Advantages and Challenges of Renewable Energy in Health Facilities

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Trama TecnoAmbiental (TTA)




- SME Founded in Barcelona en 1986
- Independent consultants in distributed renewable energy
- Consultancy, engineering, research, project management, social aspects, financial, …
- Since 1987: RE based electrification and energy practitioners
- Design and project management of RE projects for rural electrification infrastructure
- Southern Europe, Africa, Latin America, Oceania …
- Public, private and multilateral clients

Alliance for Rural Electrification · ALER · ISES International Solar Energy Society · AENOR · SEIAPI Sustainable Energy · UNEF · SMARTGRIDS

International Energy Agency Photovoltaic Power Systems Programme · PhotoVoltaic European Technology & Innovation Platform · Universitat de Barcelona · IL3 Institute for LifeLong Learning Universitat de Barcelona · Acceso Universal a la Energía · Mesa del Acceso Universal a la Energía · solartys · POWER FOR ALL · IEC

Renewable Energy and Healthcare

Why renewable energy in Healthcare?

Identified needs – from clinics to hospitals:

Need	Building	Heat	Electricity
Comfort	x	x	x
Water		x	x
Cold storage			x
Medical equipment			x
Lighting			x
Communications			x
Others .. (ie:cooking, transport,etc			

Objectives:

- Access: enable basic services
- More autonomy or resilience
- Reduction of operating expenses
- Supply critical loads

COMFORT – Adequate building design and materials

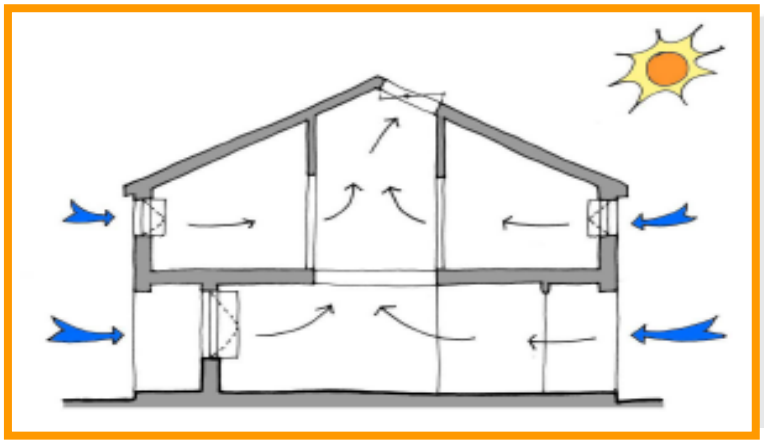
Climatic design

- Control of solar gains and shading
- Natural ventilation and illumination
- Thermal insulation
- Materials

Result:

Demand reduction

Rural Hospital in Angola - TTA



WATER – Water pumping and treatment

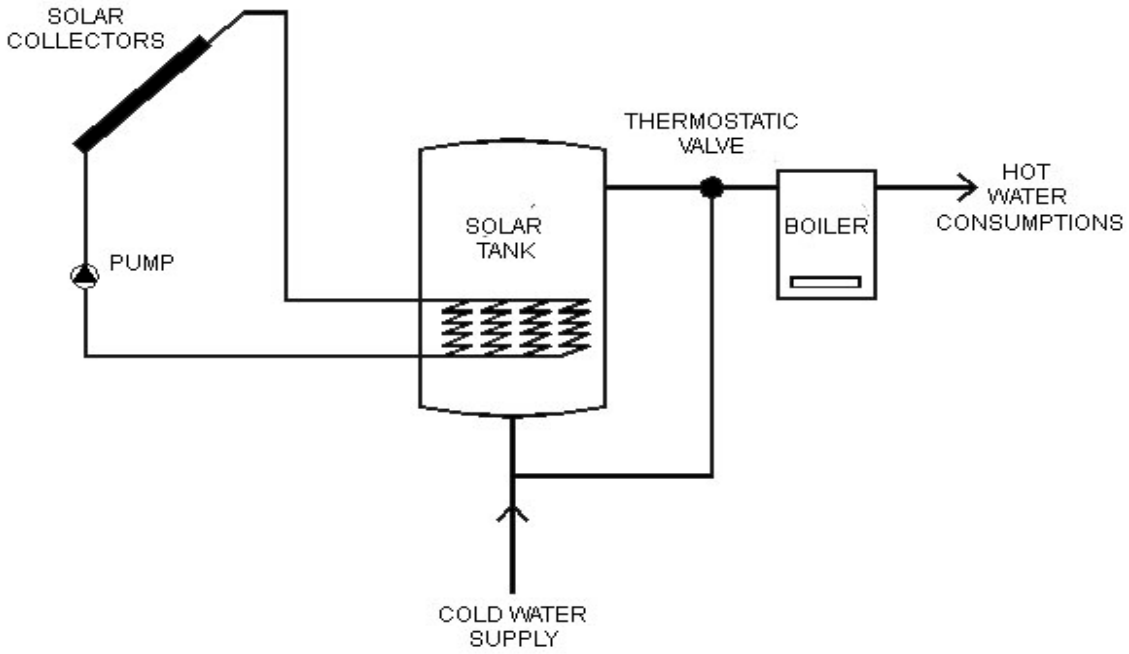
WATER – solar water heating (UNDP-CEDRO Lebanon)

