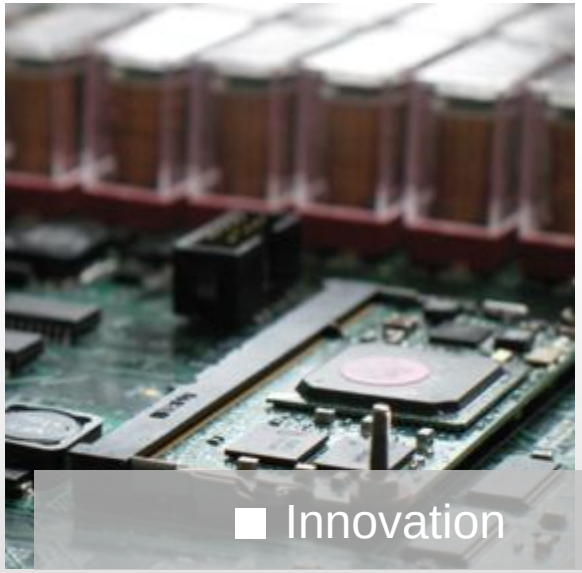
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Power for the 21st Century







Green Power for Mobile - Solutions for the 21st Century

Dieter Klein, General Manager, Heliocentris Industry GmbH

Jakarta, 25-26 September 2013

Agenda

I. Company Introduction

II. Quality through Industry Co-operation & Innovation

III. Site Management & Managed Power Solutions

IV. Customer defined Business Models

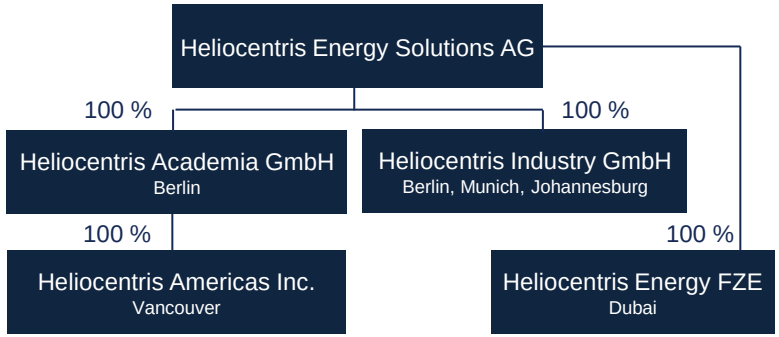
V. Implementation References + Lessons learned

Company introduction

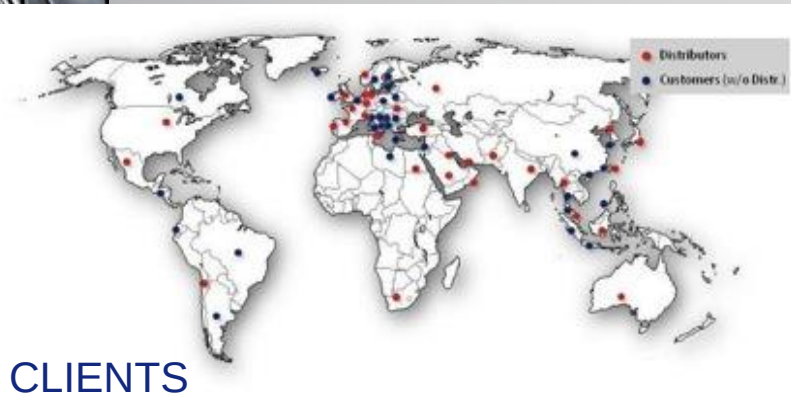
OVERVIEW	
Foundation	1995
Acquisition of P21	2011
Business	Energy Management Systems Managed Power Solutions Training & Research
Markets	> 70 countries Export ratio 60-80%
Locations	Berlin, Munich, Vancouver, Dubai, Johannesburg
Group HQ	Berlin
Main shareholders	Bmp AG Conduit Ventures, UK NTEC, Kuwait (KIA) Ruffer European Fund, UK



GROUP STRUCTURE



CLIENTS



The Vision We All Share…

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TODAY



TOMORROW

Roadmap to Clean, Energy Efficient Solutions

From Genset Efficiency Solutions today to complete Zero Emission Solutions tomorrow

TOMORROW

Zero emission genset replacement

3

Zero Emission

Energy Manager, Battery, PV, Wind, Fuel Cell, Electrolyzer

Integration of renewable energy sources

2

Renewable Hybridization

Smaller Diesel Generator, Energy Manager, Battery, PV, Wind

TODAY

Genset Efficiency Solution

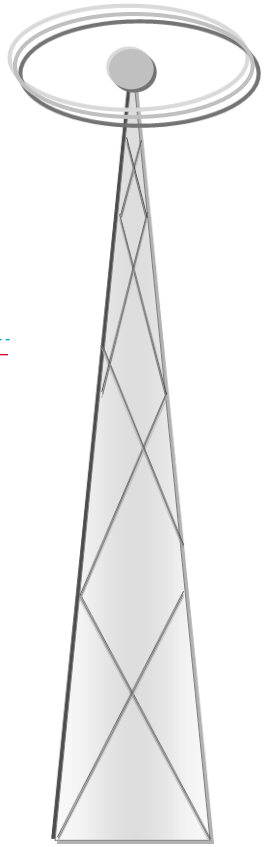
1

Battery Hybridization

Diesel Generator, Energy Manager, Battery

Conventional Setup

Diesel Generator



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Quality through Industry Co-operation & Innovation



Quality by Leveraging Internal and External Competences

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Quality- and Environmental Management

ISO9001 and ISO14001 Standard





Engineering Team

- System integration
- Qualification of Components
- System Engineering & Dimensioning
- Optimization of Energy Systems

Software Development Team

- Software-programming on Linux
- Web Applications in Java
- Software API development

Research Partners

Fraunhofer

REINER LEMOINE INSTITUT

ZSW

CHEMNITZ UNIVERSITY OF TECHNOLOGY

Innovation – Energy Storage and Battery Lifetime Mgmt

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Battery Management is one of our core competences

INNOVATION

SOH/SOC
Are interlinked, we measure both of them and operate the batteries for optimized battery life-time.

