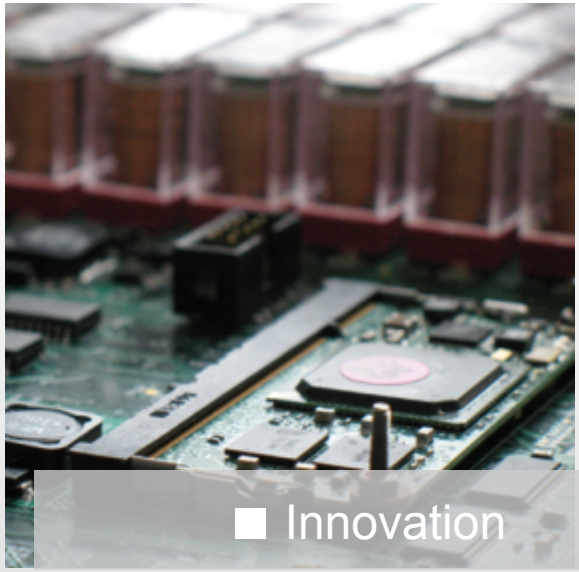
Heliocentris

Power for the 21st Century







Minimized TCO enabled by Managed Power Solutions

GSMA conference, Yangon/Myanmar, May 29, 2014

Jens Fiedler-VP Marketing, Dr. Kai Siemer-Solution Engineering

Overview

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1. Heliocentris Energy Solutions AG
2. Myanmar Power Challenges
3. TCO Considerations for Telco Power Solutions
4. Battery Considerations
5. Solar Considerations
6. Remote Energy Management Systems and Site Transparency
7. Summary
8. Q&A

Heliocentris Solutions AG



The Operators' Nightmare…

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Managed Power for lowest TCO

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All in One

- Maximum uptime over the whole lifecycle.
- Less CAPEX & best TCO/ROI through asset preserving and customized solutions, smart services.

ENERGY EFFICIENCY made in Germany

renewables Made in Germany

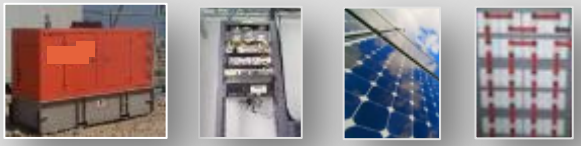
Company Value Chain

Managed Power Solutions

3 Turnkey Solutions

State of the art power components, optimized for required power solution performance

Power Components



2 Managed Power Services

From solution engineering and proactive maintenance to smart operations.

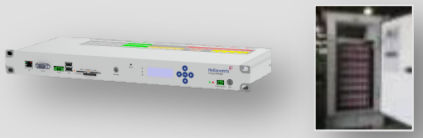
Smart Operations



1 Core IP & Technology

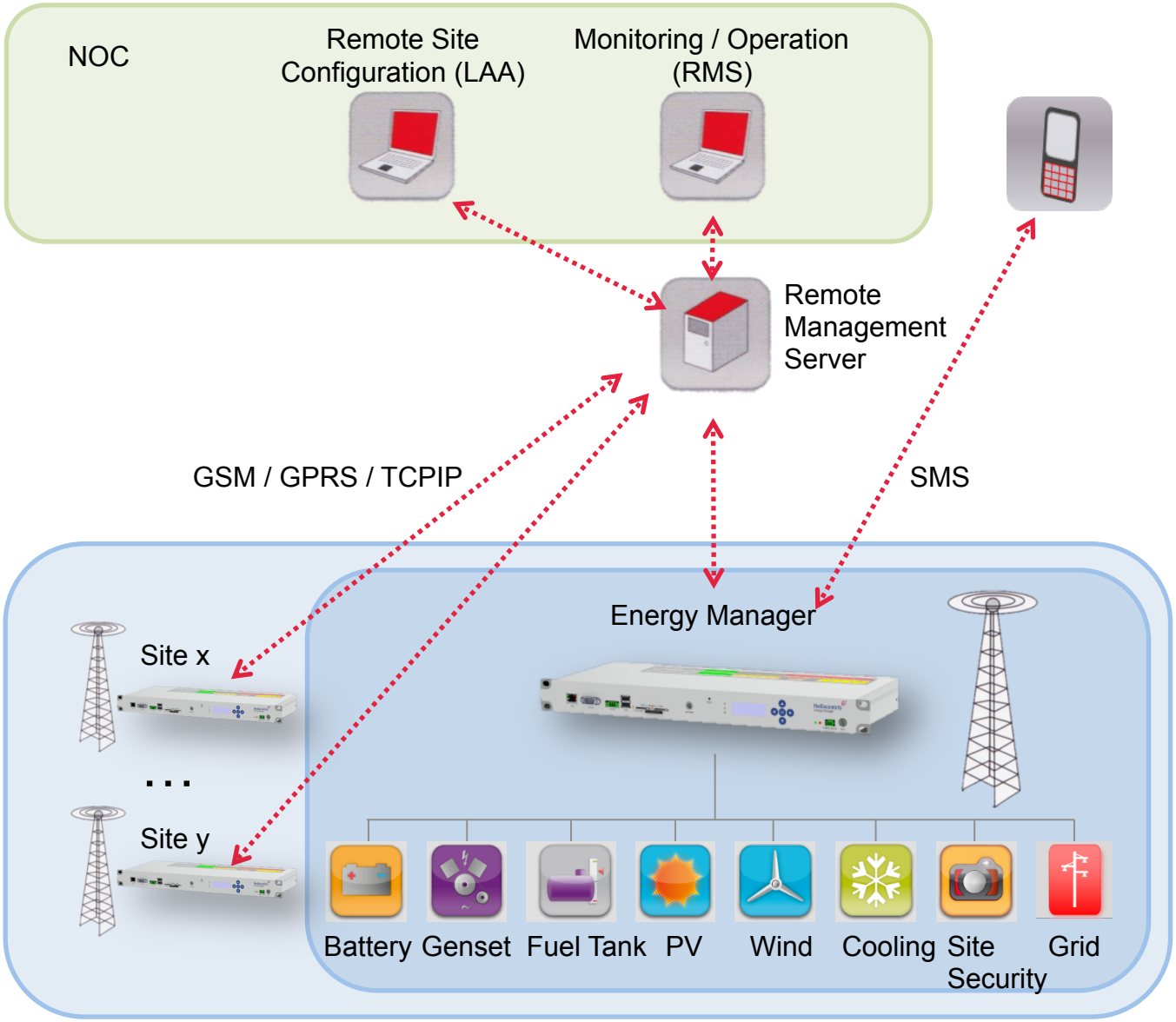
Core competencies in EMS/RMS and Fuel Cell & Hydrogen Technology. Power solutions engineering and system integration.

