Sustainable Energy Consulting

"Embrace renewable sources"

PROJECT REFERENCE 2017

SUSTAINABLE OFF-GRID SOLUTIONS

CAP KAROSO SUMBA 5★ HOTEL
Design Phase

1. Introduction

This luxury eco-friendly "off-grid" hotel mainly consists of 100 bedrooms - split in hotel rooms and private villas with swimming pool -, and of a bar & restaurant, beach club, spa, fitness room and a large hotel swimming pool.

Bedrooms are split as follow :

- Hotel : 12 standard 1 BR, 16 standard 1BR bungalows, 6 superior 1BR, 3 superior 2BR, 7 suites 2BR = 54 keys
- Villas : 8 duplex 2BR, 6x2BR and 6x3BR units = 46 keys

The **interconnected architectural, civil engineering and MEP detailed designs** are completed and this project construction is now ready to start.

2. Mechanical, Electrical and Plumbing Design

MEP design was completed for the whole resort from power and water generation to distribution outlets, and through the use of most energy efficient systems and optimized calculations. The main systems are :

- **Off-grid hybrid power system** with **solar photovoltaic** as main power source and back-up generators
- Centralized **solar hot water** with hot water circulation to distribution outlets
- Reverse Osmosis system for deep well brackish **water purification**
- Natural waste **water treatment** plant and **water recycling**
- Split Inverter Air Conditionings and fire fighting
- Stand-alone **solar PV pool pumps** for each villa swimming pool
- All water and energy **automation** and **monitoring** systems

3. Hybrid PV Power System

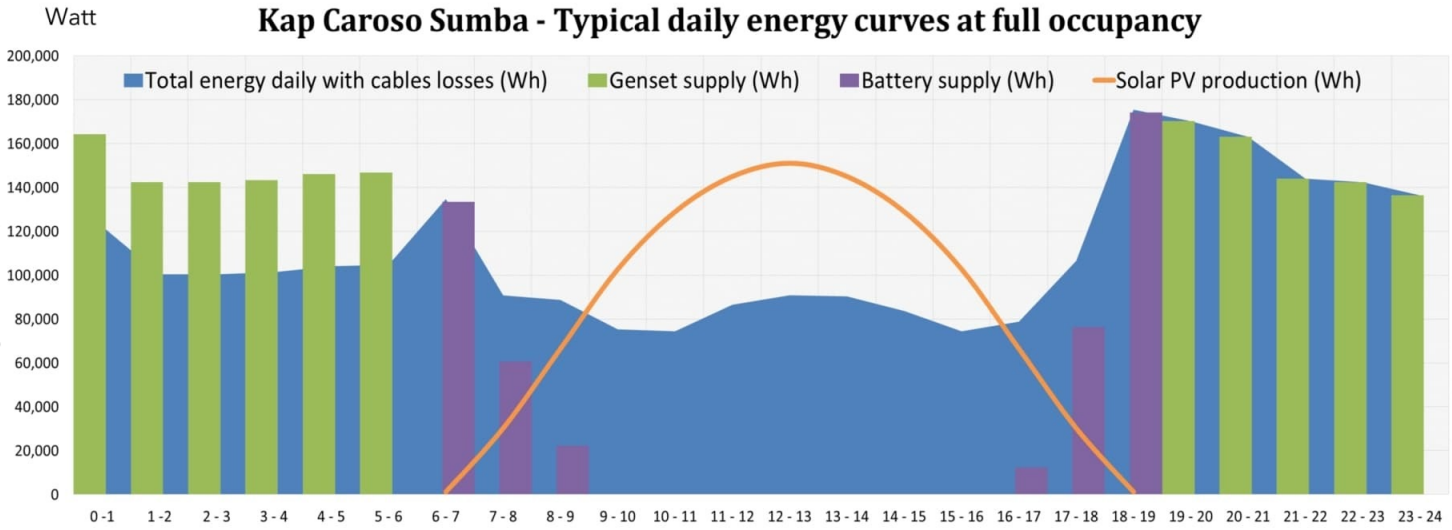
The PV hybrid power system is designed based on a real **customized hourly load profile** taking in consideration all comsumption factors for each equipment. It mainly consists of :

- A 220kWp solar array (Tier 1 JA Solar Percium Mono solar modules)
- 8 battery banks with total capacity of 1.2MWh @C10 (Hoppecke)
- SMA Sunny Tripower inverters
- SMA Sunny Island battery inverters
- 2 back-up diesel generators of 300kVA each (vs. 2x500kVA minimum with conventional design)
- SMA Multicluster Box for system's remote control and monitoring

The average solar PV production is 1.11MWh/day, which is over 40% of the hotel consumption at full occupancy. Back-up generators shall then run a maximum of 11h/night and are automatically started.

