Demonstration PV rural micro grid in the island of Santo Antão (Cape Verde, Africa) with an individual energy daily allowance (EDA)

Purpose

The objective has been to electrify a fishermen’s village of the island Santo Antão, Monte Trigo (pop.: 600) with a Multi user Solar Micro grid (MSG) supplying 61 connections. Implementation was in 2011 as part of the ACP-EU Energy Facility programme. Access to affordable electricity is important for basic needs (lighting and communication) but also for food refrigeration, producing ice for the conservation of the fish catch and community services.

Methodology

Objective:

- Defined ownership and responsibility
- 24h access to electricity for households and services at standard AC.
- Improve the social and economic development of the target groups by providing affordable energy services for lighting, small appliances and conservation of fish.

Approach:

To build up from state of the art and past experiences of RE rural micro grids electrification.

EDA Concept

Principles:

- Measurement of the total energy consumed
- Limitation of the available energy based on the tariff contracted, with disconnection.
- Limitation of power with disconnection.
- Indicators and user advice.
- Adaptation of operation algorithm to the state of charge of the battery: The bonus mode and restriction mode encourages adequate user load management.

Technology

PV rural micro-grid with back up genset and 61 connections (27,3 kWp, 369,6 kWh storage, 16 kVA inverter).

Aggregate demand of the village capped by establishing a daily energy allowance.

Dispenser meter is mandatory in order to manage each single user electricity consumption as well as to guide user to consume in a sustainable and flexible way.

Highlights

International cooperation: Cabo Verde, Spain, Portugal, France.

Other relevant aspects can be highlighted:

- The PV plant oversized 20% for demand growth.
- PV generator on a wooden pergola that provides shade to the village’s schoolyard for added value to the community.
- The existence of a genset in the village feeding a 3 phase distribution grid that supplies only single phase loads had to be combined with a single phase PV plant concept.
- Tariff collection is based on fixed monthly rates related to EDA.
- Real time pricing broadcast (Modbus) signal encourages consumption during periods of surplus solar generation.

Conclusions

- Advantage of rural PV micro grids for the electrification of rural villages dual systems.
- O&M costs saved 10.500€/year (1st year). Users have adapted their energy consumption to the state of the PV plant and started to purchase efficient appliances.
- EDA concept and the associated tariff concept are an advantage from the social point of view but also technical and economical.
- Business model permits the operator to maintain the service during life-cycle as well as to recover O&M costs plus 25% of initial capital cost.