Heliocentris

Power for the 21st Century

Energy Management Solutions for MNO's and Tower Companies

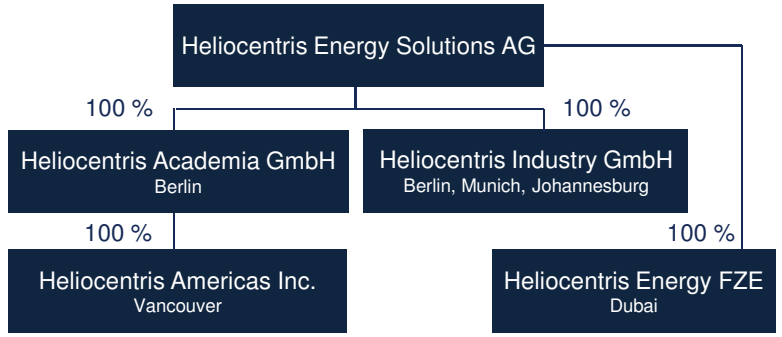
Value proposition

2013

Company Overview

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

GROUP STRUCTURE



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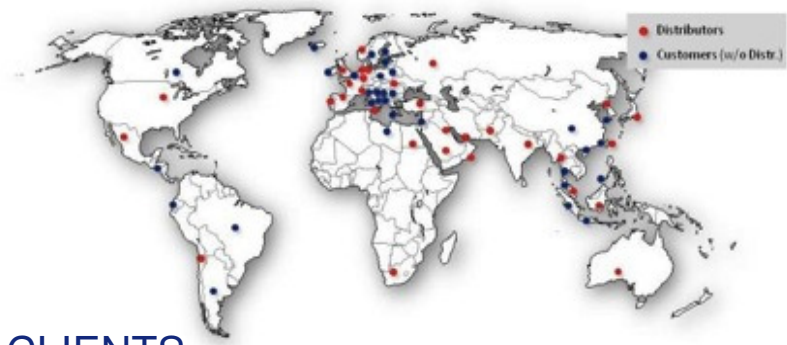

Our Solutions Address the Customer‘s Pain Points

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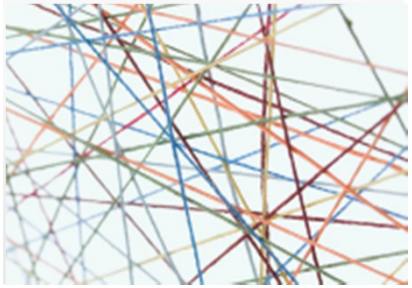
Increased Cost Pressure

Competition

Climate Change

Efficient & Clean Energy Solutions at a Reduced Total Cost of Ownership

INCREASE
Network Availability



REDUCE
Energy & Maintenance Cost (OPEX)

OPTIMIZE
CAPEX

MINIMIZE
Carbon Footprint

Changing the Energy Landscape

We develop, manufactures and delivers Energy Management Systems

We design, implement and operate Turnkey Power Solutions for Partners and End-Customers.

TODAY

- Offgrid energy supply mainly via diesel generators
- Only limited management required
- Low complexity as well as low efficiency setup

ENERGY GENERATION

Diesel Generator

PV

Wind

Fuel cell

Diesel

Battery

Electrolyser/
H2 Storage

ENERGY STORAGE

MANAGEMENT

Management
Monitoring
Control

TOMORROW

Energy supply becomes **hybrid** to leverage strengths of various technologies and to

- increase efficiency
- become green

Energy supply becomes **intelligent to**

- reduce Maintenance Cost
- Increase uptime

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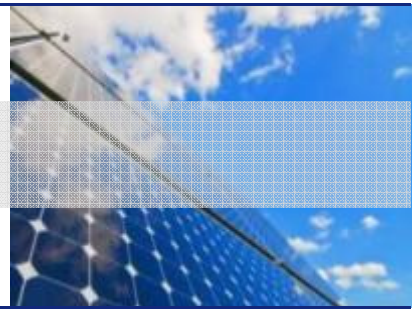
Site Management & Managed Power Solutions



Site & Power Management Overview

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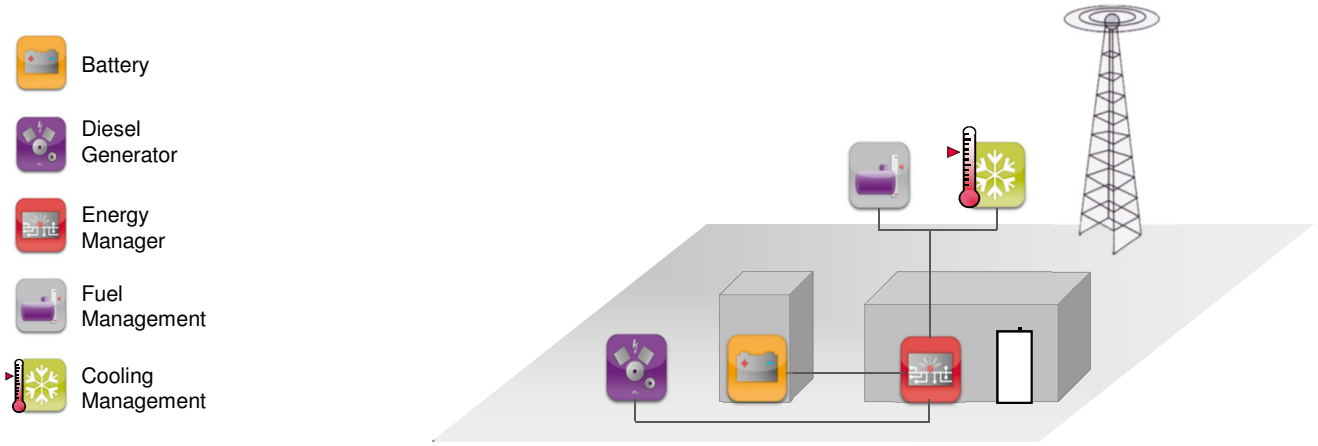

1 **Site management** + 2 **Power management**

Reduced CAPEX & OPEX

Improved ROI

Integrated Energy Site Management System

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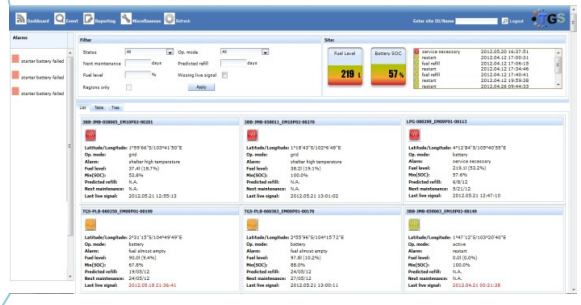
Architecture overview