Battery lifetime control
Allows us to understand and design battery lifetime for different business cases to the point.

Bad Cell Detection
Automatic battery failure detection with automated recovery procedures.

Battery Care
Boost Charge, extended boost charge, equalization charge and further measures are customized to the battery manufacturer.

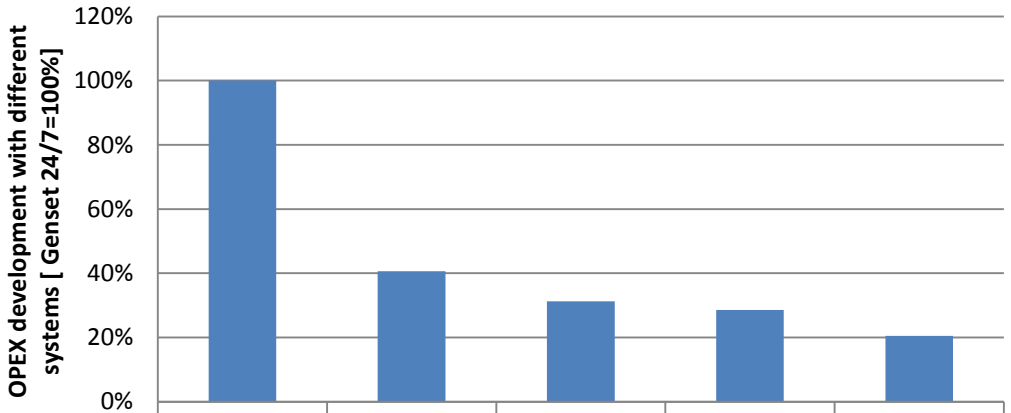
General Principles
Many battery manufacturer specific life extension requirements are already implemented in our Energy Manager algorithms and are extendable and adaptable as needed.



Continued Evaluation - Battery Technologies

OPEX for Lead Acid and Lithium-Ion Batteries

- GenSet overhaul: 5,000 $ every 15,000 running hours
- GenSet maintenance: 100 $ every 250 running hours
- Fuel Price: 1,10 $ / liter
- Data based on irradiation values of Ghana



Source: Heliocentris projections

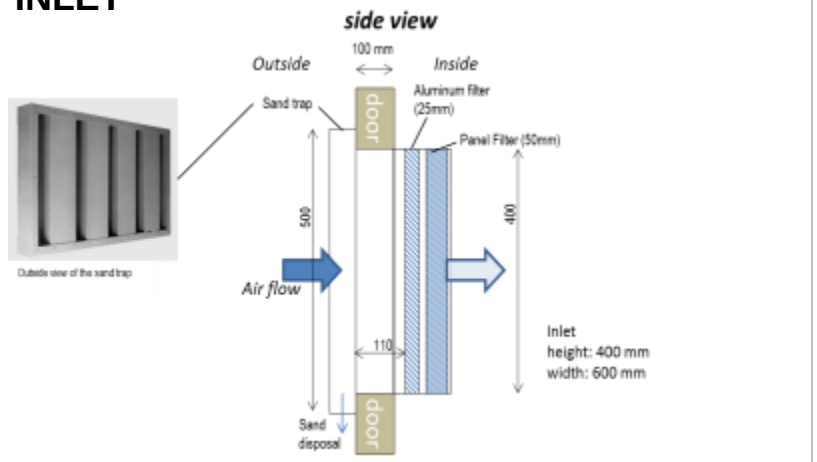
→ Li-Ion Systems are favorable for longer business cases (TCO 5y+) and special site conditions. The respective systems follow a comparable path, higher fuel costs as stated are promoting solar

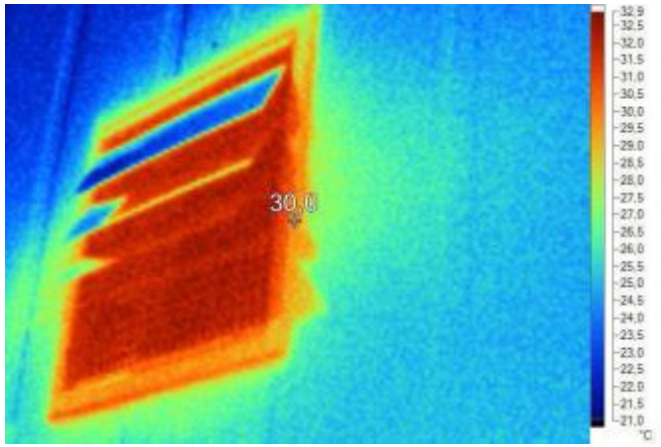
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Free Air Cooling – Opening up the Window for Savings

Development and qualification and qualified a proprietary FCU

- Starts at lowest temperature delta of all free cooling solutions
- Highest power up to 400 W/K per unit
- Low electricity consumption 110 W and highest COP





