Younicos
Let the fossils rest in peace.
The PV-wind-battery storage project on the Azores island Graciosa

International Workshop on Renewable Energy Development in Macaronesia and West Africa
Graciosa, Azores – Setting the Course for Future Generations

Key factors until 2015

- One of 9 islands of Azores
- 4500 inhabitants
- Annual production: 13.9 GWh
- Peak load: 2.3 MW
- Installed capacity (Diesel): 4.6 MW
History of the Graciosa Project

Graciosa Chosen as Pilot Project

Technology Center Construction

LOI with EDA

PPA Negotiations

Ground Breaking Ceremony

2006 2007 2008 2009 2010 2011 2012 2013 2014

Technical Pre-Evaluation

Technology Center Inauguration

Proof of Concept

Signing of PPA & PIR*

* Project of Regional interest
…2015

Provides the energy control system

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>MWh-s Installed</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery Power Plant</td>
<td>3.2</td>
<td>Commissioning</td>
</tr>
<tr>
<td>Photovoltaic Plant</td>
<td>1.0</td>
<td>Ready for production</td>
</tr>
<tr>
<td>Diesel Generators</td>
<td>4.6</td>
<td>Commissioning of the interconnection</td>
</tr>
<tr>
<td>Transmission Line</td>
<td>-</td>
<td>Completed</td>
</tr>
<tr>
<td>Wind Park</td>
<td>4.5</td>
<td>Completed by July</td>
</tr>
</tbody>
</table>
Commercial aspects

**Reliability**
- Our system guarantees stable, reliable power quality
- Battery balances demand and supply within milliseconds
- Less downtime than diesel-based system

**Cost-efficiency**
- Cost savings due to lower diesel consumption
- The project will result in local value creation
- Independence of rising fuel prices

**Sustainability**
- 100% Renewable Energy penetration is possible
- Decrease of carbon footprint
Why Graciosa
Microgrid – Challenges

High diesel fuel costs
- Can be >€1/liter in remote locations

Inefficient diesel generator operations
- Operation at reduced output for reliability needs increases fuel costs
- Constant cycling of units to meet load leads to more frequent O&M

Grid instability
- Weak grid can lead to loss of critical loads
- Poor power quality may require purchase of additional electrical equipment
- Transient events occur < 10 milliseconds
- Diesel response > 200 milliseconds

Unable to achieve high renewable penetration
- Intermittency of solar and wind can cause grid disturbances
- Curtailment of renewables common to maintain grid reliability
Microgrid – Younicos Solutions

Decrease operating costs
- Allow diesels to operate in optimal range
- Increase diesel generator efficiency
- Decrease cycling to reduce O&M

Improve grid stability
- Act as back up power source to keep critical loads online
- Maintain high power quality with VAR support
- Avoid additional grid support equipment expenses
- Response time < 50 milliseconds

Integrate more renewable resources
- Reduce strain on grid caused by intermittency
- Decrease diesel consumption through less curtailment of renewable resources
From south pole to Alaska: Experience from over 97 MW in the field
Thank you for your attention!
Thank you!

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