WIND FARM OF SANTO ANTÃO
The First IPP in Cabo Verde

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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 49,000 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 2012

<table>
<thead>
<tr>
<th></th>
<th>Production (kW.h)</th>
<th>Running Hours</th>
<th>Average Production / Running Hours (kWh)</th>
<th>Capacity Factor (Full Load Hours)</th>
<th>Wind Turbine and Grid Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>WT1</td>
<td>687.798</td>
<td>6.887</td>
<td>100</td>
<td>31,4% (2.751 Horas)</td>
<td>79%</td>
</tr>
<tr>
<td>WT2</td>
<td>676.807</td>
<td>6.463</td>
<td>105</td>
<td>30,9% (2.707 Horas)</td>
<td>74%</td>
</tr>
</tbody>
</table>
Monthly Production

Figure 1

Monthly Average Production of 117,200 kW.h
Wind Power Contribution for the Electrical System

- Wind Power Contribution of 13.8% on Year 2011
- Wind Power Contribution of 16.4% on Year 2012
Anomalies in The Functioning of the Wind Turbine Units

- Total Number of Anomalies in the period April 2011/Dec 2013 was 772;
- Average number of Anomalies per Wind Turbine 0,6 / day;
- 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

![Graph showing fuel consumption per kW.h from 2000 to 2012. The mean value is 235.2 gr/kW.h.](image)

Figure 4

Mean Value of 235.2 gr/kW.h
Technical Impact of the Wind Farm at the Diesel Power Plant

2. Fuel Saving versus Wind Power Production: An almost Linear Correlation

Figure 5
### Technical Impact of the Wind Farm at the Diesel Power Plant

#### 3. Black Outs

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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 2: Number of Black Outs per Year</td>
<td>9</td>
<td>14</td>
<td>14</td>
<td>13</td>
<td>12</td>
</tr>
</tbody>
</table>
Technical Impact of the Wind Farm at the Diesel Power Plant

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

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*

<table>
<thead>
<tr>
<th>Ano</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perdas</td>
<td>29,1%</td>
<td>23,7%</td>
<td>23,1%</td>
<td>22,9%</td>
</tr>
</tbody>
</table>
Financial and Environmental Impact of the Wind Farm.

i. Electric Wind has had net profit on years 2011 and 2012;

ii. Electra, SA (public utility) has had and avoided cost of fuel higher than price paid for kW.h wind power;

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;
This is a significant positive impact (technical, financial and environmental) of a small Wind Farm connected to an Electric System feeding around 11,000 consumers. 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.

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

<table>
<thead>
<tr>
<th>Production (kW.h)</th>
<th>Fuel Saving (liter)</th>
<th>Savings on the Balance of Payments (Euro)</th>
<th>Saving on Gaz Emission (Ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,164,297</td>
<td>887,800</td>
<td>899,537</td>
<td>2.237</td>
</tr>
</tbody>
</table>
THANKS FOR YOUR ATTENTION

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