Why solar energy to heat water in hospitals with grid black-outs?

- Typically, the energy needed to produce hot water is around 25% of the total energy consumption.
- Example: In a 40 bed hospital, 50 l/bed-day hot water, 35 m^2 of solar collectors cover around 75% of the needs
- Gensets means more noise, pollution and increases the dependency on external supplies.
- The solar resource is abundant.

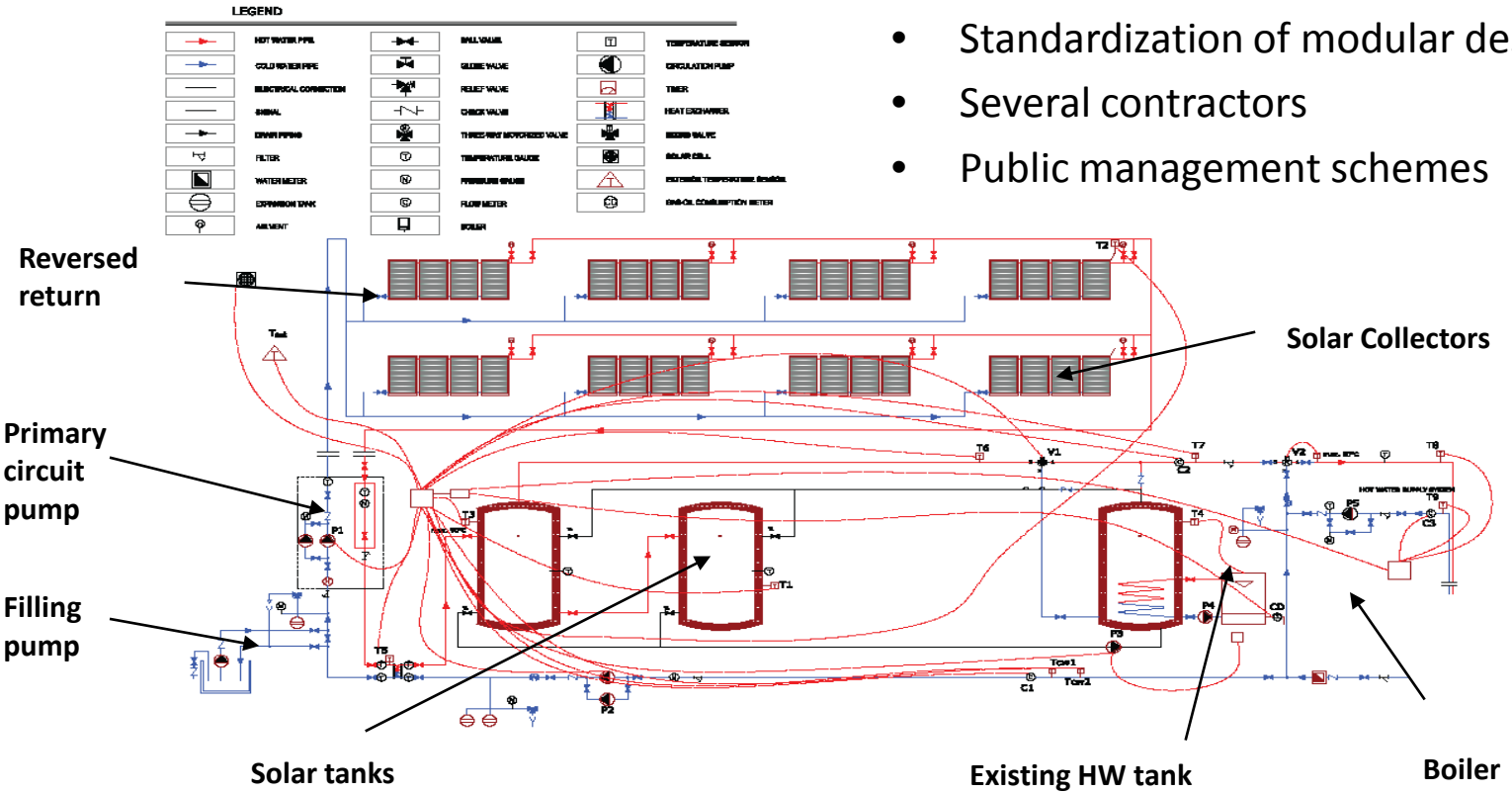
WATER – solar water heating main components

