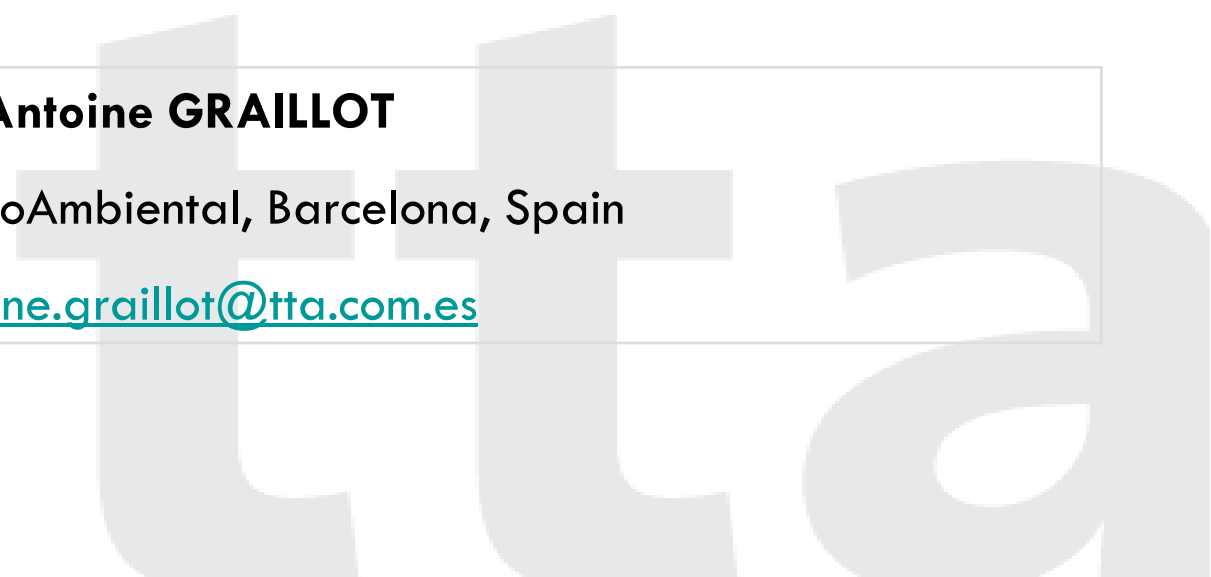# RURAL MICRO-GRIDS: EDA APPROACH FOR SUSTAINABLE BUSINESS MODELS
-TARIFFS, INVOICING AND MANAGEMENT-

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OVERVIEW OF THE FIRM - TTA

- SME Founded in Barcelona en 1986

- Independent International Engineering Consultants highly specialized in Renewable Energy (RE) distributed generation

- Reference in Micro-grids with Solar Hybrid Generation(MSG) - Since 1987: Off-grid rural electrification practitioners

- Consolidated experience in each and every phase of a rural electrification project cycle - including: Turn-key / O&M / Transversal Issues: institutional, social, regulatory

- Europe, Africa, Latin America, Middle East, Asia, Oceania ...

Member of:

Alliance for Rural Electrification
Shining a Light for Progress

solartys
Asociación Española para la Internacionalización y la Innovación de las Empresas Solares

UNEF
Unión Española Fotovoltaica

PIONEER EXPERIENCE IN RURAL MICRO-GRIDS (MSG)

Akane (Morocco)

Isla Floreana (Ecuador)

Santo Antâo (Cape Verde)

Chad

Burundi

Cal Peraire (Spain)

Ghana

2015

2014

2013

2012

2009

2007

2006

2005

2002

1997

1994

Las Balsas (Ecuador)

Escuain (Spain)

Atouf (Palestine)

1987: Beginning
Country house electrification (Spain)

La Rambla del Agua (Spain)

Diakha Madina (Senegal)

Beni Said (Morocco)

Font:TTA

PROJECT CYCLE OF A MICRO-GRID

PROJECT CYCLE OF A RURAL MICRO-GRID – MSG

1. Project identification

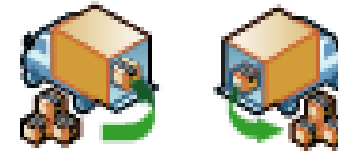2. Need assessment and data gathering

3. Business model and tariff definition

4. Techno-economic analysis

5. Engineering
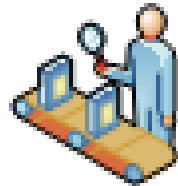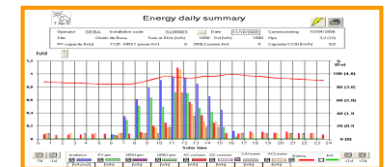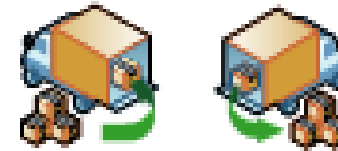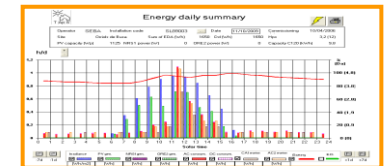
6. Procurement