NETWORK OPERATIONS CENTER

Monitoring / Operation (RMS)

Remote Site Configuration

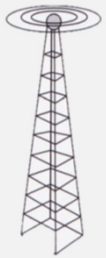
Management Server



GPRS / 3G/ TCP-IP

SMS

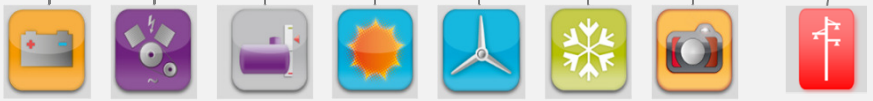
Energy Manager



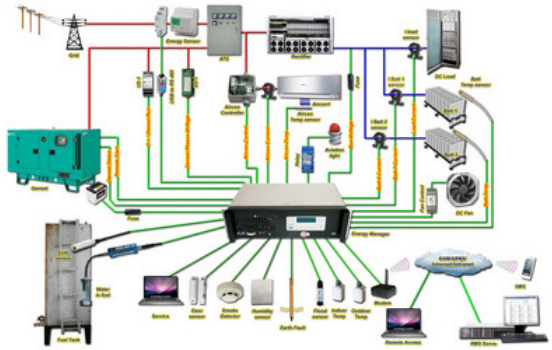
Site x

...

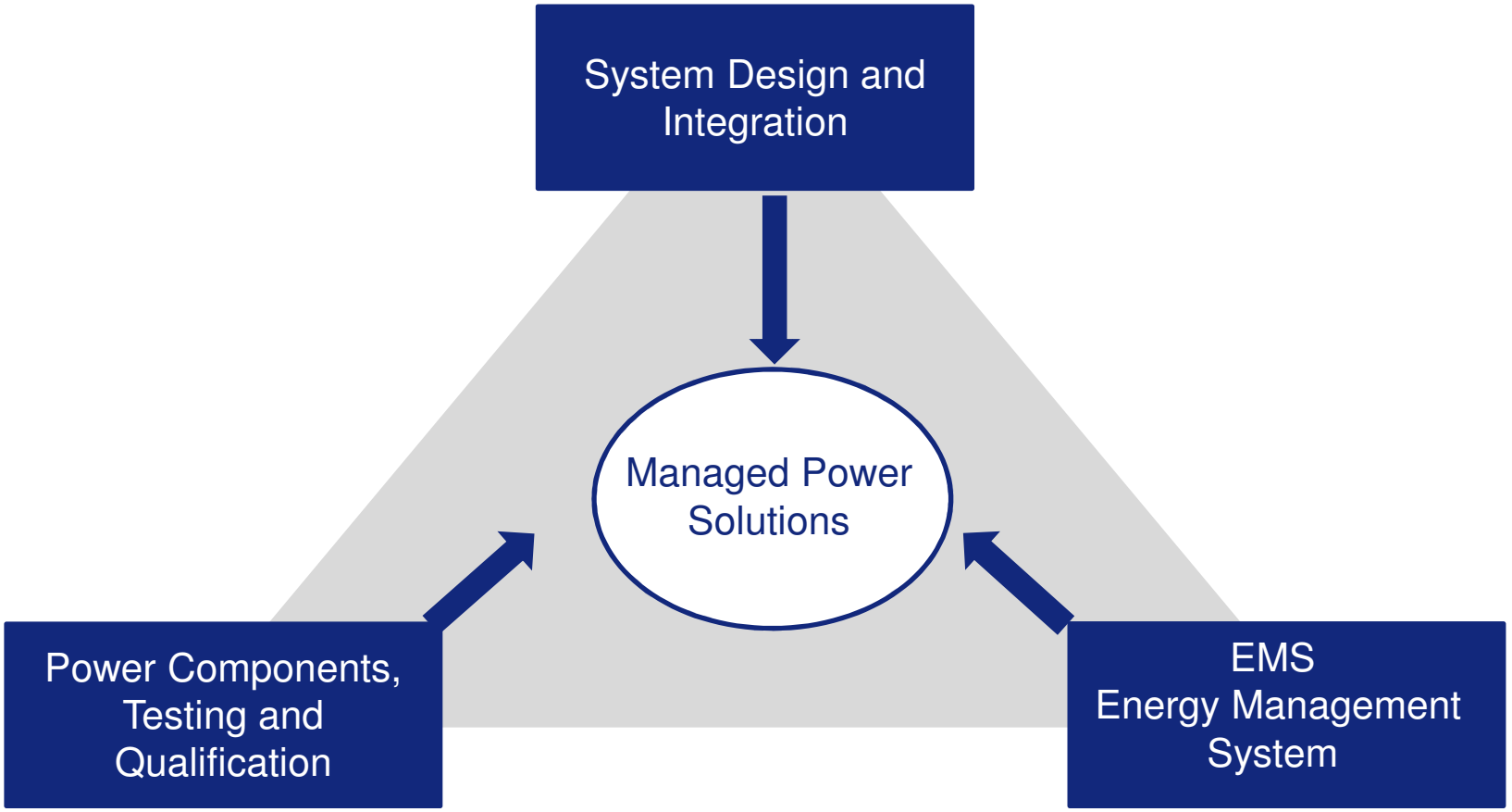
Site y



Battery Genset Fuel Tank PV Wind Cooling Site Security Grid



Heliocentris Core Competences define the Managed Power Solution



Managed Power Solutions

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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

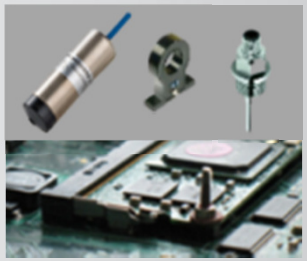
Power Components

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

Energy Management Feature Modules

Monitoring & Control

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



Power Solutions Portfolio

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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 + Genset	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	✓	✓	✓	✓
Lithium powered Sites	EMS, Li-Batteries, Battery Cabinet	✓	✓	✓	✓

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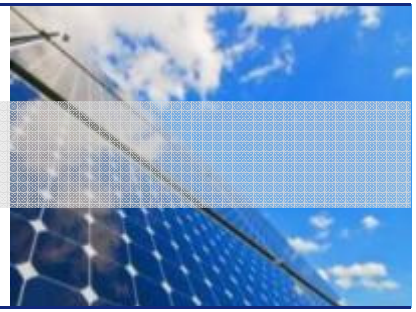
Customer defined Business Models