- Flat Solar collectors
- Primary circuit
- Hot water tank
- Heat exchanger
- Back-up generator (boiler)



SOLAR WATER HEATING – field experience UNDP-CEDRO

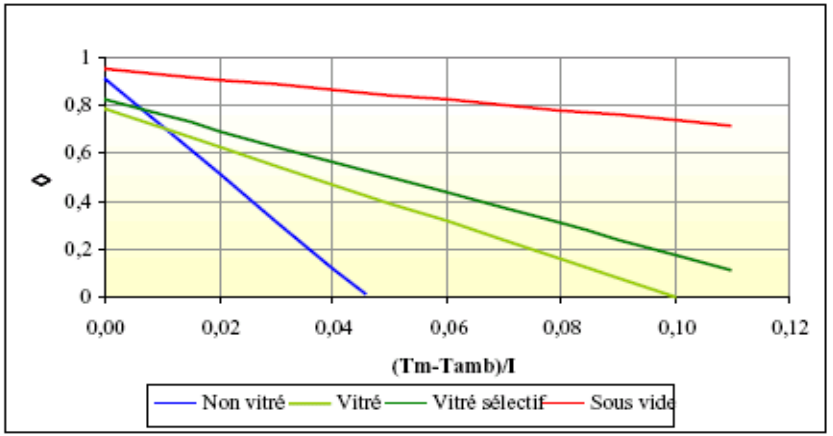
- 9 public hospitals
- Retrofit Solar Water heaters
- Standardization of modular designs
- Several contractors
- Public management schemes

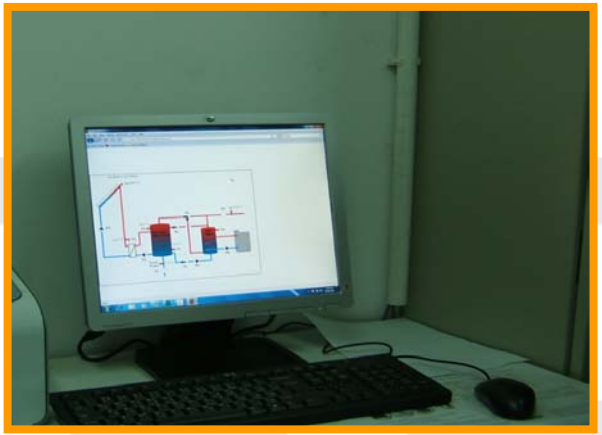


SOLAR WATER HEATING – field experience UNDP-CEDRO

Design principles

- Collector efficiency vs area
- Stagnation (power cuts)
- Monitoring
- Redundancy
- Anti-legionella