7. Installation

8. Commissioning

9. Capacity building

10. Operation

BUSINESS MODELS FOR RURAL ELECTRIFICATION

Local model (community based)	• Government ownership and Operator is the community itself
Private model	• Private entrepreneurs are encouraged by grant mechanisms or long term concessions
Utility Model	• Diversified electrical distribution companies
Mixed model	• Shared ownership between public company & private investors

THE FINANCIAL CHALLENGE

> Uncertain revenues

> O&M concerns

> Local acceptance

> Complex issue: willingness to pay vs national tariff

> Economies of scale

Economic objectives

Cover capital costs   (?)

Cover O&M costs   ✓

Generate profit   ✓

THE METHOD

✓ **Assessment**

> Energy demand
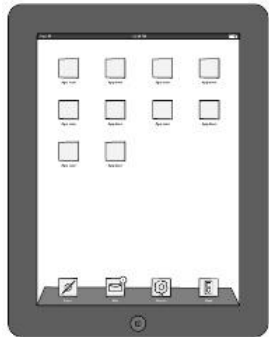> Business model definition
> Ability & willingness to pay

✓ **Site specific tariff setting**
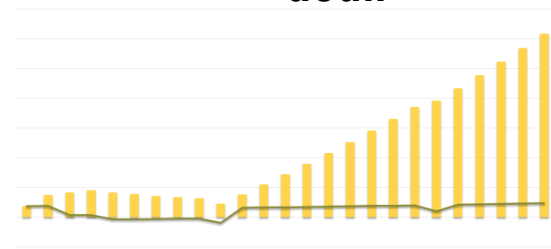
✓ **Capacity building**

TTA's SOLUTION

Vending system

+

Electricity metering

+

Energy and Financial audit

Client's management and financial statements

METERING AND INVOICING

Technological development enabling New Business Models

Energy demand control
- **EDA concept (Energy Daily Allowance)**
- **Increasing block tariff structure**

Different features:
- **Net metering**
- **Quality of service**
- **Different tariffs for community uses**

Time-of-use tariff
- **Pre-defined schedule**
- **Real time price signal**

Tariff structures:
- **Energy-based**
- **Power-based**
- **Binomial (energy & power)**
- **Service based (subscription)**

Electricity Dispenser

Flexible tariffs – can include:
- **Net metering charges**
- **Micro financing**
- **Other costs**

User-friendly interface:
- **Simple screen**
- **LED lights**
- **Load shedding**

INNOVATIVE CONCEPT: TTA's Energy Daily Allowance (EDA)

- Traditionally in conventional grid connection: users pay for consumed kWh

- In autonomous electrification with RE: Key aspect is the constrain on available energy

- In RE electricity, user should pay for availability not for the consumed energy

- Tariff based on the **Energy Daily Allowance** (fee for service ≠ prepayment)

