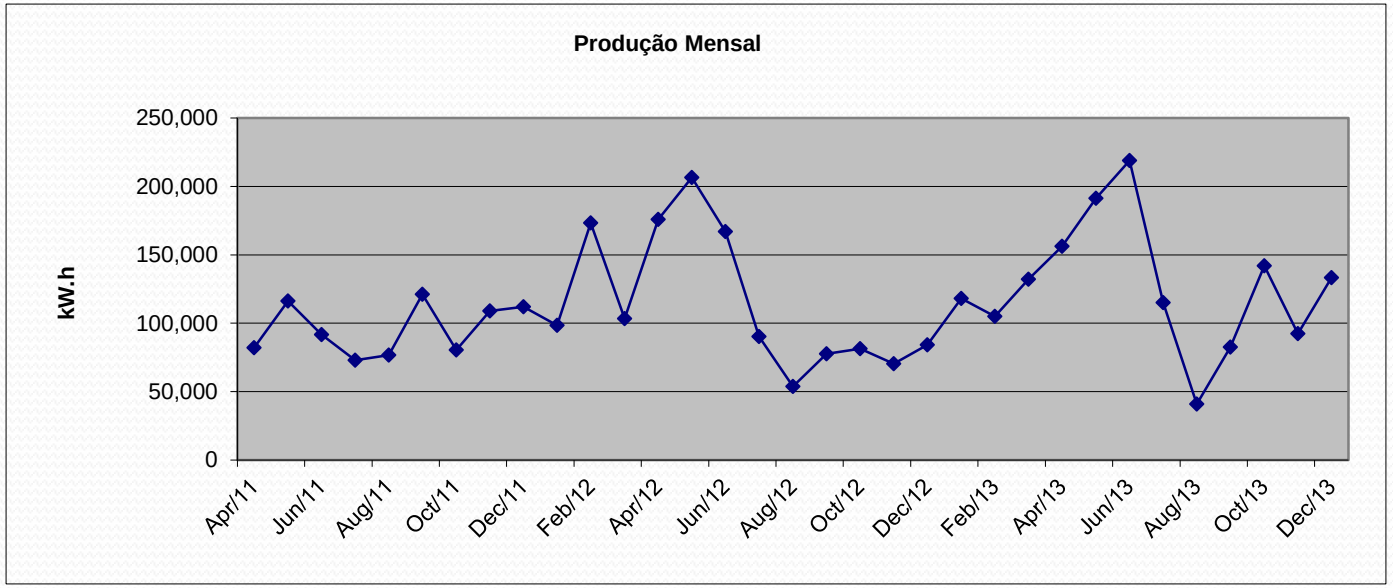


**Figure 1**

**Monthly Average Production of 114.250 kW.h**

# Wind Power Contribution for the Electrical System

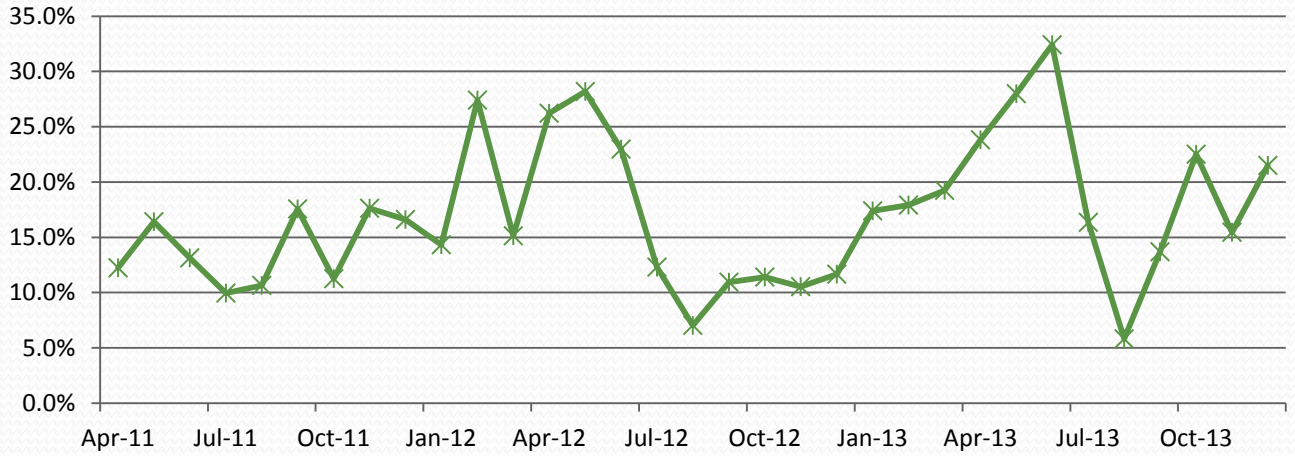


**Figure 2**

- **Wind Power Contribution of 13,8% on Year 2011**
- **Wind Power Contribution of 16,4% on Year 2012**
- **Wind Power Contribution of 19,4% on Year 2013**