Customer Responsiveness by Business Model

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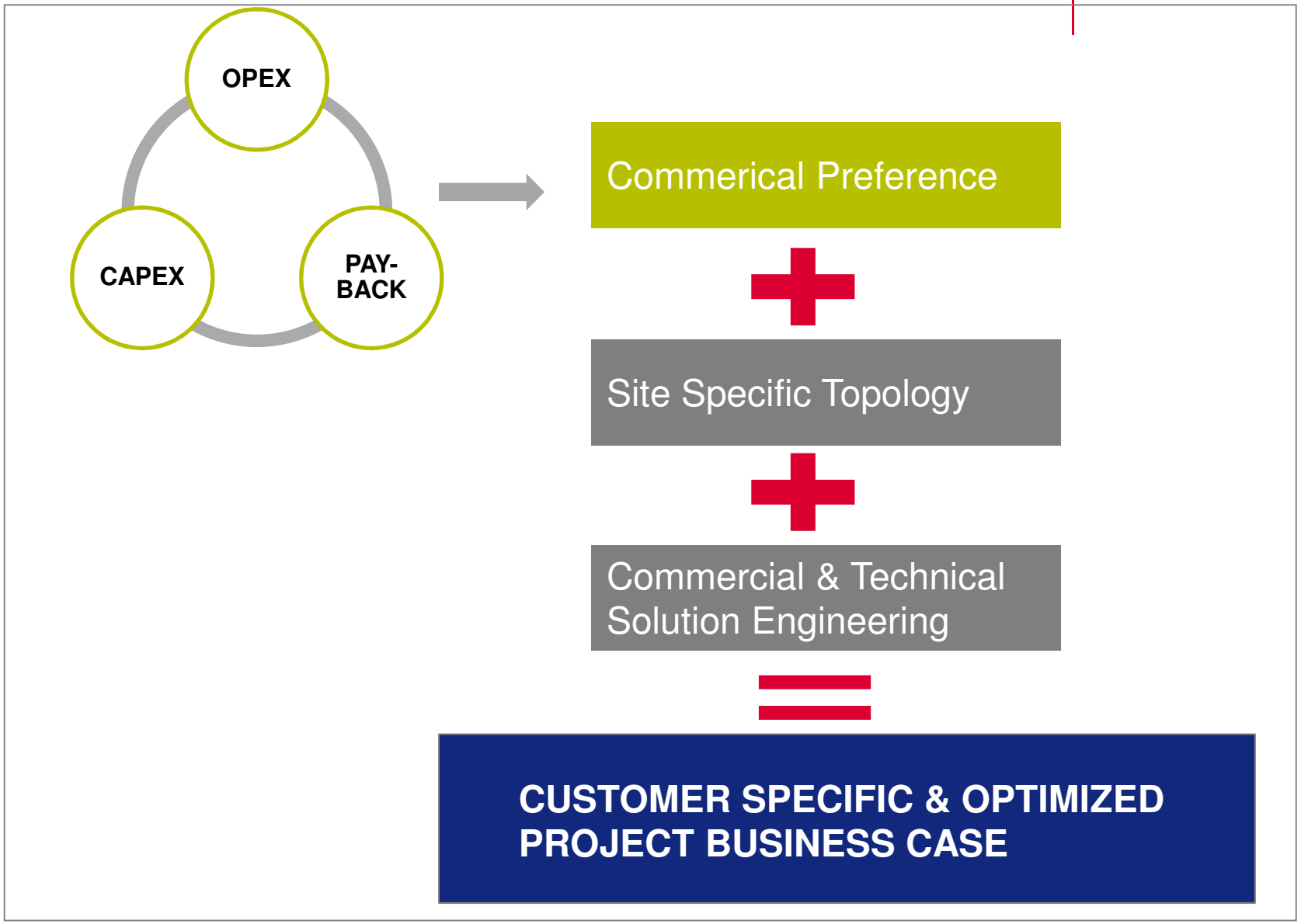
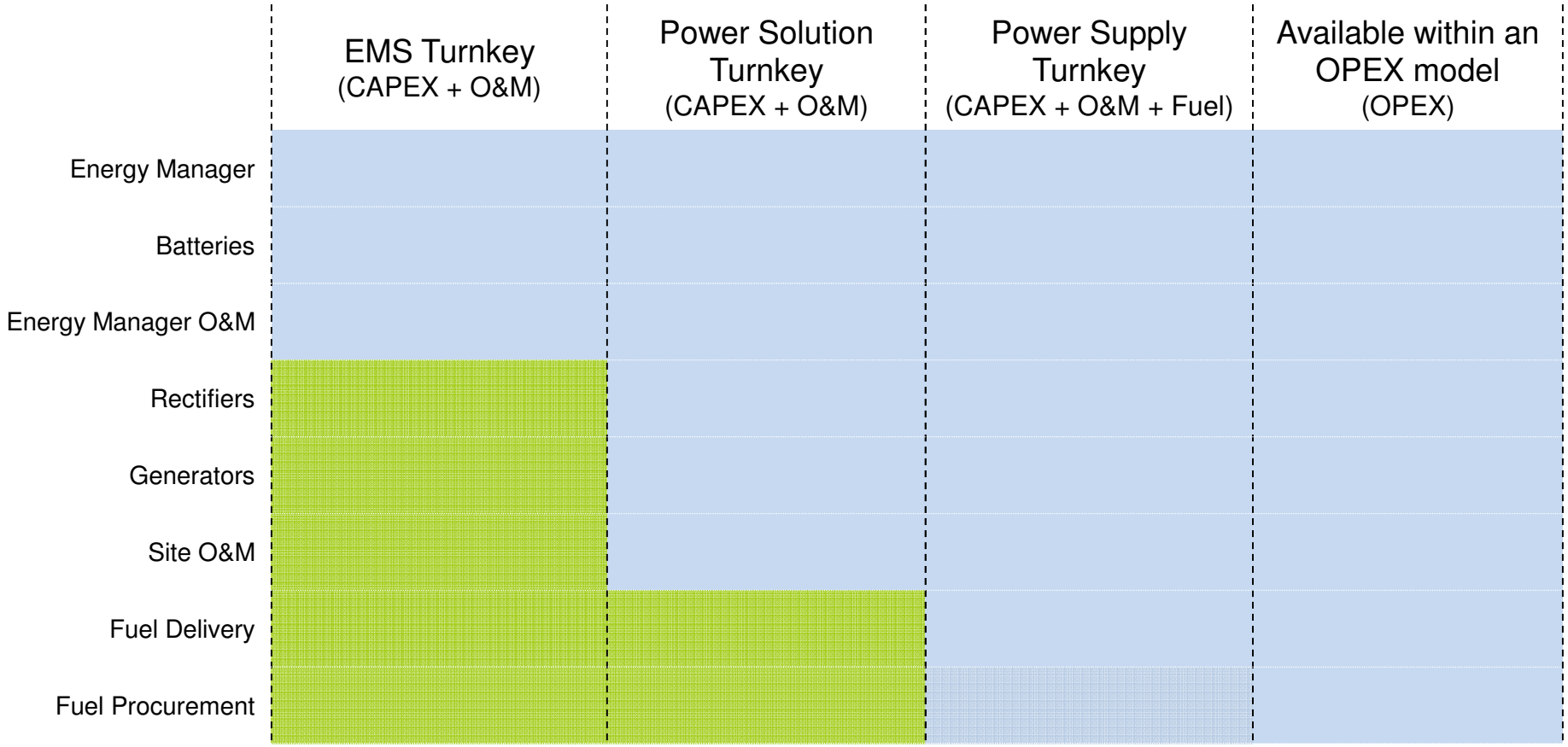