Public hospitals in Lebanon - TTA

ELECTRICITY – Medical equipment

Electricity for

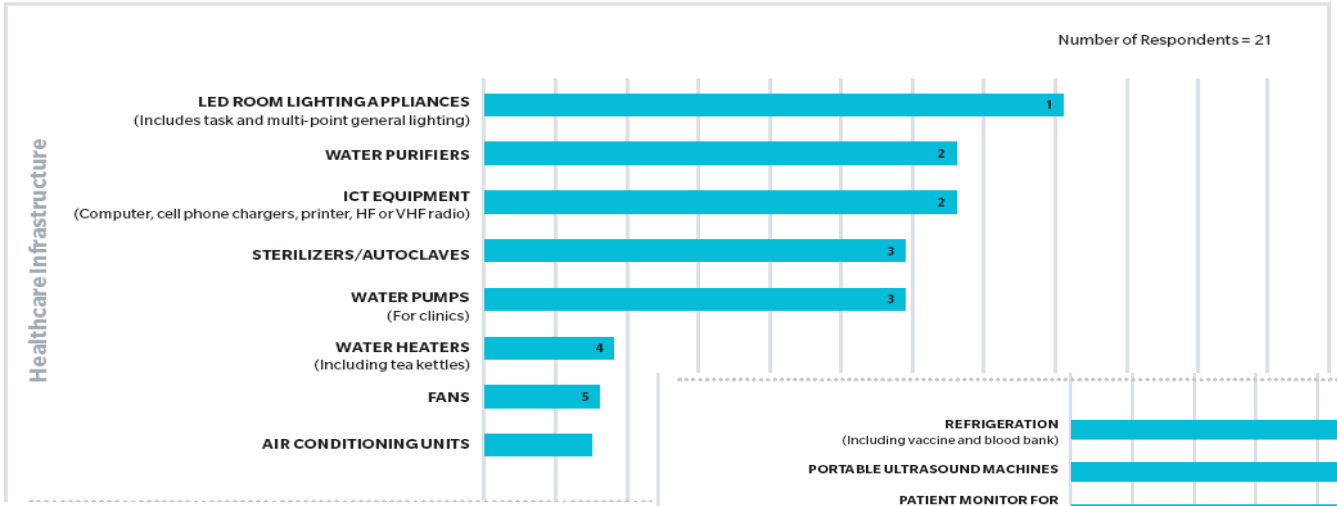
- Cold chain
- Instrumentation
- Sterilization
- Lighting
- Staff housing

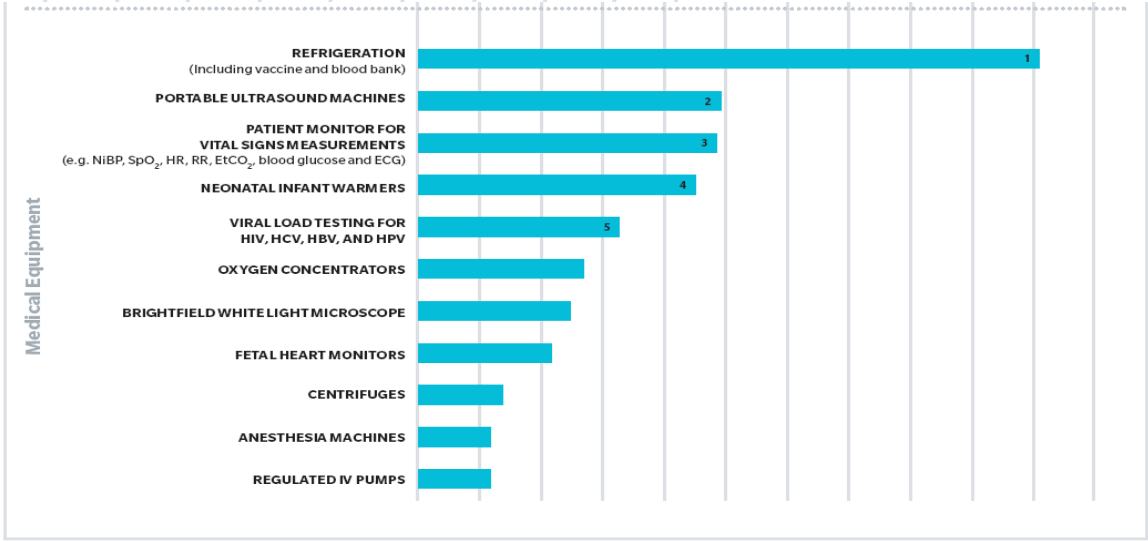
Note: Equipment with High requirements in the quality of their power supply.