# Anomalies in The Functioning of the Wind Turbine Units

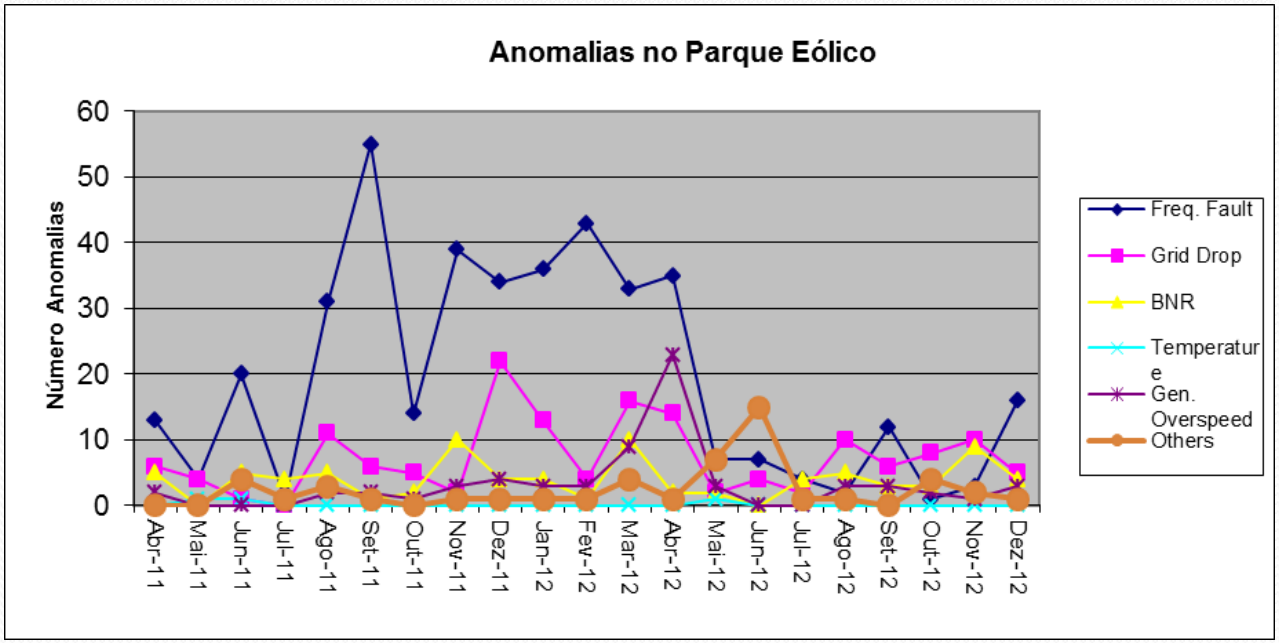


Figura 3

- Total Number of Anomalies in the period April 2011/Dec 2013 was 772;
- Average number of Anomalies per Wind Turbine 0,6 / day on 2011/2012 and dropped to 0,24/day on 2013
- 72% of Anomalies are Frequency Fault and Grid Drop (Electric Grid and Power Plant Problems)