→ 10 % Fuel Savings p.a in the middle of MEA deserts

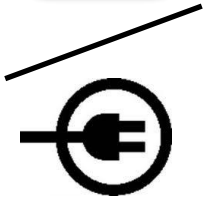
Hydrogen Solution – GenStore®



GenStore®

Power Generation
Primary Power





Power & Data Management



Energy Manager

Power Generation
Secondary Power

Hydrogen Generation

Energy Storage



Fuel Cell



Electrolyzer



Battery



Hydrogen



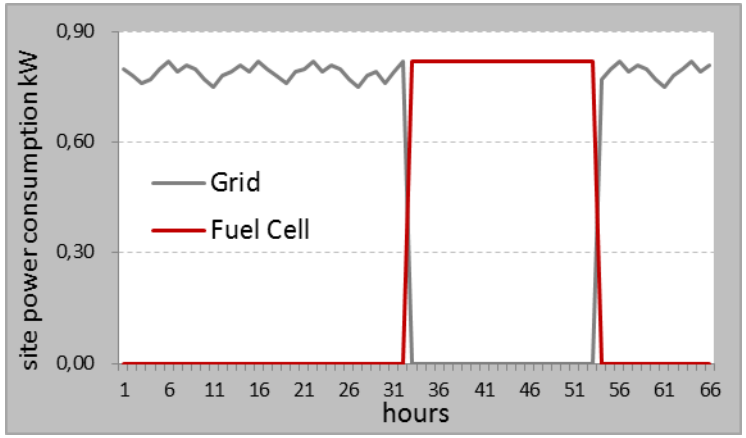
BTS

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2 markets – 1 solution

Unreliable grid

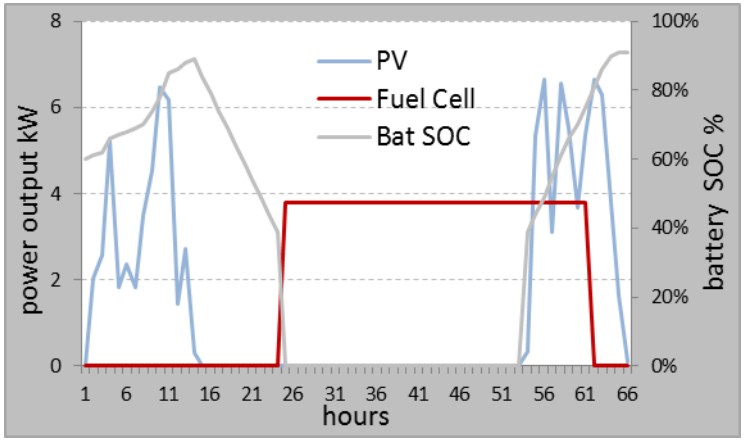
- Increasing Site availability



- GenStore® taking over energy supply after grid outages
- 12…72+ hours backup time
- Reduced onsite battery capacity
- Reduced LCC compared to diesel solutions

Renewable energy sites

- Optimizing renewable energy sites



- GenStore® providing energy supply when renewable energy source not available
- up to 72 hours
- Optimized energy storage with battery and H_2
- Optimized battery protection



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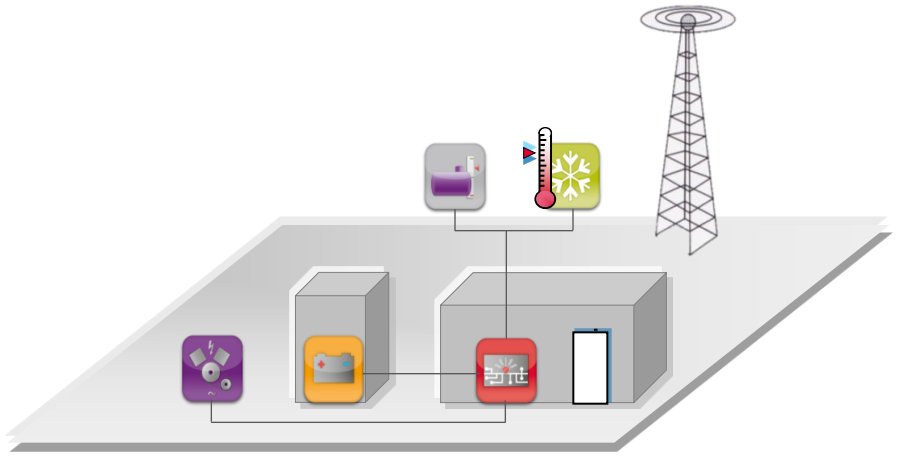
Site Management & Managed Power Solutions



Site & Power Management Overview

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- Battery
- Diesel Generator
- Energy Manager
- Fuel Management
- Cooling Management



1 **Site management** + 2 **Power management**

Reduced CAPEX & OPEX

Improved ROI

Integrated Energy Site Management System

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Architecture overview



NETWORK OPERATIONS CENTER

Monitoring / Operation (RMS)



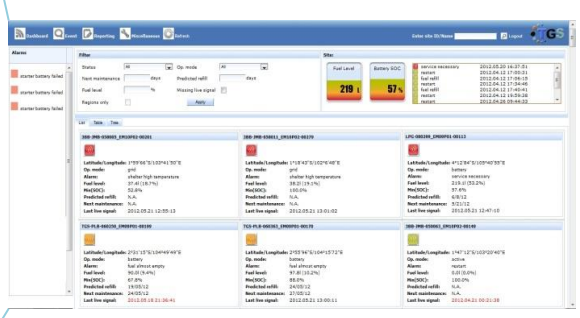
Remote Site Configuration







Management Server

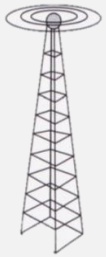


GPRS / 3G/ TCP-IP

SMS

Energy Manager







Site x

. . .