Heliocentris Business Models



Mobile Network Operator / TowerCo

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CAPEX / OPEX model

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CAPEX Model

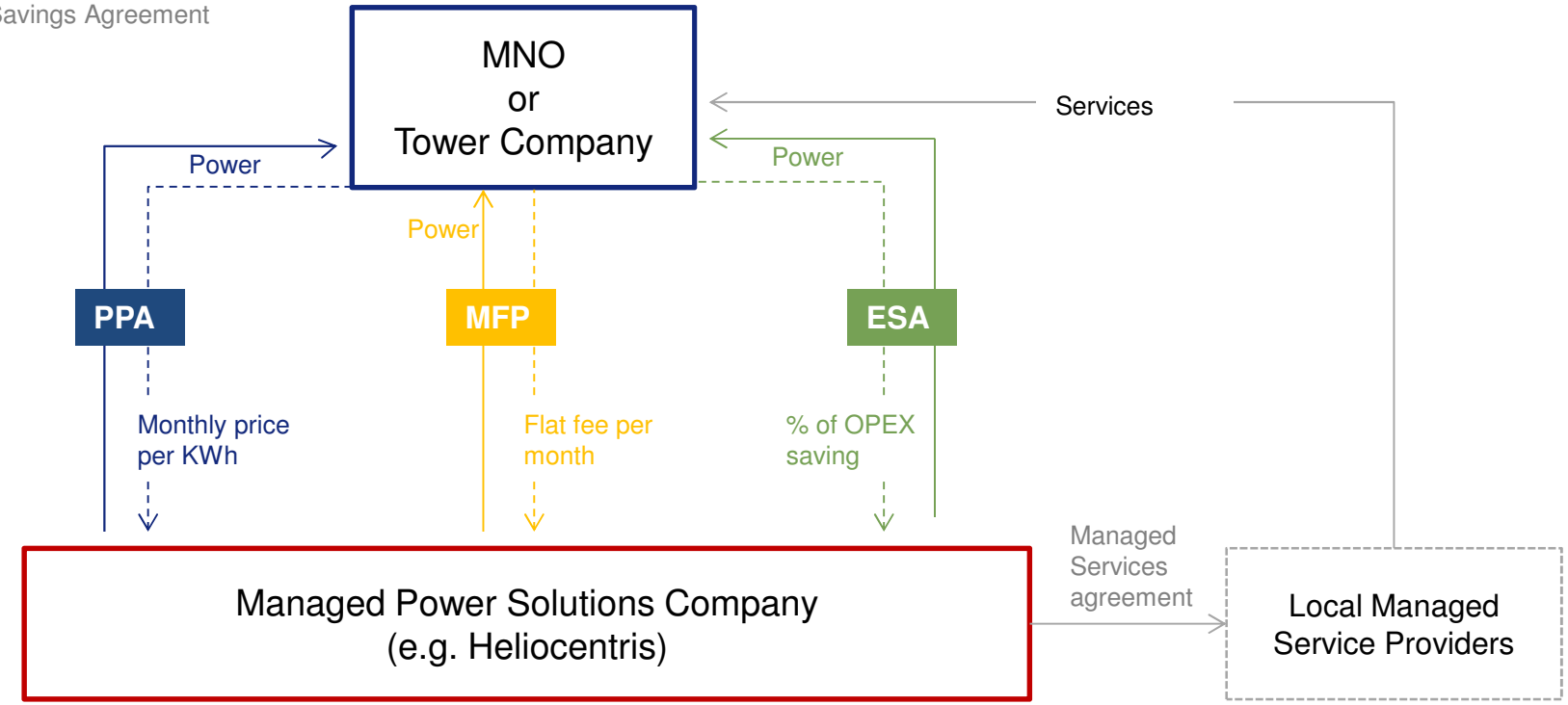
- MNO/MNO/TowerCo invest all CAPEX either from its own source or from capital market, therefore financial risk belongs to MNO/TowerCo
- IRR and NPV of Green Power deployment is significantly more attractive
- For volume deployment, CAPEX investment can be a barrier since it require large investments and might be in conflict with other investment priorities.

OPEX Model

- MNO/TowerCo does not have to invest for CAPEX, therefore no financial risk to deploy green power.
- IRR and NPV increases for telecom site since site OPEX reduces
- CAPEX can be released for other telecom investments.
- With mass deployment, the business opportunity for the Energy provider becomes more viable.

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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A major cost saver is proper Site Management

Saves a lot more than you think.