ELECTRICITY – Medical equipment

Hôpital Bon Samaritain , N'Dajamena, Chad - TTA

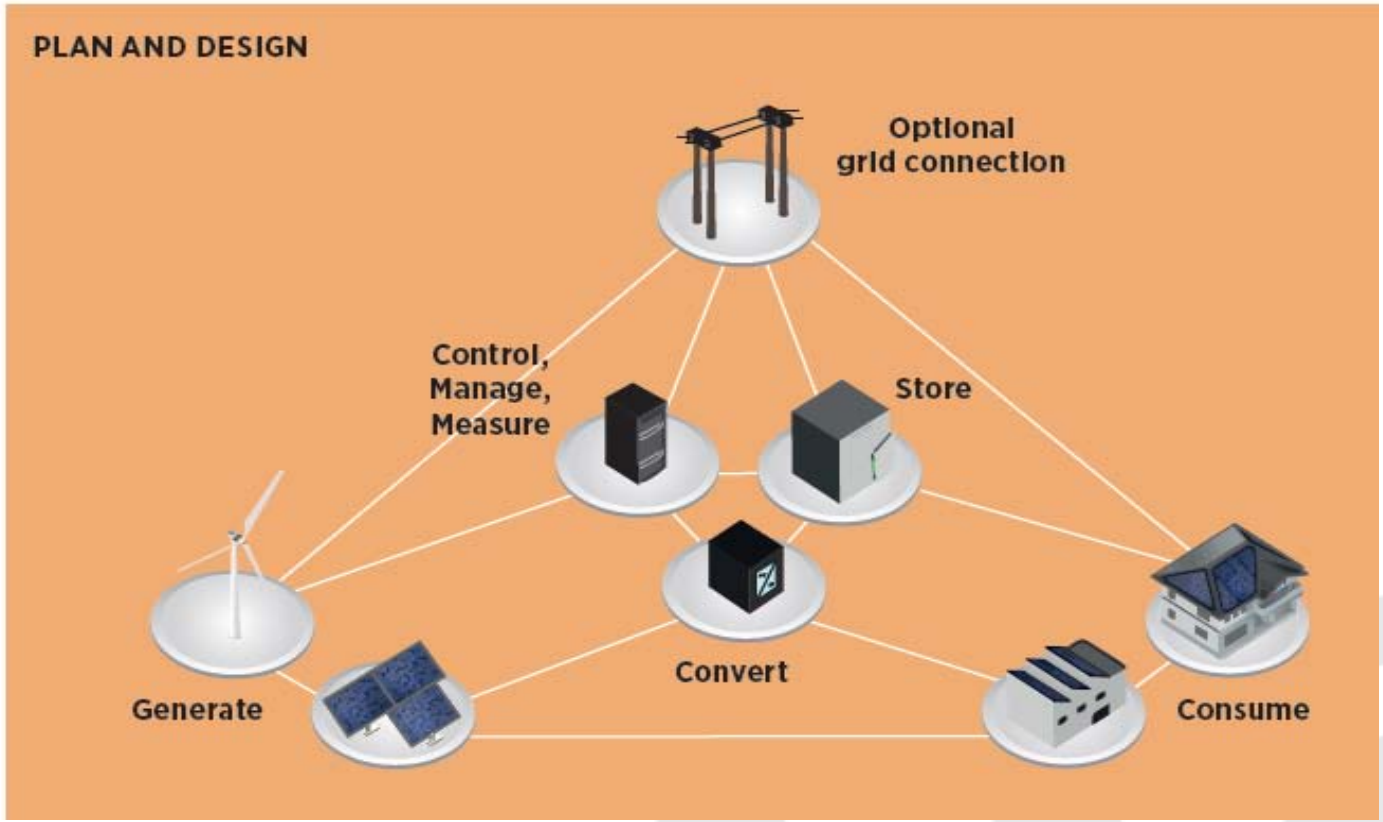
DEMAND RANKINGS of healthcare infrastructure & Medical equipment





ENERGY FOR ACCESS COALITION, 2018
Off-grid appliance market survey

RE ELECTRICITY - Technology & functionalities



http://www.irena.org/DocumentDownloads/Publications/IRENA_Innovation_Outlook_Minigrids_2016.pdf