Site y



Battery



Genset



Fuel Tank



PV



Wind



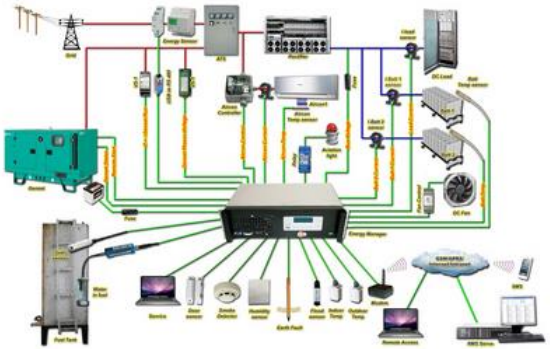
Cooling



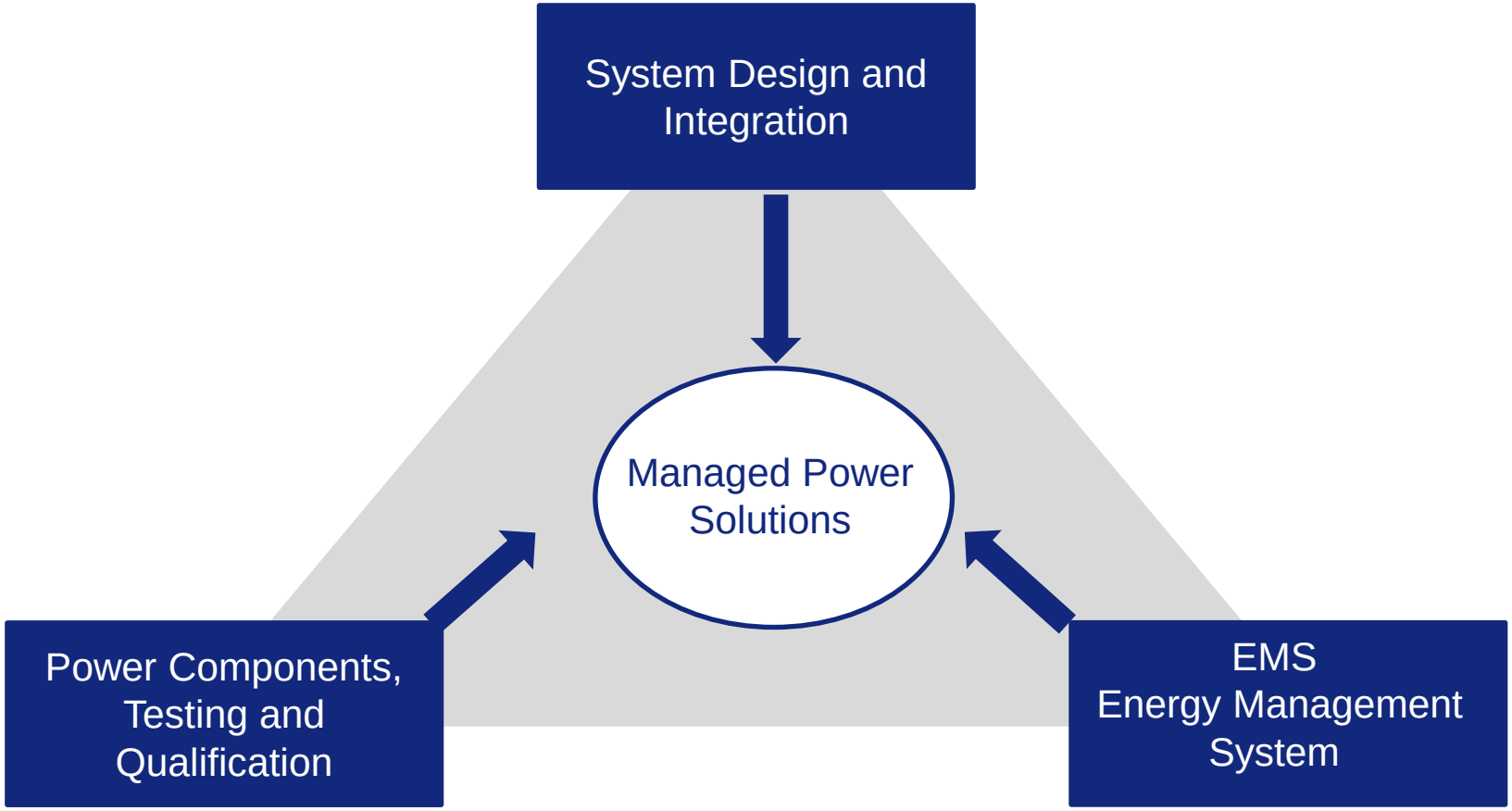
Site Security



Grid



Heliocentris Core Competences define the Managed Power Solution



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Solutions to help you take the lead.

We provide turnkey installations for

- Genset Efficiency
- Solar Hybrid
- Bad Grid Box





Our turnkey Managed Power Solutions consist of

Power Components

- Batteries
- Rectifiers
- Cooling
- PV
- and more…





Energy Management Feature Modules

Monitoring & Control

- Genset Management
- Battery Management
- Fuel Monitoring
- Site Security
- and more…



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Modular Clean Energy Solutions for all grid and site types

Solutions	Components	Site Type		Grid Type	
		New Site	Retrofit	Bad	Off
Genset Efficiency	EMS, Genset, Batteries, Battery Cabinet, Rectifier	✓	✓	✓	✓
Grid Cube	EMS, Batteries, Battery Cabinet, Rectifier	✓	✓	✓	
Solar Hybrid	EMS, Genset, Solar panels, Solar Charger Batteries, Battery Cabinet, Rectifier	✓	✓	✓	✓
Pure Solar 24+	EMS, Solar panels, Solar Charger, Batteries, Battery Cabinet, Rectifier	✓	✓		✓
H2-Extention	EMS, Fuel Cell, Batteries, Battery Cabinet Rectifier	✓	✓	✓	✓



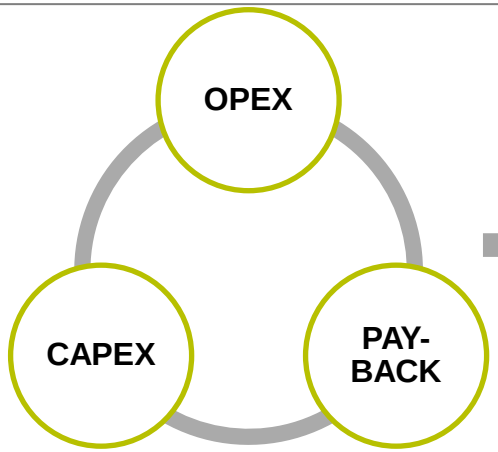


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Customer defined Business Models