- Clearer and easier financial planning for operator and for client

- It reduces transaction costs because of flat fees

THE EDA ALGORITHM

Units

Service fee

EDA
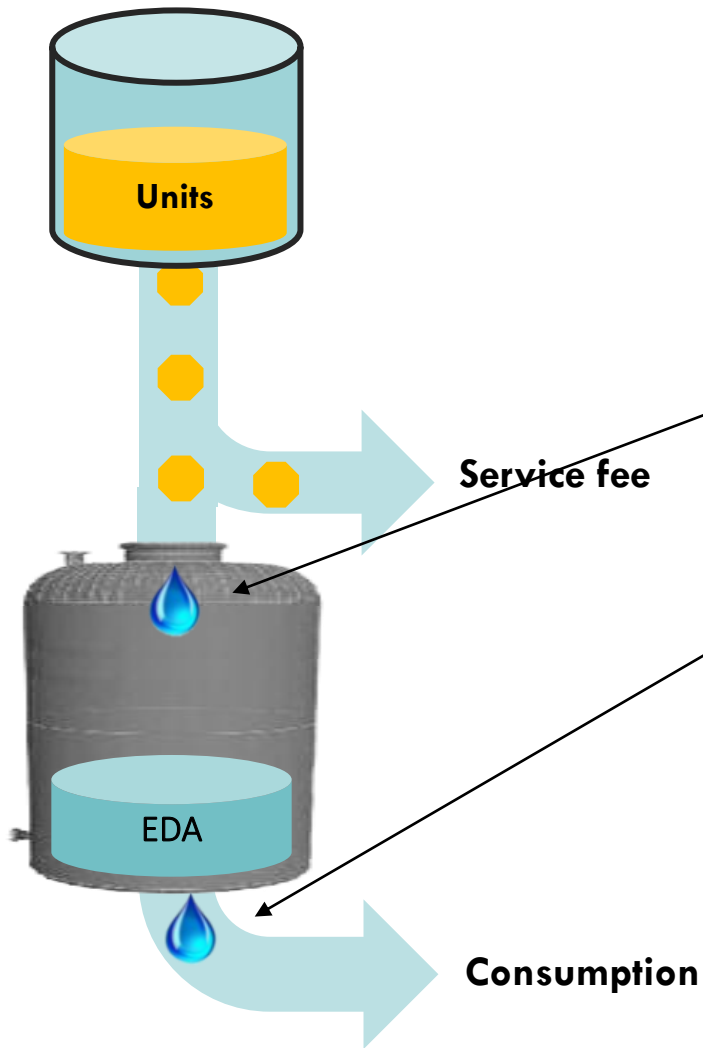
Consumption

Water tank simile

The tank gets a constant trickle inflow from the micro-grid proportional to the contracted energy daily allowance
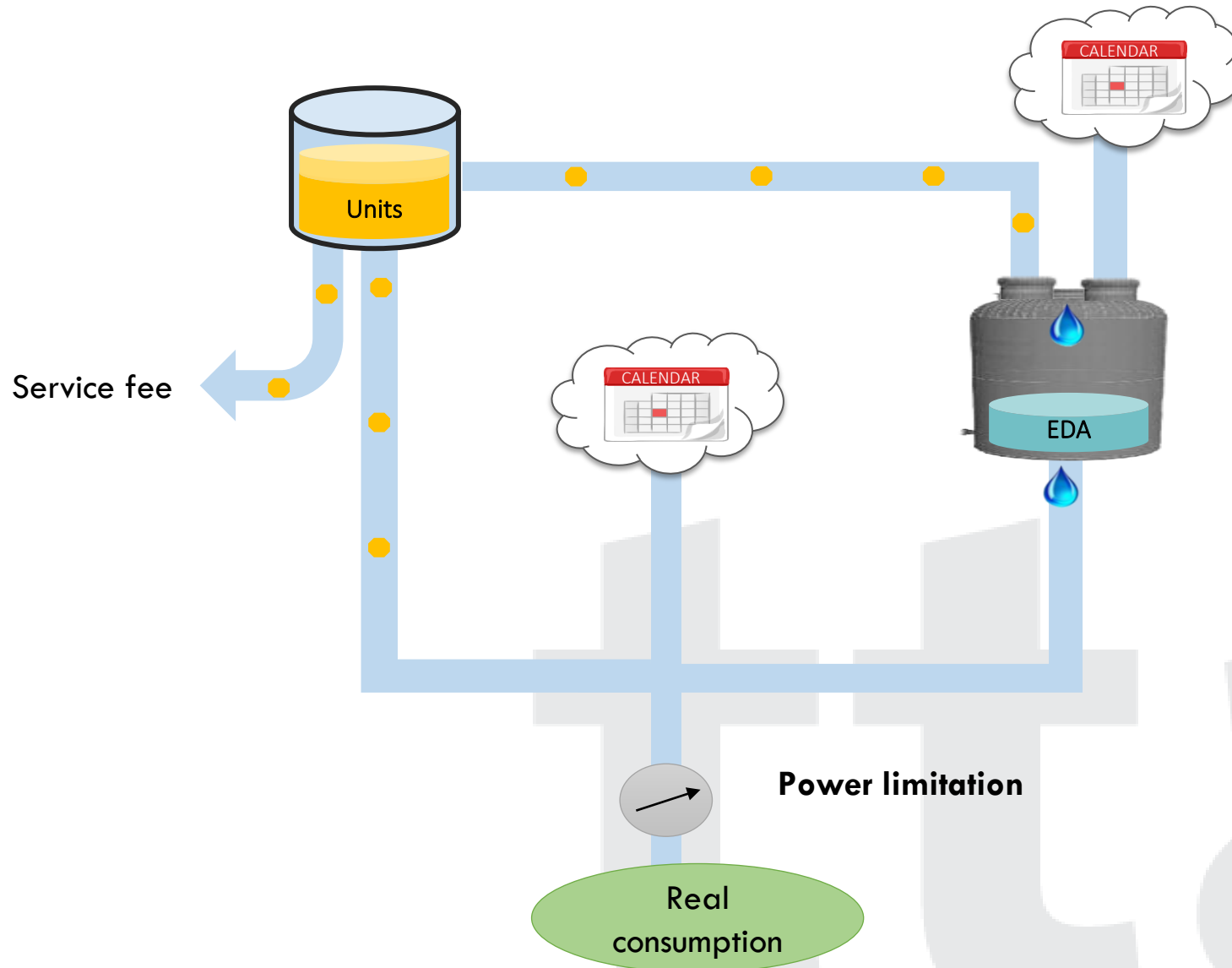
The tank empties as energy is consumed