Site Management enables

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Benchmarking to determine savings potential

TCO analysis and optimization potential

Increased site uptime through fix before fail and fix on first visit

Centralized site monitoring enables benchmarking

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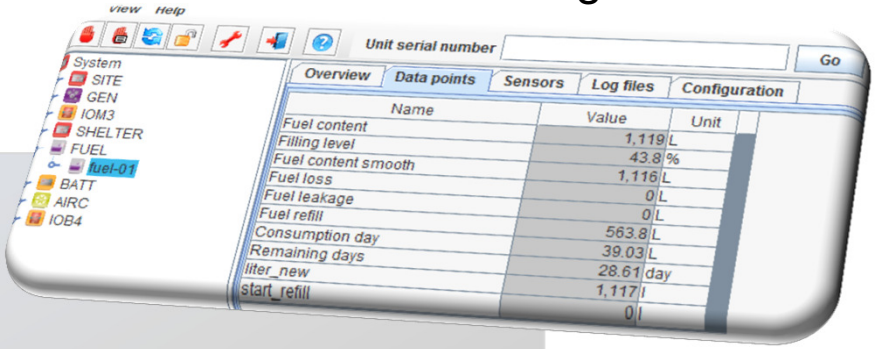
Centralized Remote Management Server



Site

TCO Analysis: Drivers

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Battery

- High CAPEX, needing replacement after 2.5-5 years
- Life cycle depends on ambient conditions and maintenance
- Life cycle depends on depth of discharge regime
- Defective cell replacement can mean string replacement
- No monitoring, no manufacturer warranty

Genset

- Delivered fuel cost
- Partial load efficiency / rectifier sizing
- Maintenance

Aircon

- High temperature. low efficiency
- Significatn site electricity consumption
- Two units needed, high CAPEX
- Cleaning filters

Site Management: Sit-in-network housekeeper

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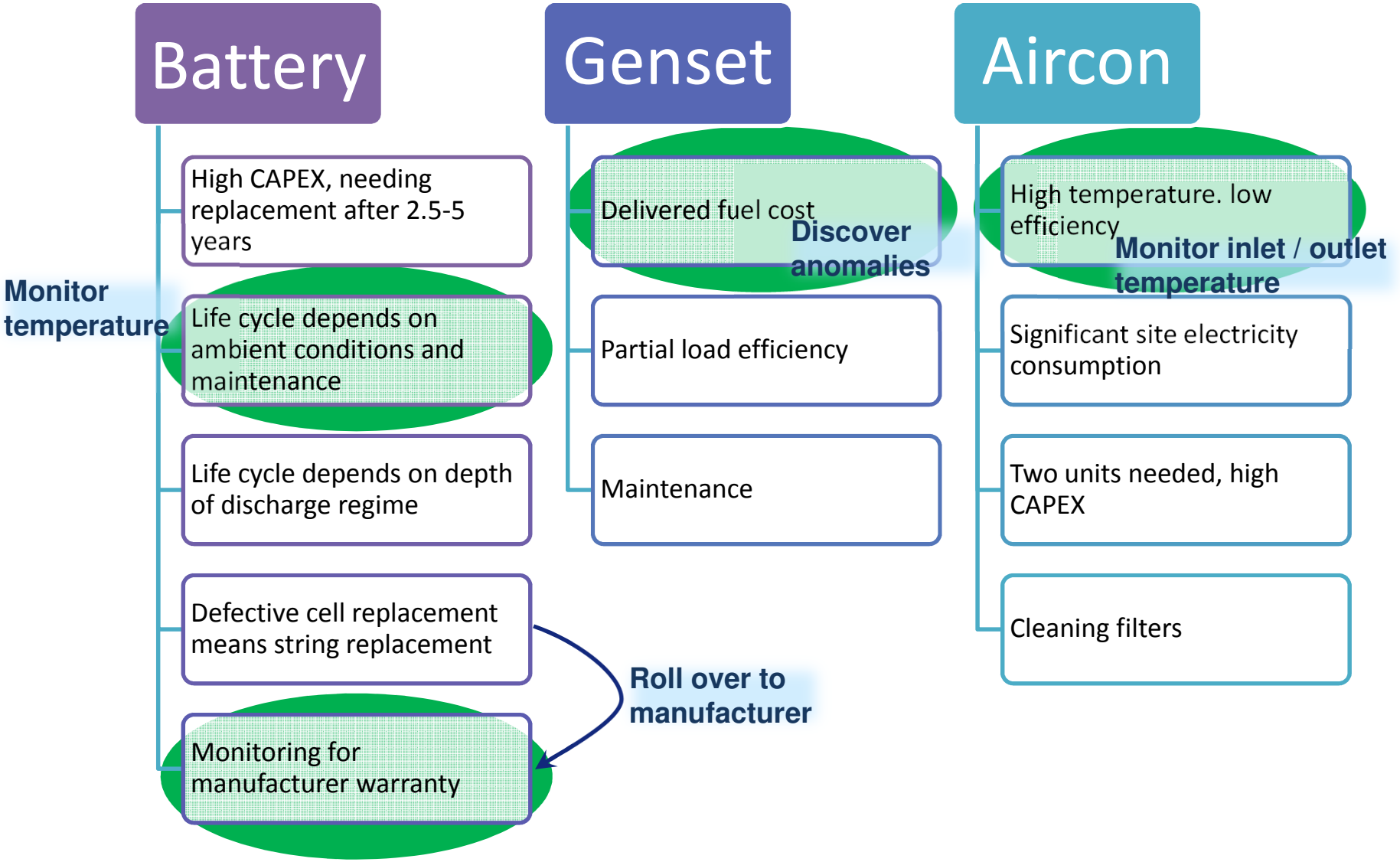

Savings: Battery temperature monitoring

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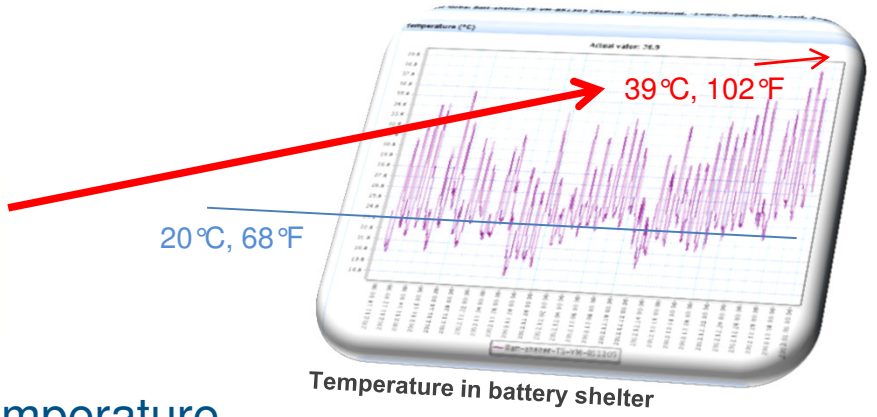
Typical field observation when monitoring becomes available for first time