Customer Responsiveness by Business Model



Commerical Preference

+

Site Specific Topology

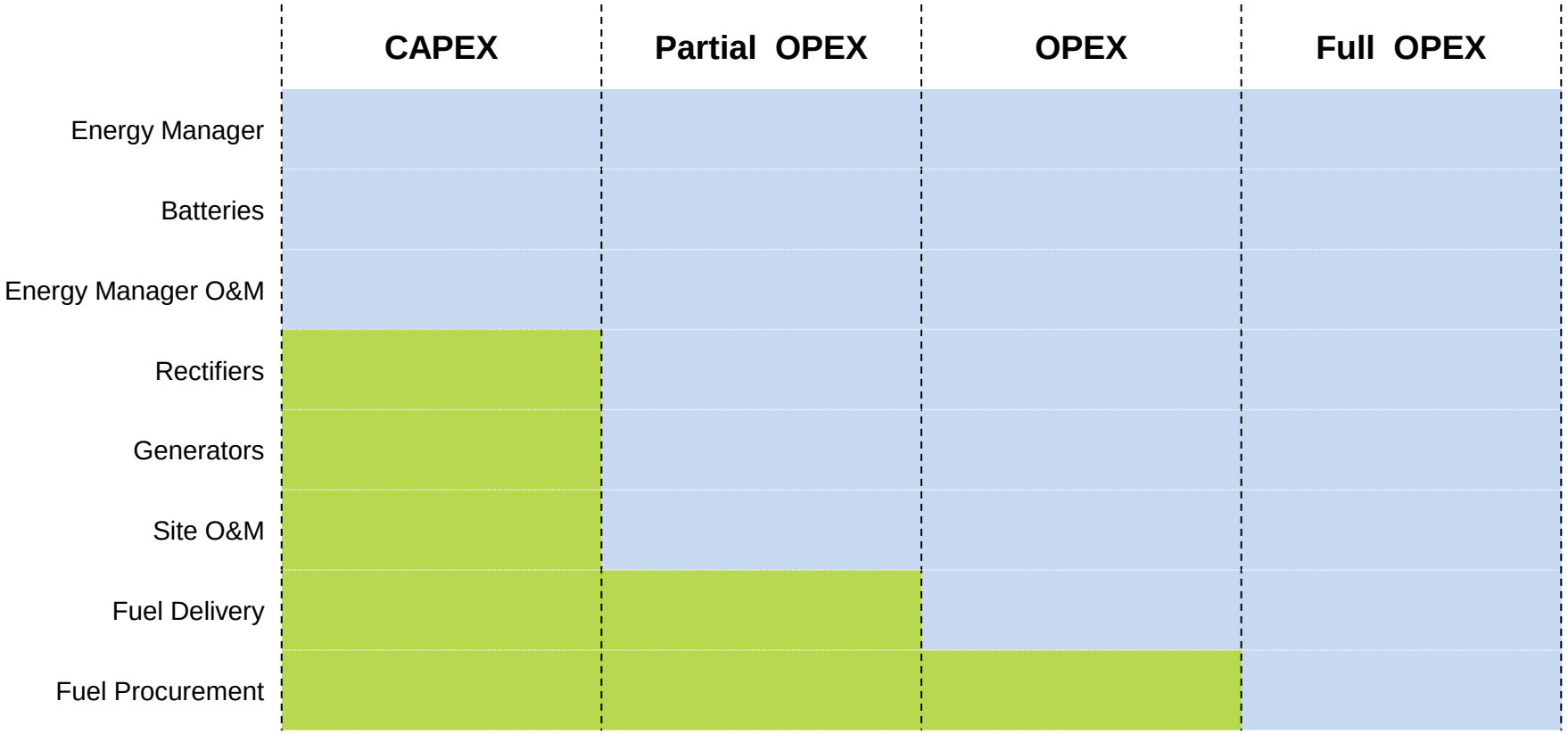
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Commercial & Technical
Solution Engineering