When the consumption is equal to the fill up rate we are in balanced consumption

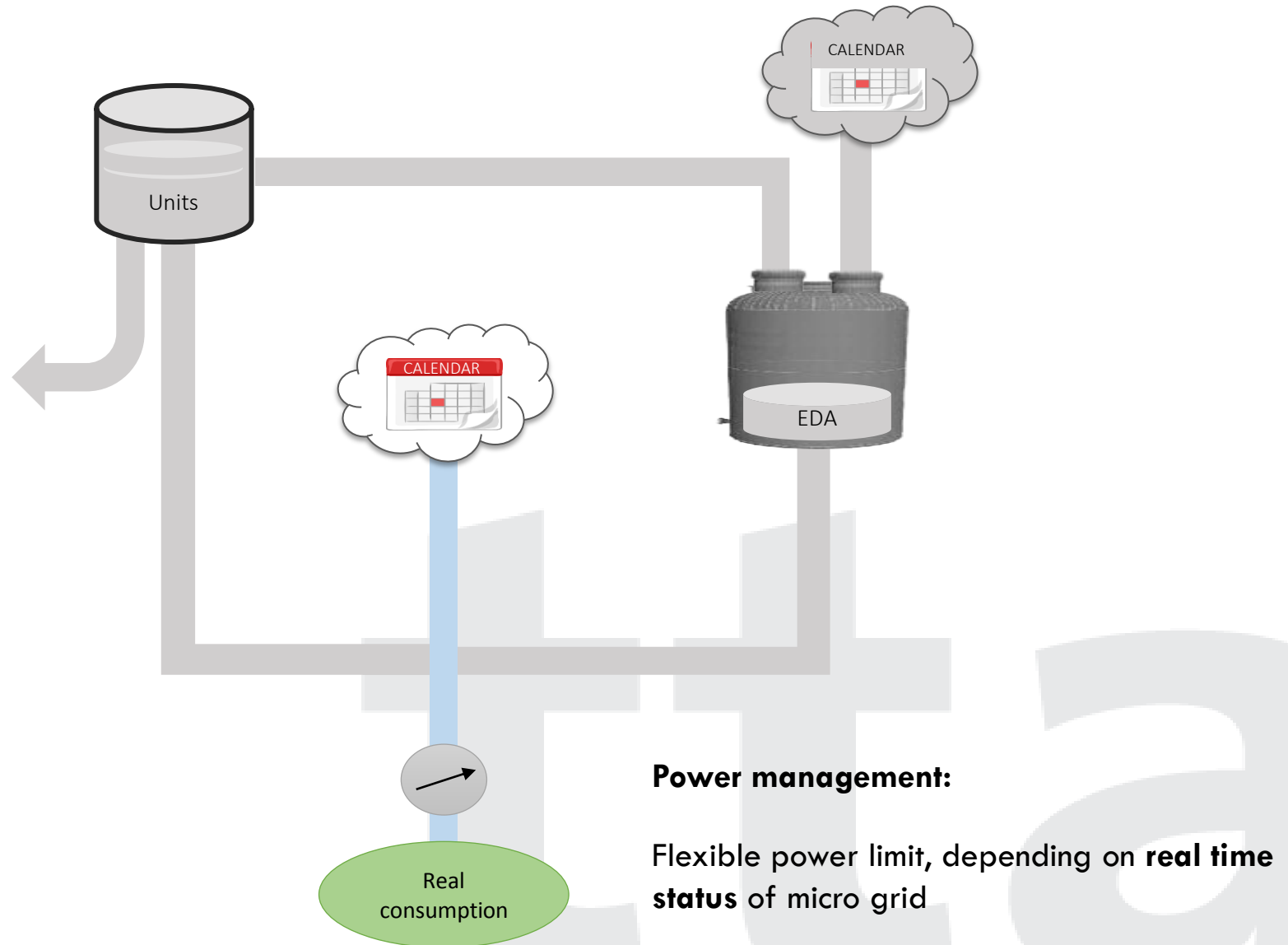You can use