Battery lifetime as a function of temperature

Temperature	Type	Block battery	Cell
		12V 3PVV 210	5PVV 350
40°C, 104°F	Cycles	2.100	3.150
25°C, 77°F	Cycles	3.360	5.040
20°C, 68°F	Cycles	4.200	6.300

Price of 600 AH battery

6000 USD

50% difference for cycles

between 20°C and 40°C

Value impact: Fuel consumption

Fuel consumption
for sites with 15 kVA genset
1,500 Liters/month/site

Fuel Delivery Cost Region		
A	B	C
100	105	120

Number of sites per region		
A	B	C
100	100	100

Fuel consumption per region
150.000 ltrs/month

1. Analyze consumption
2. Take measures

Fuel Delivery Optimized		
A	B	C
100	105	105

15% of fuel saved in region C

15% of fuel saved in region C

Total savings from benchmarking
22.500 USD/month (1 ltrs = 1 USD)
270.000 USD/year

Cost for fuel monitoring per site: 2400 USD
300 sites at 720.000 USD
Payback ~ 2.7 years

Fuel theft by insiders, leading indicators

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Fuel theft by insiders

Maintenance visits with disabled fuel sensors

Pattern: theft occurs shortly after refill

Hybrid cycle disabled for suspicious reasons

Theft
within distributor or in transit.
Operator estimates
10% of fuel costs due to theft
50% in extreme cases

Estimate 10%

Actual 50%

Best Practice

- Separate RMS oversite from ground crew
- Predict fuel consumption based on runtimes
- Send in outside team to verify obscure errors
- Change filling routines regularly

Refilling on demand reduces truck rolls

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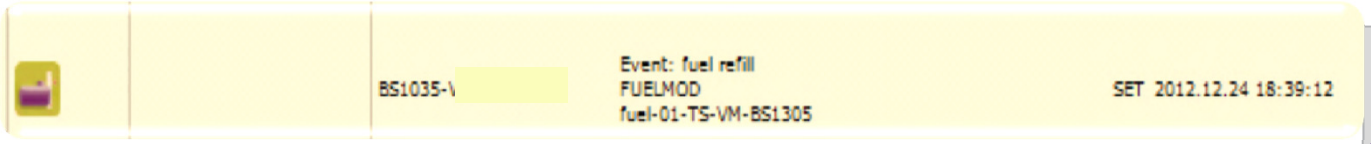

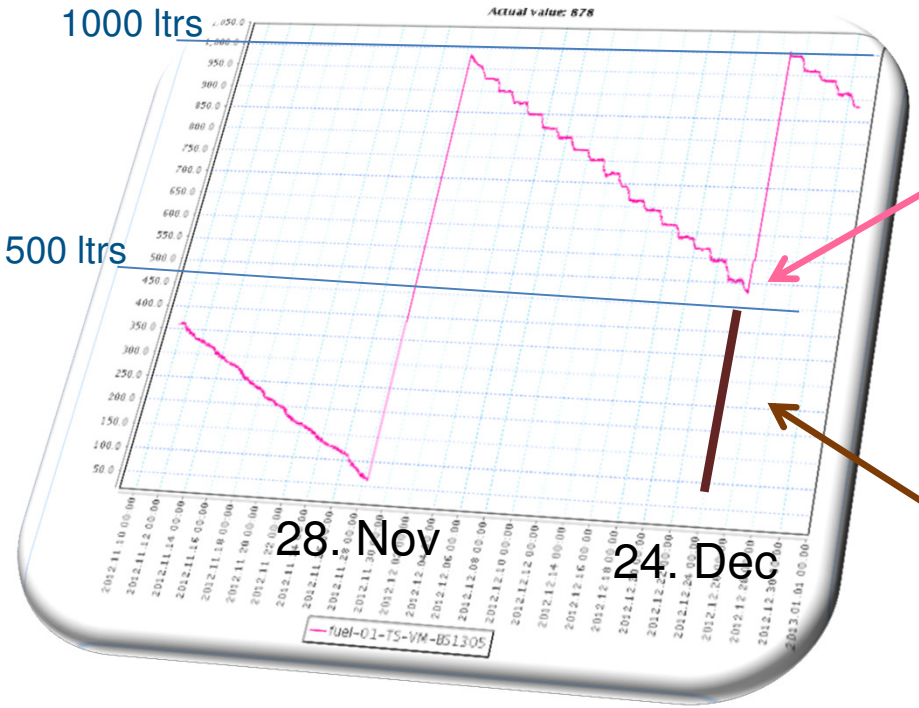

Refilling on a fixed schedule

Still five hundred liters in tank, good for another four weeks

Housekeeper roles

- Accumulated fuel consumption
- "Fuel Refill Event" message to RMS
- Compare plan / actual
- „Let them know that you know"

Benefits centralized fuel measurement

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Live Centralized Reporting

Prevent, respond, calculate

Transportation cost

Theft control

Fill as late as possible

Reduce truck rolls

Leakage

Avoid fines

Site Management enables

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Benchmarking

TCO analysis

Service Optimization

Monitoring comes at a price, not monitoring comes at a cost.

Service optimization

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Prevent, respond, optimize with Live Centralized Monitoring