=

CUSTOMER SPECIFIC & OPTIMIZED PROJECT BUSINESS CASE

Customer Can Choose Among Different Business Models

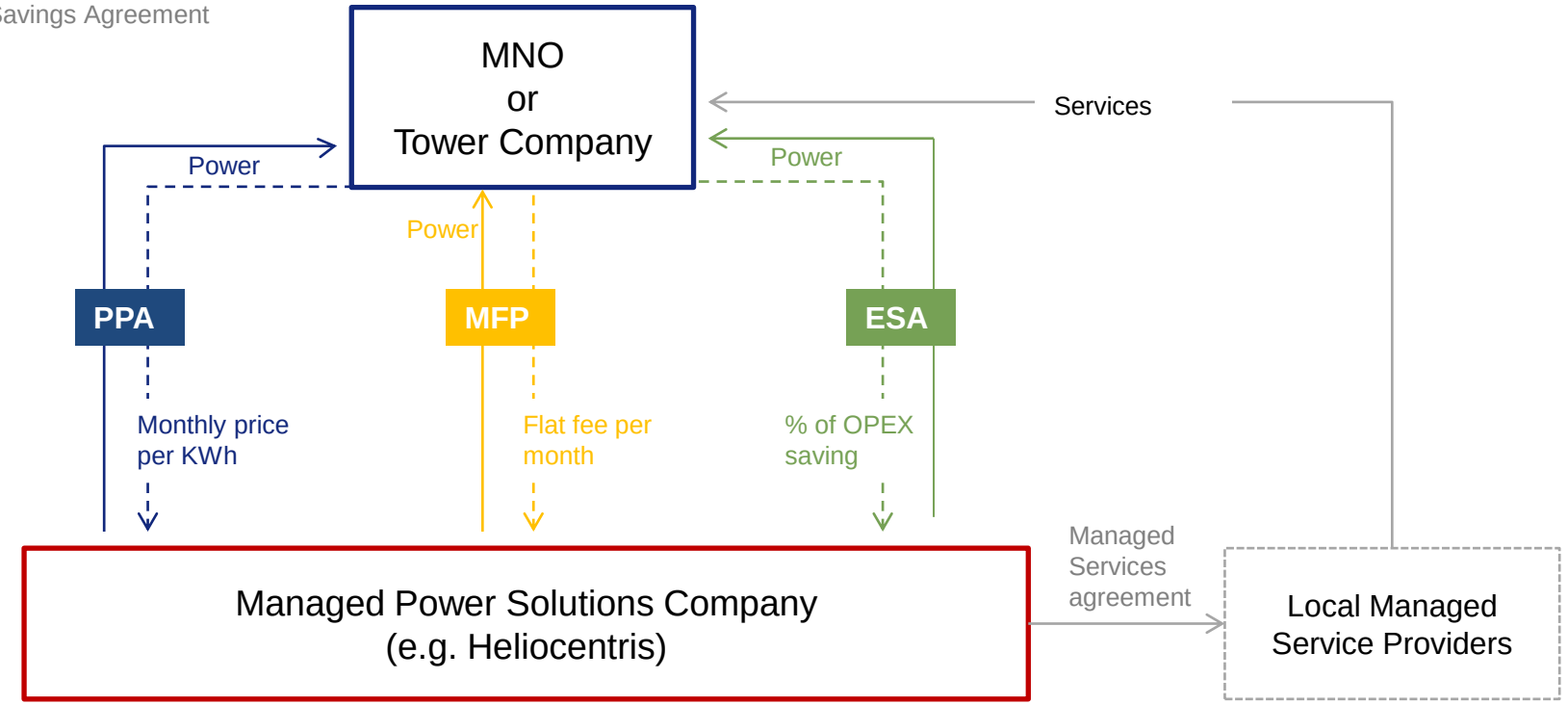


Mobile Network Operator / TowerCo

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Business Model Concepts with Heliocentris

PPA - Power Purchase Agreement
MFP - Monthly fixed payment
ESA - Energy Savings Agreement



→ Limit or eliminate Investments

→ Outsource Risks

→ Outsource Ownership (Lean Asset)

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Project Experience Indonesia



Customer: Hutchison 3 Indonesia

Monitoring & Control Solutions for 116 Backbone Sites

Genset Efficiency (Battery Hybrid) Solutions for 35 Sites

Project Reference - Backbone Sites Monitoring & Control

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Status as per September 2013: 83 Sites Installed out of 116 sites planned

Project Reference - Genset Efficiency Solution

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Project Implementation Samples - Genset Efficiency Solution

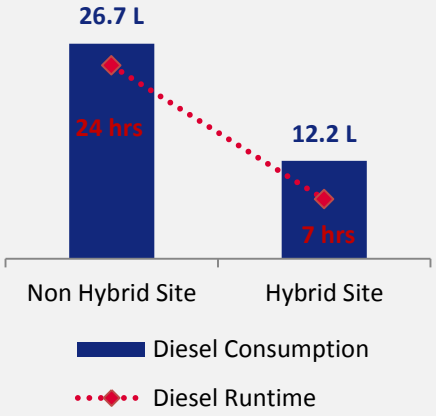
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Diesel Consumption and Runtime
per day and site
before and after Hybridization







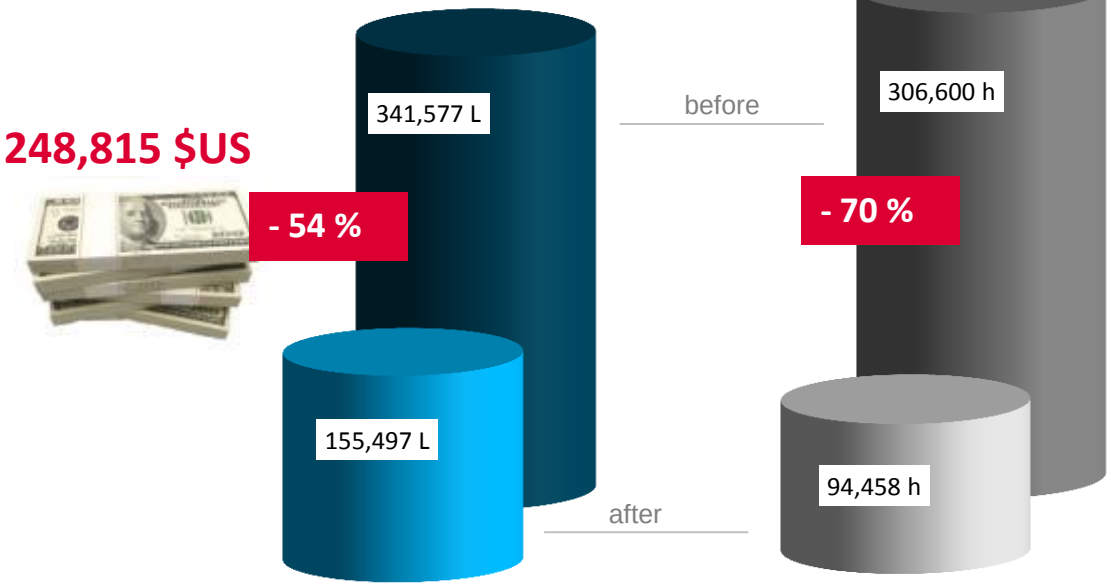
Project Reference Indonesia- Genset Efficiency Solution

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Realized Savings over all 35 Hybridized Sites

- Solution: Battery Hybridization of Diesel BTS sites
- Actual Number of Hybrid Sites: 35
- Diesel Price on site: 1,30 US$
- Period Examined: 01/01/2011 to 01/07/2013

Fuel Savings per Year (L)