this energy anytime but you cannot store more units than the tank's capacity
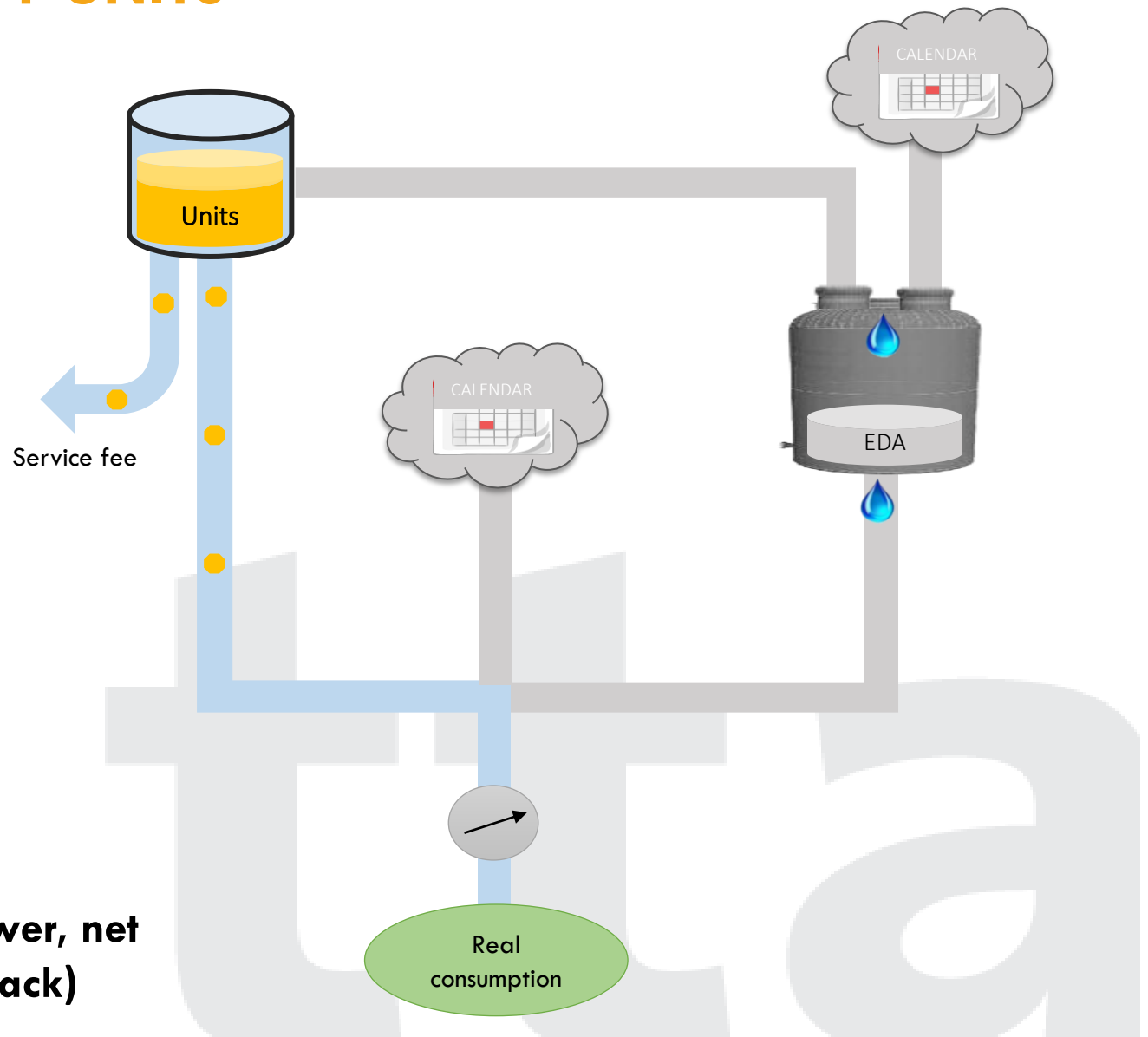
TARIFF STRUCTURES