Optimize dispatch

Routine, preventive and emergency

Monitor genset runtimes, refueling and maintenance

Send right person to fix issue – save travel time

Fix before fail – reduce outage time

Monitor ambient temperature

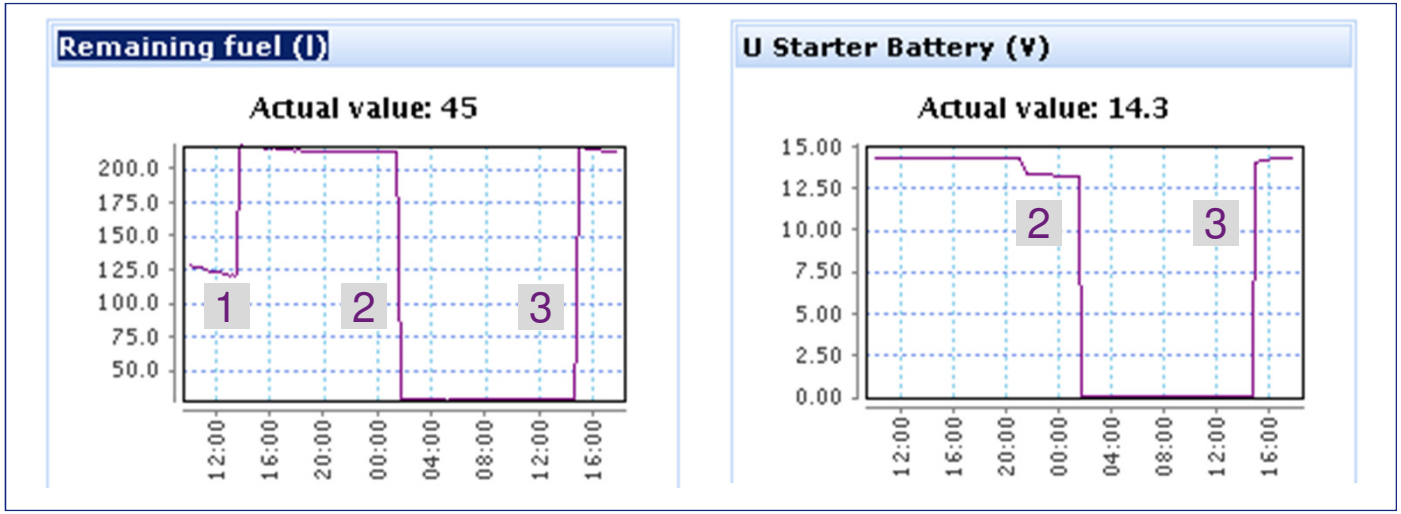
Cutting travel and outage time

Fix on first visit
With remote analysis send the right person with the right part

Fix before fail

Saving: Dispatch during working hours

Fuel and battery theft



1 **12:17** | Scheduled fuel refill at site (100 l)

2 **00:23** | Remote Management Server Alarm: Fuel theft & genset starter battery failure
Energy Manager data confirmed >14h hybrid-battery runtime left
Field service was dispatched for standard working hours

3 **14:00** | Field service replaced genset starter battery and fuel

Bring spare starter battery

Full site transparency ▶ Saves cost for emergency services

Hybrid-battery optimization ▶ Radio-services were never interrupted

Measures planned to reduce/prevent fuel theft (alarm at site, authorities)

Energy Management Systems

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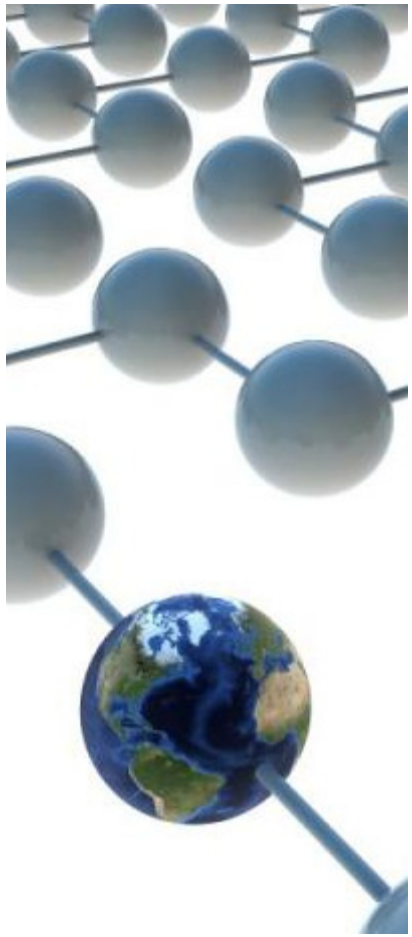
Key Benefits and Savings

CUSTOMER UTILITY	BENEFITS	SAVINGS
Fuel Theft Detection	Fuel loss detection in real time	Up to 50% fuel savings
Cooling Optimization	Smart aircon control	Site energy consumption
Site Infrastrucure Uptime	Fix site issues remotely or with one site visit Fix before failure based on warning messages (preventive maintenance)	Increased availability of radio services (>99,8%) Reduced site downtime
Site Security	Intrusion detection and fuel monitoring	Reduced fraud and vandalism damage



Site Infrastructure Uptime

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Predictive and smart maintenance

GENSET

Genset monitoring

- When starter battery is close to failure
- When genset is overheating

Trigger genset maintenance only as required

FUEL TANK

- Refuel tank before empty
- Refill only when required

SECURITY

- Intrusion Alarm
- Fire alarm
- Access control

FIX BEFORE FAIL

TRANSPARENCY

BACKUP BATTERY

- Automatic, remote battery monitoring gives early detection of battery cell failures before backup time becomes too short (on-grid sites)
- Optimize battery lifetime with state of charge monitoring for hybrid sites

AIRCON

Aircon cooling deterioration detection

GRID AVAILABILITY

Availability and quality of the grid

Strategic Roadmap

Strategic Roadmap

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From Genset Efficiency Solution 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

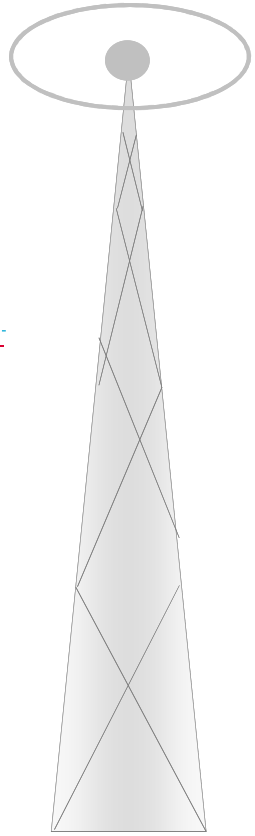
Genset Efficiency Solution

1 Battery Hybridization

Diesel Generator, Energy Manager, Battery

Conventional Setup

Diesel Generator



Savings from Helicoentris‘ Efficiency Solutions

Case Study: Yemen

SAVINGS

Fuel: 4,640 L / 55.2%

CO2: 29,4 Tons per site

Genset runtime savings (Maintenance cost): 72,6%

Savings over a period of 1 year.

Configuration

Genset Management

Battery Management

Diesel Fuel Management incl. Fuel Level Sensor

Remote Access & Control

Aircon Management

Case Study: Zimbabwe

SAVINGS

Fuel: 4,640 L / 56.4%

CO2: 12.3 Tons per site

Genset runtime savings (Maintenance cost): 70%

Savings over a period of 1 year.

Configuration

Genset Management

Battery Management

Diesel Fuel Management incl. Fuel Level Sensor

Remote Access & Control

Aircon Management

Free Air Cooling

Case Study: Indonesia

SAVINGS

Fuel: 9,360 L / 54%

CO2: 24.8 Tons per site

Genset runtime savings (Maintenance cost): 70%

Savings over a period of 1 year.