Runtime Savings per Year (h)

483,807 kg

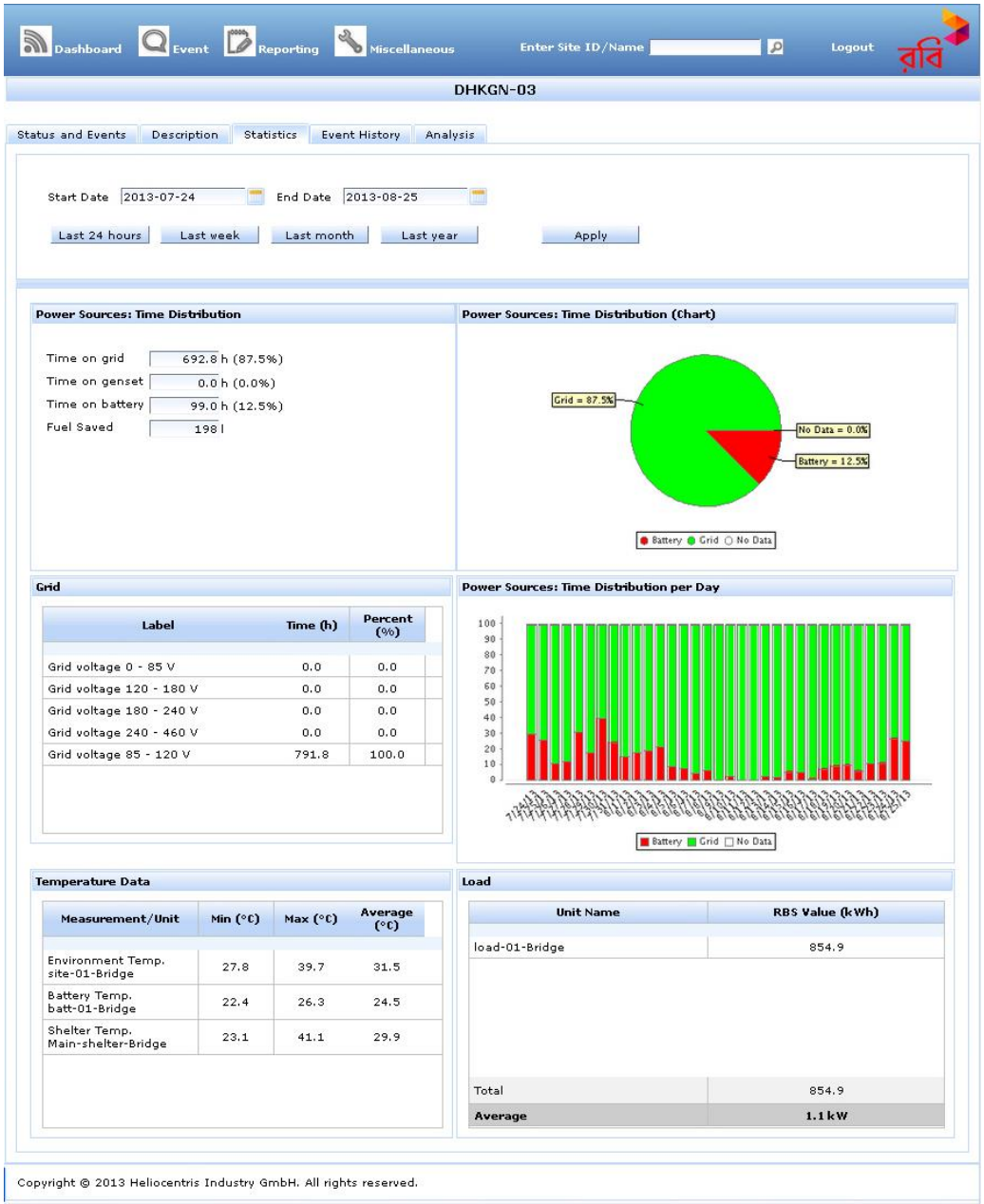


Savings per Year

- Fuel Savings more than halved (54%)
- Maintenance Savings (generator related) of almost 70%
- 500 tons of CO_2 emissions avoided per year

Lessons Learned - Grid Management

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Grid Behavior ⇨ ***Batt dimensioning***

- Periode 33 days
- Grid available 692h
- Grid unavailable 99h

Average grid unavailable 3h/day

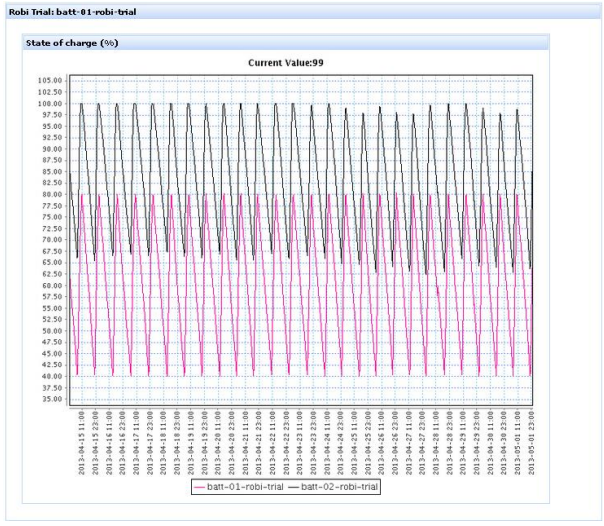
200 Ah Batt needed to Backup the 1.1 kW load for 4 hours (50% DOD)