TARIFF FOR HYDROELECTRIC, (BIO)DIESEL MICRO-GRIDS FLAT RATE

Power management:

Flexible power limit, depending on **real time status** of micro grid

TARIFF FOR LARGER HYBRID RURAL GRIDS PURCHASE OF ENERGY UNITS
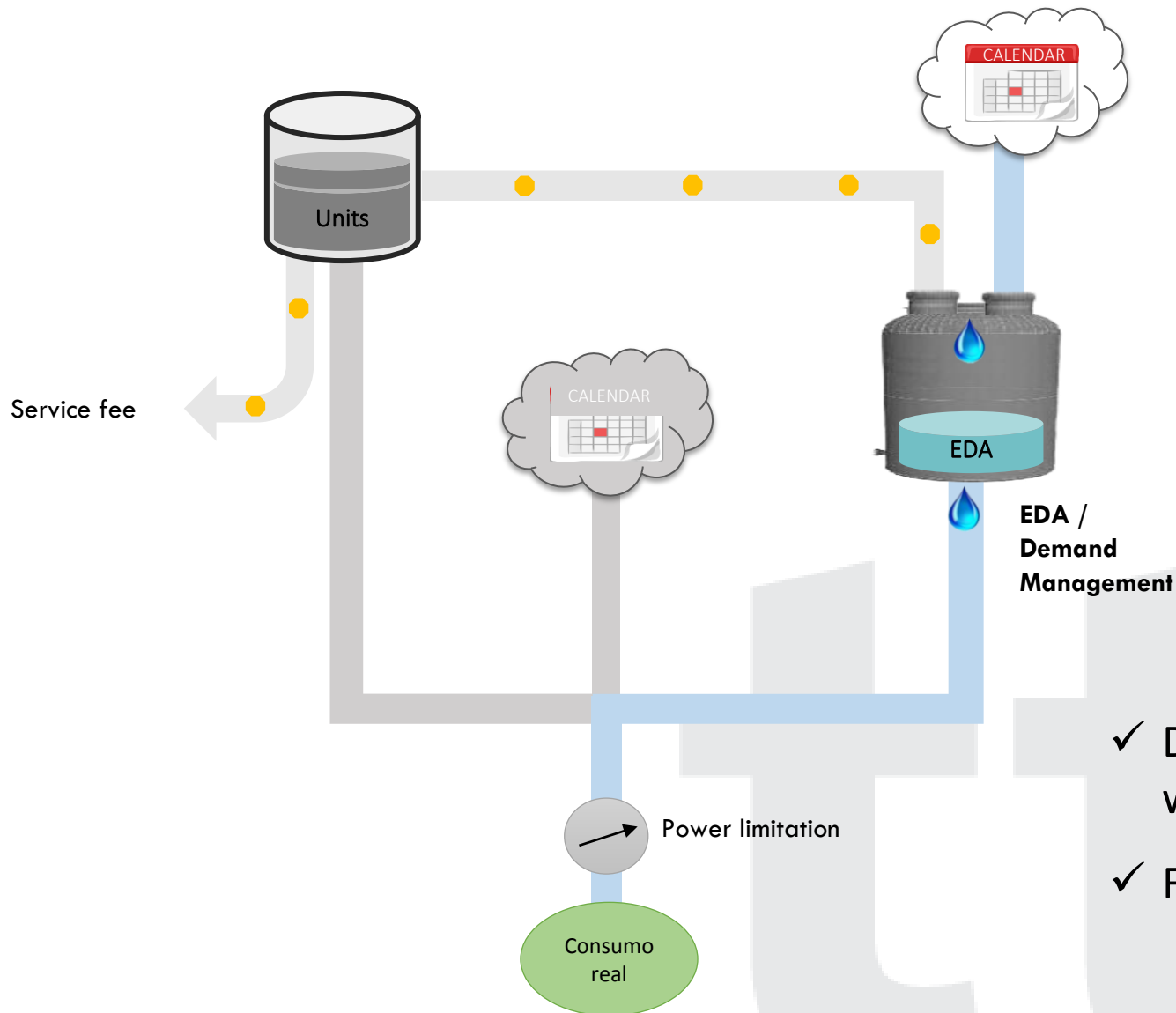

Tariff structure derived from:

✓ **Energy consumption**

and/or

✓ **Service fee (contracted power, net metering, microloan pay back)**

TARIFF FOR SOLAR, WIND HYBRID MICRO-GRIDS
PURCHASE OF UNITS WITH EDA

Units

CALENDAR

Service fee

CALENDAR

EDA

EDA / Demand Management

Gestión de potencia

Real consumption

✓ Demand side management with **EDA** concept

✓ Fixed fee per month or consumption based tariff setting

TARIFF FOR SOLAR, WIND HYBRID MICRO-GRIDS
FLAT RATE WITH EDA

Units

CALENDAR

Service fee

CALENDAR

EDA

EDA / Demand Management

Power limitation

Consumo real

✓ Demand side management with **EDA** concept

✓ Fixed fee per month

The universal Dispenser is capable to handle:

- **Net metering**

- **Quality of service:** Different duration 24/24, 11/24, etc. and interrumptibility [%] priority to various groups of customers (social tariff, premium tariff,…).