Technology aspects

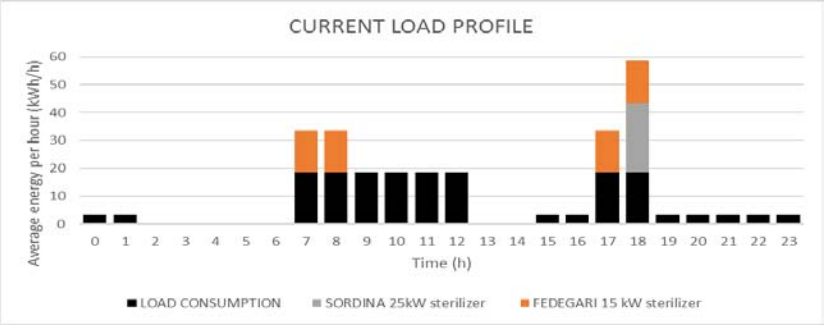
Supply Categories

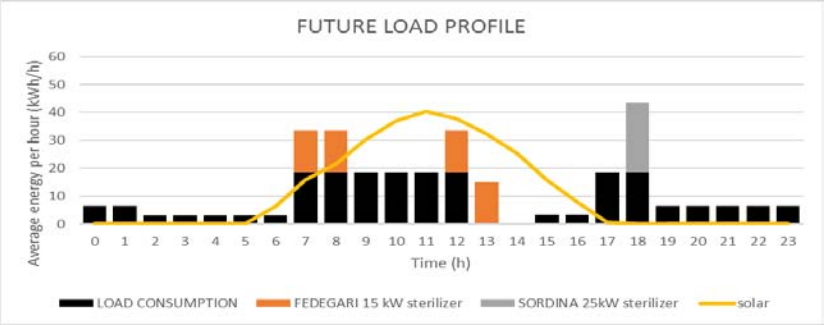
- On-grid
- Off-grid/Autonomous
- Grid-connected with blackouts

Demand assessment

- Priority circuits: high, medium, low
- High-consumption loads: autoclave, iron, centrifuge, washing machines
- Daytime demand, coincides with PV production
- Load characterisation: priority, base, deferrable, interruptible…

TTA case study: Goundi hospital (Chad)