Lessons Learned - Battery Management







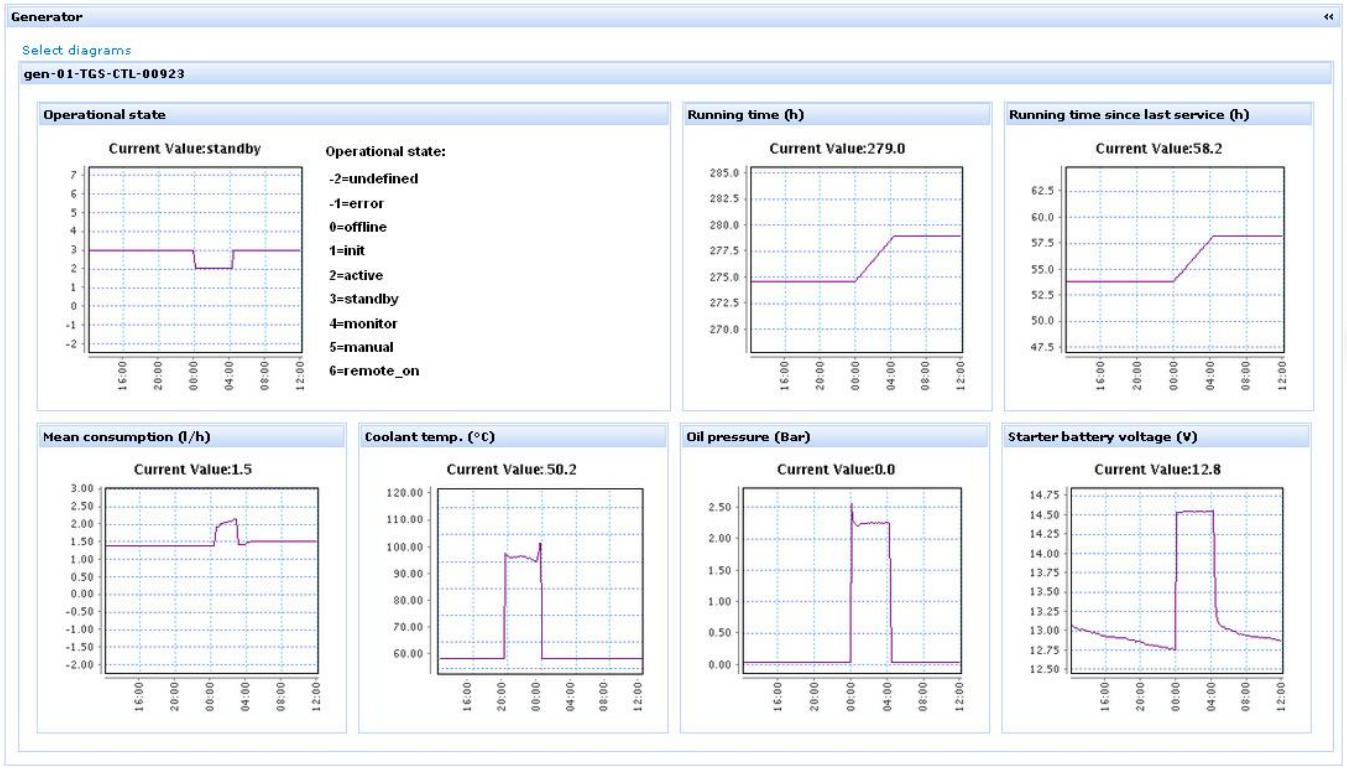


Battery Installation needs to be considered:

- **Old battery can't be installed together with a new one**
- **Different battery brands and types should not be installed together**

Lesson’s Learned - Genset Management

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- **Real time information data**
- **Easy maintenance scheduling**
- **Know in advance before failure**
- **Proper preparation prior to site visit**

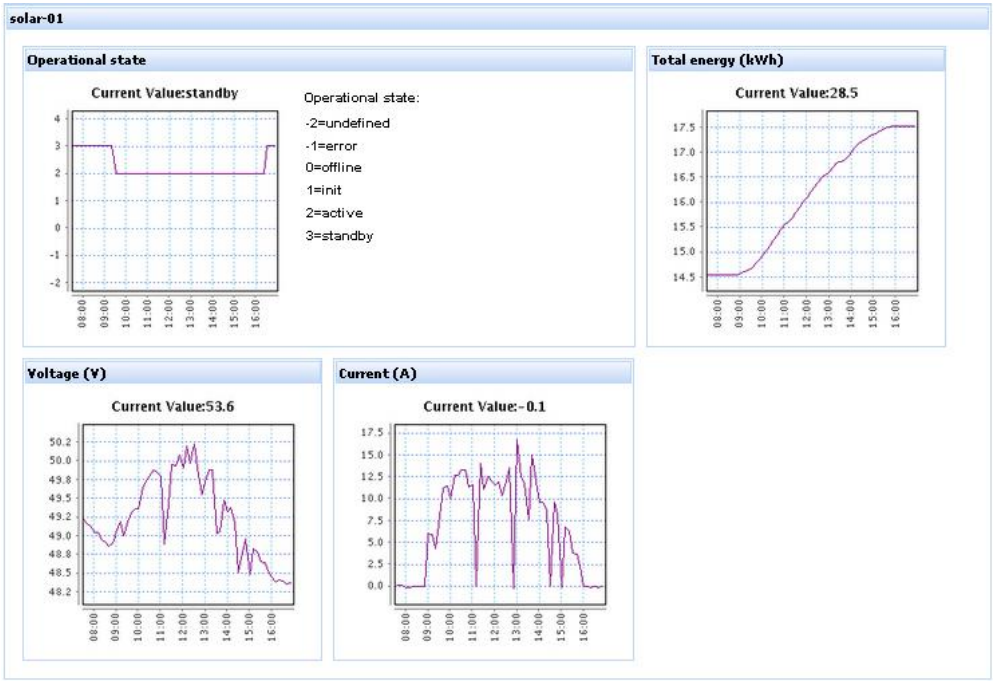
Lessons Learned – Solar Panel Real Time Intelligence

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Solar panels efficiency productivity deacrease due to:

- **Growing trees**
- **Dust Collected on the solar panels**
- **One or more solar panels damaged**



Thank you for your attention

Dieter Klein

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