- **Community dispensers**

STATUS OF MICROGRID ON PRICE FACTOR AND POWER LIMIT
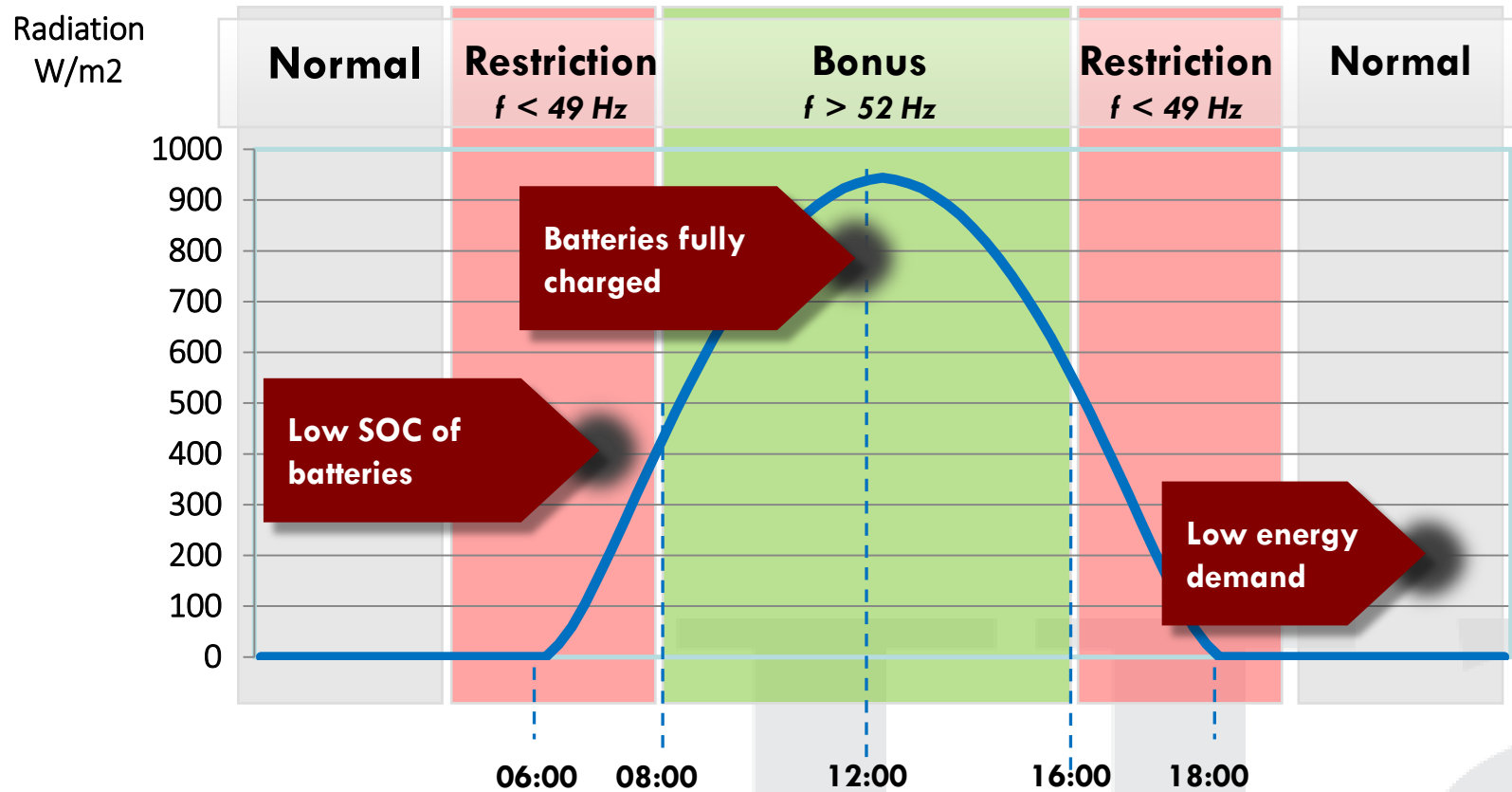
Influences:

- Price of energy
- Price of contracted power
- Limit of contracted power
- Status of auxiliary relay (on or off)

Frequency mode: the Dispenser detects the variance of the microgrid's frequency, e.g. related to the state of the batteries.

Communication mode: the Dispenser receives information communicating the status via its RS485 port