Total installed equipment nominal power: 300kW, peak load is 175kW.

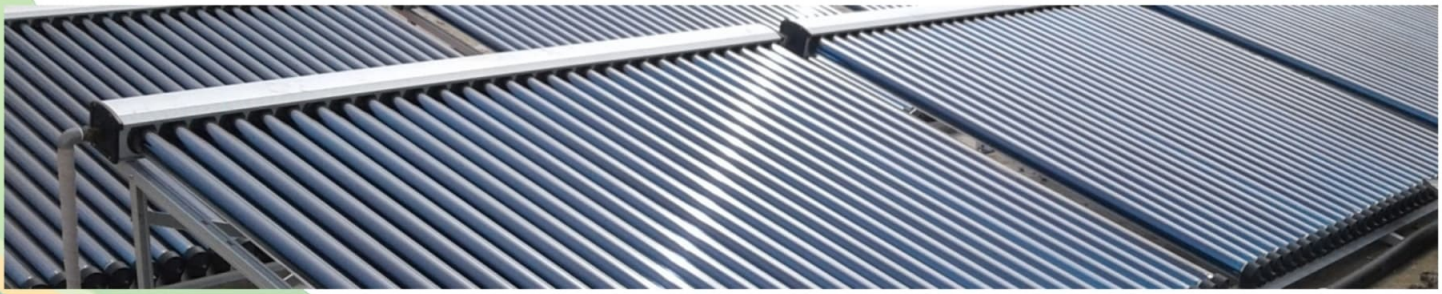
Return-On-Investment compared to full generator operation is **5 years.**



4. Solar Hot Water System

The highly efficient centralized Solar Hot Water system mainly consists of:

- 18 arrays of 30 evacuated tubes + 30 arrays of 25 tubes each
- A 6,000l fully isolated storage buffer tank with 90°C water
- Resol controllers for close loop operation
- Hot water circulation loop to all points of use for supply at 55°C
- Fuel boiler back-up, hardly used during normal operation



5. Cold Water Systems

Brackish **raw water** will be pumped in a timely manner from 2 different deep wells. It is filtered then purified through a highly energy efficient RO system (2kWh/m^3), enabling to produce **drinking quality water**. **Clean water** is then stored in a tower tank of 50m^3 at 15m height. This enables to distribute it mostly by **gravitation. Variable speed booster pumps** achieve a very energy efficient and stable process for clean water supply. Estimated consumption at full occupancy: 120m^3/day.

The **waste water** treatment plant is using Sequencing Batch Reactors, which enables **100%** of black and grey waters to be **recycled and reused** for gardening purposes. No chemical usage, a pure natural process.

6. Fire Fighting and AC

The **fire fighting** system is connected to **500m³** of water storage. It operates through a **centralized** heat and smoke detectors system and 23 hydrant boxes.

The **AC load** was **reduced by 40%** by working on the architectural design, by using lightweight concrete instead of conventional CMU for the walls, and by using inverter units.

It can be further reduced by **controlling** the minimum **temperature** in each room.

Month (full occupancy)	HVAC load in kWh
January	61,679
February	56,580
March	62,630
April	59,593
May	58,157
June	43,935
July	40,301
August	41,070
September	46,133
October	57,723
November	63,196
December	68,548
TOTAL	**659,543**

7. Automation and Monitoring Systems

From power plant, energy usage and supply, to cold water supply, storage and waste water treatment plant, dedicated automation programs allow to manage and supervise each system remotely through dedicated controllers and software's.

In addition to key tag use for each room, a KNX automation and monitoring system, operated from the hotel reception, will unable to remotely control equipment used in each room and switch off AC if the room if doors or windows are not properly closed.

This completes the loop of **energy efficiency**, as most potential operational problem can be instantaneously detected and addressed.

This project design does not only comply or exceed **quality and safety international standards**, but it proves that **sustainable off-grid solutions** for all energies are not only cost-effective, but of much **higher value-added** than conventional solutions.

Please contact us via: **www.sustainable-energy-consulting.com**