# Technical Impact of the Wind Farm at the Diesel Power Plant

## *1. Fuel Consumption per kW.h Produced*

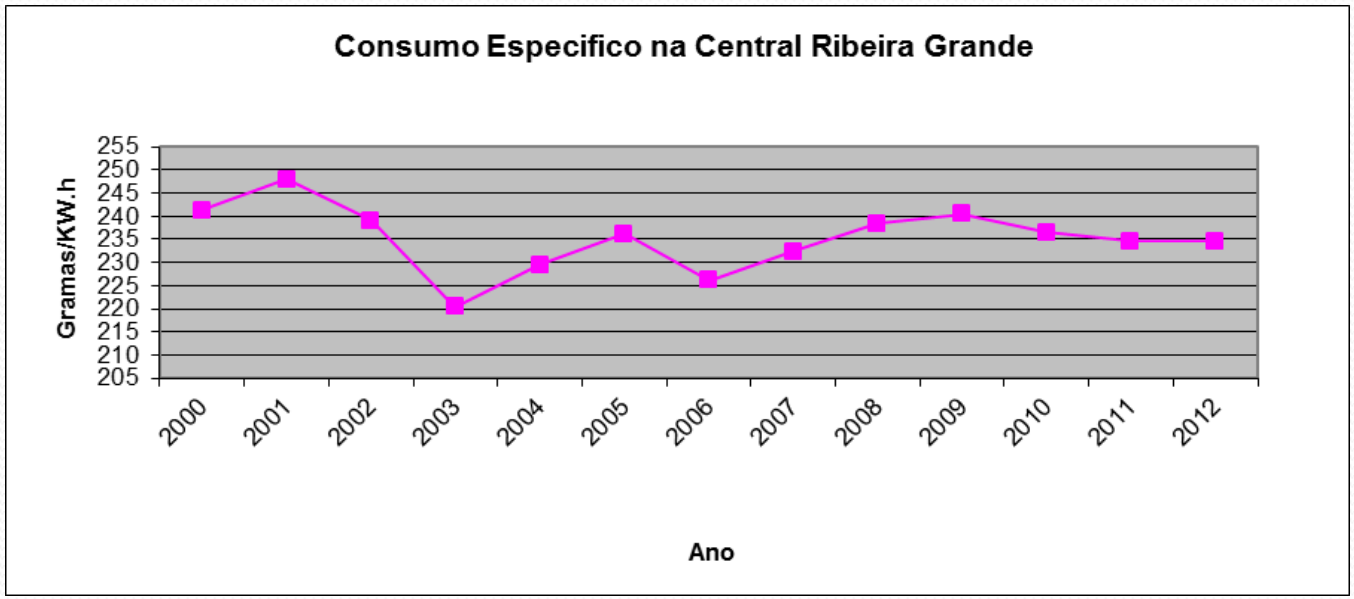


**Figure 4**

**Mean Value of 235,2 gr/kW.h**

# Technical Impact of the Wind Farm at the Diesel Power Plant

***3. Black Outs***

**Table 2: Number of Black Outs per Year**

| Ano 2008 | Ano 2009 | Ano 2010 | Abril/Dez 2011 | Ano 2012 |
|---|---|---|---|---|
| 9 | 14 | 14 | 13 | 12 |

# Technical Impact of the Wind Farm at the Diesel Power Plant

## *4. Average Power Factor of the Wind Farm*

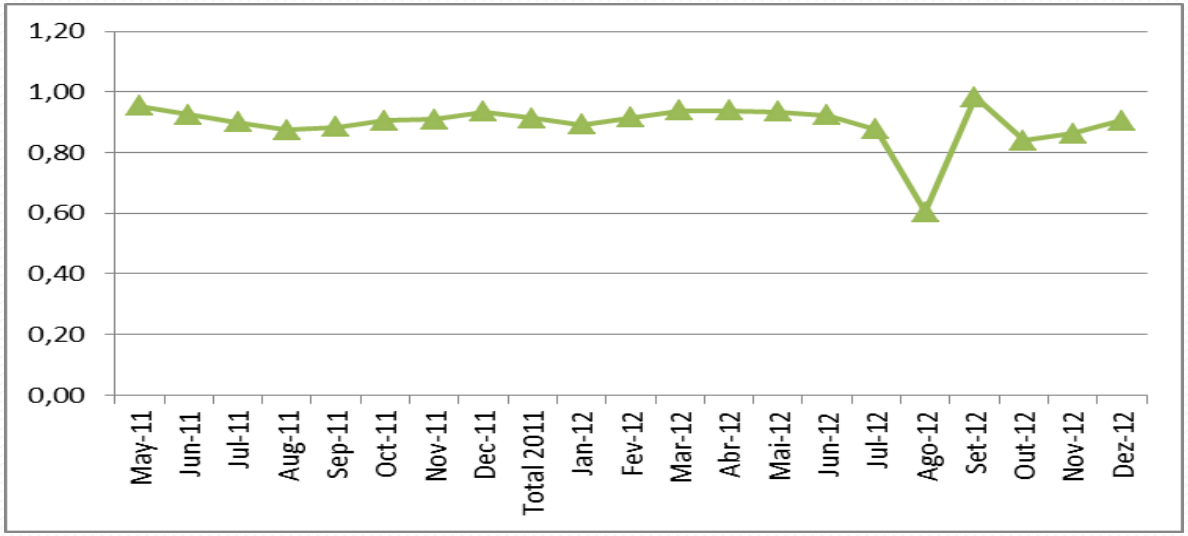


**Figure 6**

**Average Power Factor is 0,91 and the minimum allowed is 0,85**

# Technical Impact of the Wind Farm at the Diesel Power Plant

5. ***Losses in the Electrical System***

| 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|
| 29,1% | 23,7% | 23,1% | 22,9% | 23,2% |

# Financial and Environmental Impact of the Wind Farm.

i. Electric Wind has had net profit on years 2011 and 2012 and 2013;
ii. Electra, SA (public utility) is saving about 7 c€/kW.h on avoided cost of fuel at the Power Plant;
iii. Cap Verde has had positive impact on its Balance of Payments derived from fuel savings on the Diesel Power Plant;
iv. Environment has benefited from significant amount of gas emission saving;

# Financial and Environmental Impact of the Wind Farm.

**Table 4 – Financial and Environmental Impact on period April 2011/ June 2013**

| Production (kW.h) | Fuel Saving (liter) | Savings on the Balance of Payment | Saving on Gaz Emission |
|---|---|---|---|
| 3.770.166 kW.h | 1.061.131 liters | 812.463 € | 2.653 Ton |

In the near future, after interconnection of the electrical grids in the Island of Santo Antão, the installed capacity at the Wind Farm will be reinforced and the positive impact is likely to double.

# Three Main Lessons:

A small size Wind Farm is not a Mine of Gold

1. Choose very good sites;

2. Be prudent on production estimates;

3. Very careful with bank loans (interest rate);

4. Look for some kind of incentives;

# THANKS FOR YOUR ATTENTION

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