Configuration

Genset Management

Battery Management

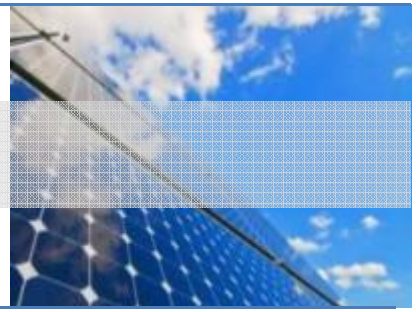
Diesel Fuel Management

Remote Access & Control

Aircon Management

Free Air Cooling

Project Implementation Samples



Solar Monitoring Reference

BTS Station, Mozambique

Customer value

Visibility of site conditions and all energy systems. Efficient maintenance/logistic planning.

PV Monitoring, Mozambique

Customer
Mobile Network Operator from Mozambique

Description
Operator with more than 400 sites across the country. looking for visibility of the energy systems on their sites, e.g. batteries, genset, PV and general alarms.

Project
Site data analysis and reporting through centralised management system to increase site visibility and reliability.

Solution
Energy Manager and a number of Heliocentris Site Management features implemented

Results
The field-based Energy Manager monitored and reported the energy produced by the solar panels. Sites were clearly visible. Site data and corresponding analysis were made available.

Solar Project Reference (1/2)

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Scope of work

- System design, civil and mechanical works
- All power and control cabling
- Arrangement of material from local market
- Local sourcing
- Configuration, testing and commissioning
- Activate solar hybrid mode

Solar Hybrid Site Installation

Customer

Global Mobile Network Operator, Pakistan Network.

Description

One of the world's major operators with operations in 11 countries.

Project

Mobile base stations are mainly located in off-grid and bad-grid sites and are operated by diesel gensets. Due to high fuel costs and CO2 emissions the operator is looking for alternative energy solutions.

Solution

Heliocentris has designed and built up a Solar-Hybrid Power Solution based on an existing Genset Efficiency System, integrating existing components with EM.

Solar Project Reference (2/2)

Solar Hybrid Site Installation

Location

Pakistan

- » 2 hours from Islamabad
- » 43°C
- » Bad Grid / 12 hour outage per day

Site data

900 W Load

- » Solar Panel Capacity 3.36 KW
- » Battery 500 AH
- » Generator 13.5 KVA

Time

Project Time

- » Installed in June 2013
- » Implementation time 9 days
- » Trial time 3 months

Customer value

Visibility of site conditions and all energy systems.
Efficient maintenance/logistic planning.

Clean Power Site Demonstration System

Clean Power Site, KISR

Kuwait Institute for Scientific Research,
in partnership with KIA.

Design and erection of a Renewable Energy Management Demonstration System.
Solar and wind electricity.

- Energy Manager coordinates energy sources.
- Battery buffers short-term fluctuations and supplies power at night.
- Fuel cell system ensures energy supply during all daily and seasonal circumstances.
- Excess energy of the primary power sources will be converted into hydrogen by an electrolyzer. The hydrogen will be used by the fuel cell to provide power.

Customer value

Visibility of site conditions and all energy systems.
Efficient maintenance/logistic planning.

Project Implementation Samples - Genset Efficiency Solution

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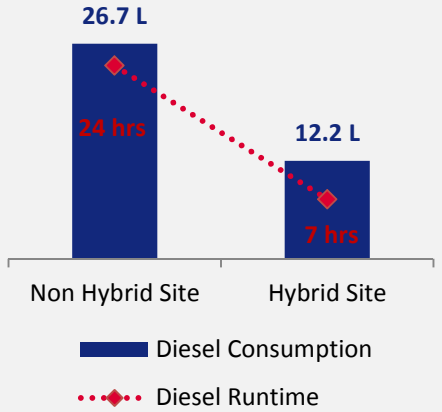
Diesel Consumption and Runtime per day and site before and after Hybridization



Customer: Hutchison 3 Indonesia

Monitoring & Control Solutions for 116 Backbone Sites

Genset Efficiency (Battery Hybrid) Solutions for 35 Sites

Energy Management Project References - Indonesia

Backbone Sites Monitoring & Control for Hutch's Backbone

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Project Reference Indonesia - Genset Efficiency Solution

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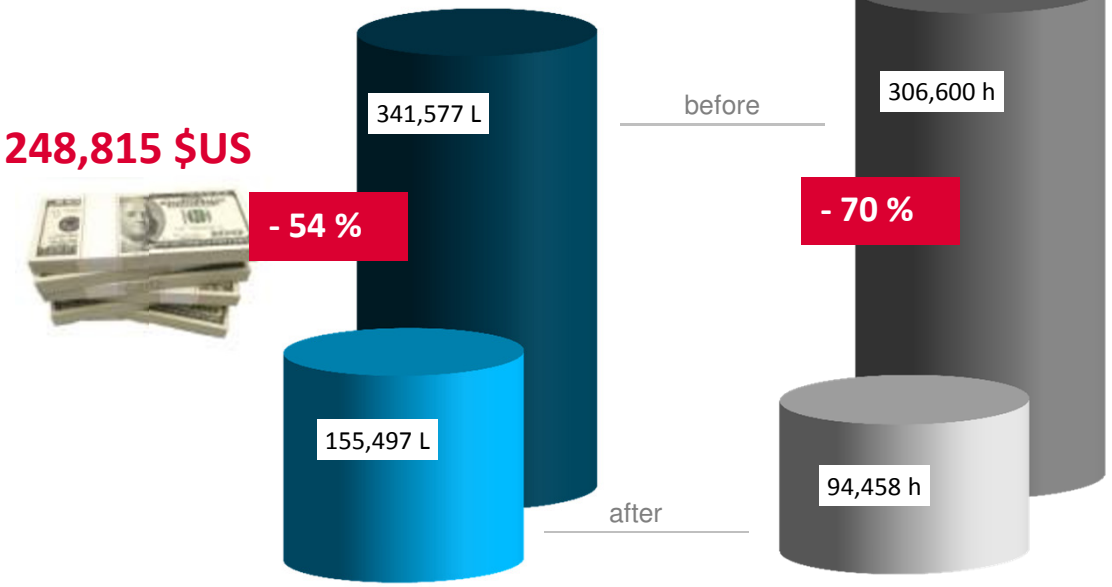
Realized Savings over all 35 Hybridized Sites

- 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