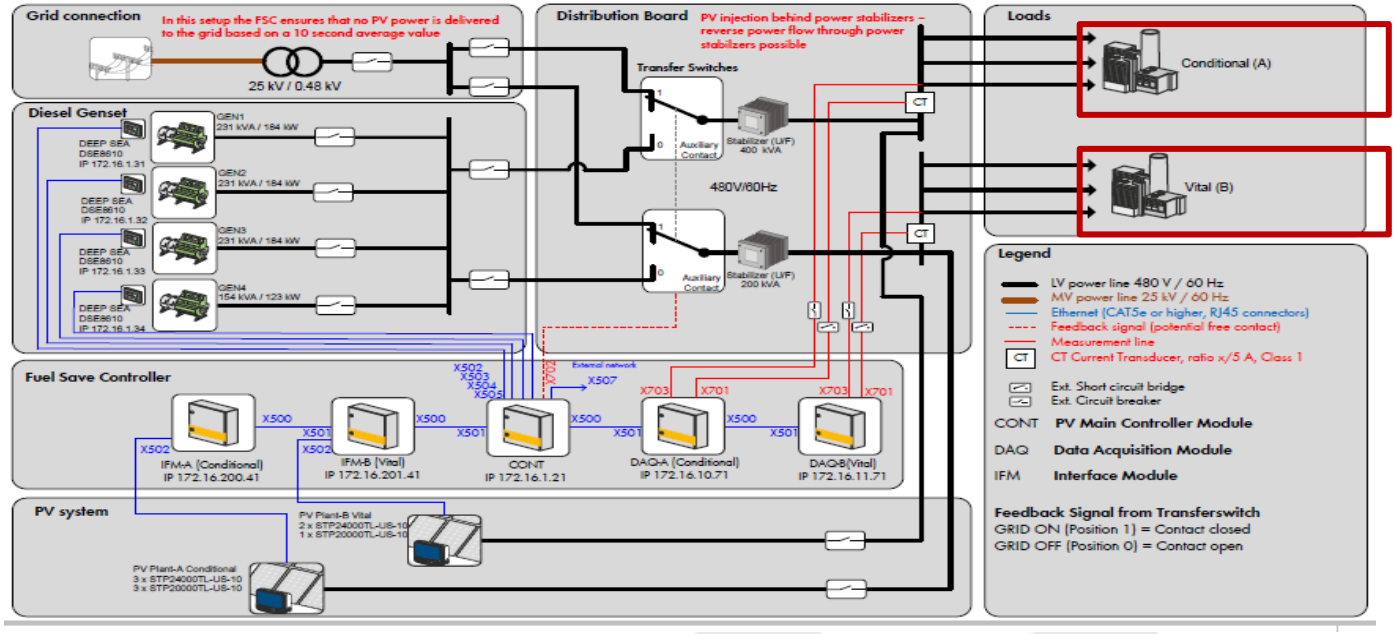




Example: Grid-connected hospital in Haiti with blackouts

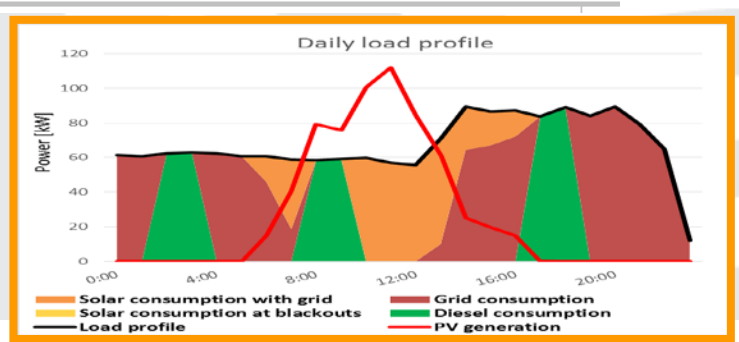
- Objective: **Increase resilience and save fuel from backup generators**
- PV Capacity: 228 kWp / 200 kVA
- 4 gensets: 3x184 kVA + 1x112 kVA
- Solar Water Heating

Example: Grid-connected hospital in Haiti with blackouts



Simulation results:

6h blackout: **23%** solar fraction



Example: Off-grid clinics in Ghana (URC – USAid)

- Objective: **Enable basic services in remote areas**
- Capacity: 3 kWp / 4 kVA
- 100% solar
- End-users: clinic and 2 houses for staff
- Priority loads (clinics) and non-priority loads (houses) with automatic demand-side management

Clinic and houses - TTA

Energy room - TTA

Management model

	Actor	Example
1	Financier	International donor, Government, NGOs
2	Beneficiary	Staff, Communities
3	Owner	Ministry, NGO, Private
4	O&M	Hospital staff, Private operator, Ministry, …

Challenges:

- Different objectives among key actors
- Coordination among stakeholders
- Lack of technical capacity for O&M
- Unclear O&M responsibilities
- Financial sustainability

Management model

Challenges:

- **Different objectives among key actors.** Sometimes all actors align on the willingness to install solar PV but the final objective of the project is not clear. Examples of possible objectives which result in different design approaches:
  - *Environmental*. Minimization of CO_2 emissions
  - *Economic*. Minimization of fuel demand (from gensets) and its associated expenses.
  - *Reliability*. Secure the supply of 24x7 for some limited essential loads (e.g: surgery room or vaccine refrigerator).

Management model

Challenges:

- **Coordination among stakeholders.** Potential challenges:
  - *Different Ministries in charge*. Ministry of Health in charge of hospital operations, and Ministry of Energy leading the coordination of donors to deploy renewable energy: are they aligned?
  - *Donors timing*. Sometimes donors offer funds subject to strict time constraints. Need to avoid missing methodological steps like to design and build a solar PV plant without previous detailed assessment of the existing facilities. This can results in "surprises" during construction, or over sized solar plant to supply inefficient demand (first energy efficiency, then renewable energies).
- **Lack of technical capacity for O&M.** Health facilities are experts in health, not in energy. A critical aspect is the decision in-house VS externalized O&M. If the O&M is to be conducted in house, high emphasis in capacity building and training is needed.
- **Unclear O&M responsibilities**. Sometimes hospital might have external company to service back-up generators. Will this same company be in charge of the operations of the solar PV plant? Is it capable? If not, how to handle the boundary between the solar operator and the genset operator?

Management model

Challenges:

- **Financial sustainability**. Related to the O&M point. Usually the O&M financial needs are not quantified and secured prior to project implementation. This issue is intensified by the fact that donors tend to finance initial investment but not the O&M.

***Example**: The clinic has been selected by the Ministry to get a solar PV plant. Upon inspection it is observed that there is a solar hot water system not operational due to lack of funds to repair.*

How can this be avoided?

THANK YOU!

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