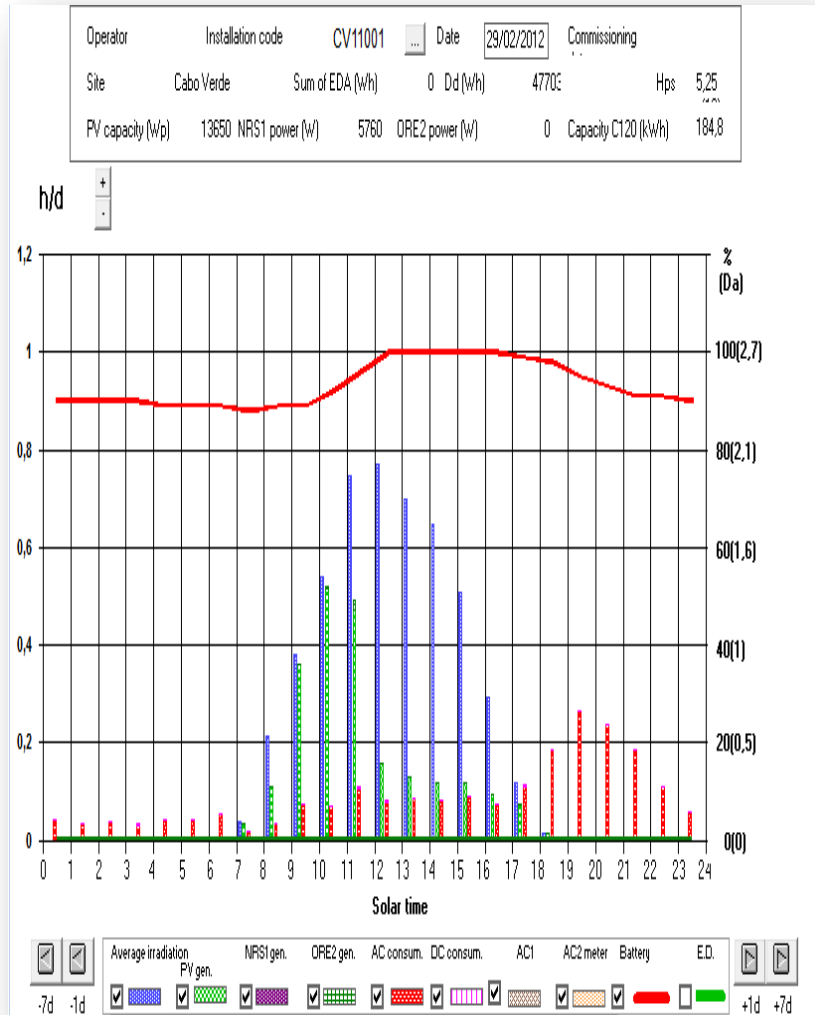**Time-Of-Use:** the operator distributes the factors in a predefined table
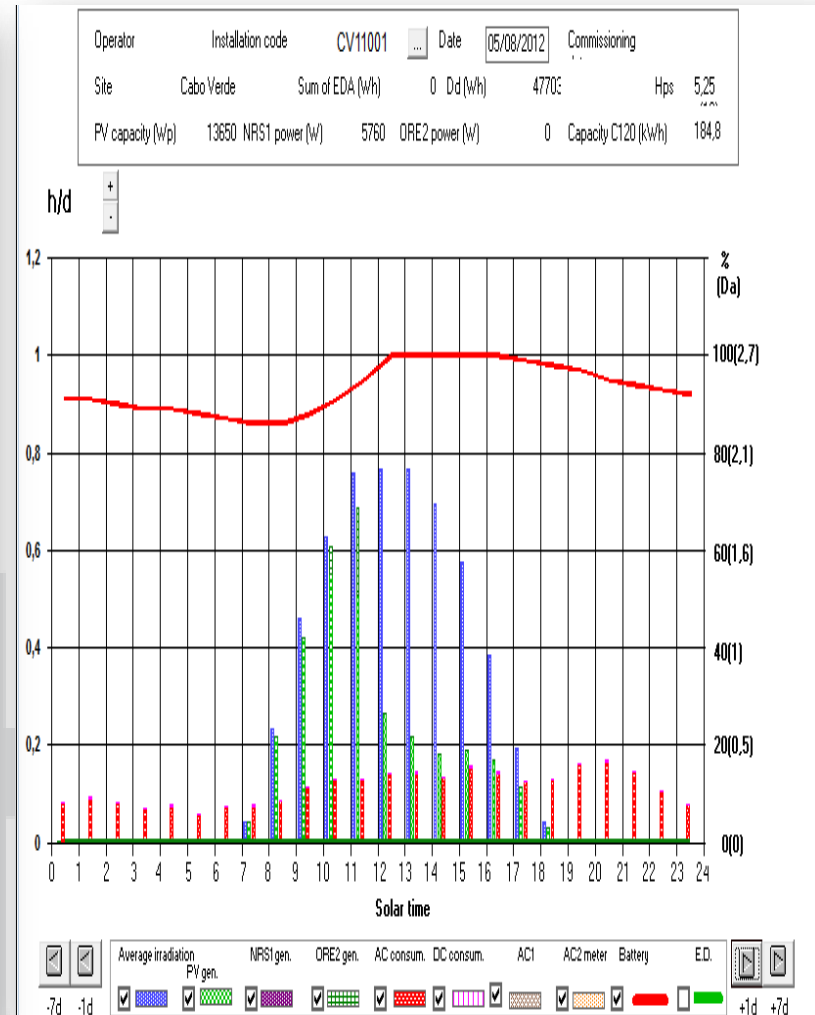
EXAMPLE: FREQUENCY MODE

EXAMPLE: EDA SERVICE TARIFFS IN A VILLAGE IN CHAD

Tariffs			
Code (Txy)	Monthly cost (CFA)	EDA (Wh/day)	Maximum power (kW)
T11	4.100	550	0,5
T21	11.200	1.100	0,5
T41	22.000	2.200	0,5
T72	38.600	3.850	1,0
T82	43.900	4.400	1,0

EFFECTS OF DISPENSER'S SIGNAL ON CONSUMER HABITS (CAPE VERDE)

February 2012

August 2012

RECOMMENDATIONS

1. Tariffs and business models should be designed in an early stage of the project

2. Optimum tariff design is a key for user acceptance and long viability of project

3. Monitor closely the fulfillment of commercial objectives

4. Monitor closely operating expenses and maintenance…

5. Review the tariff after two years of operation

6. Correct accordingly (if required)

THANK YOU FOR YOUR ATTENTION!

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