ePower Systems & Solutions



Power Solution with Remote Energy Management System

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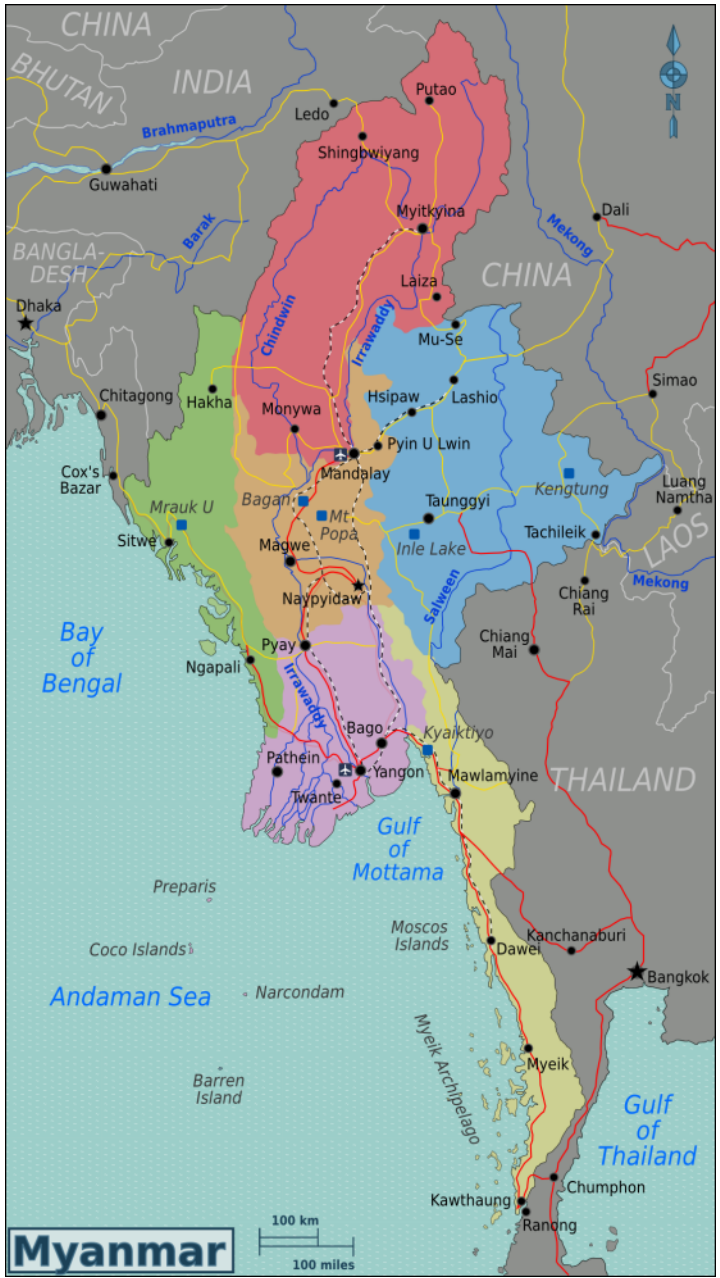




Myanmar Power Challenges



Myanmar and its power challenges



- A fascinating country with some fascinating power challenges:
  - Size of country and transport distances
  - (Non-) availability of utility grid
    - ~50% w/o electricity
    - Regional variation
    - Daily / Seasonal variation
  - Wide range of accessibility
    - From urban…
    - To most remote rugged highlands
- … but also a lot of opportunities:
  - More than 60 Mio people
  - Only 10% mobile coverage
  - Need for many mobile towers

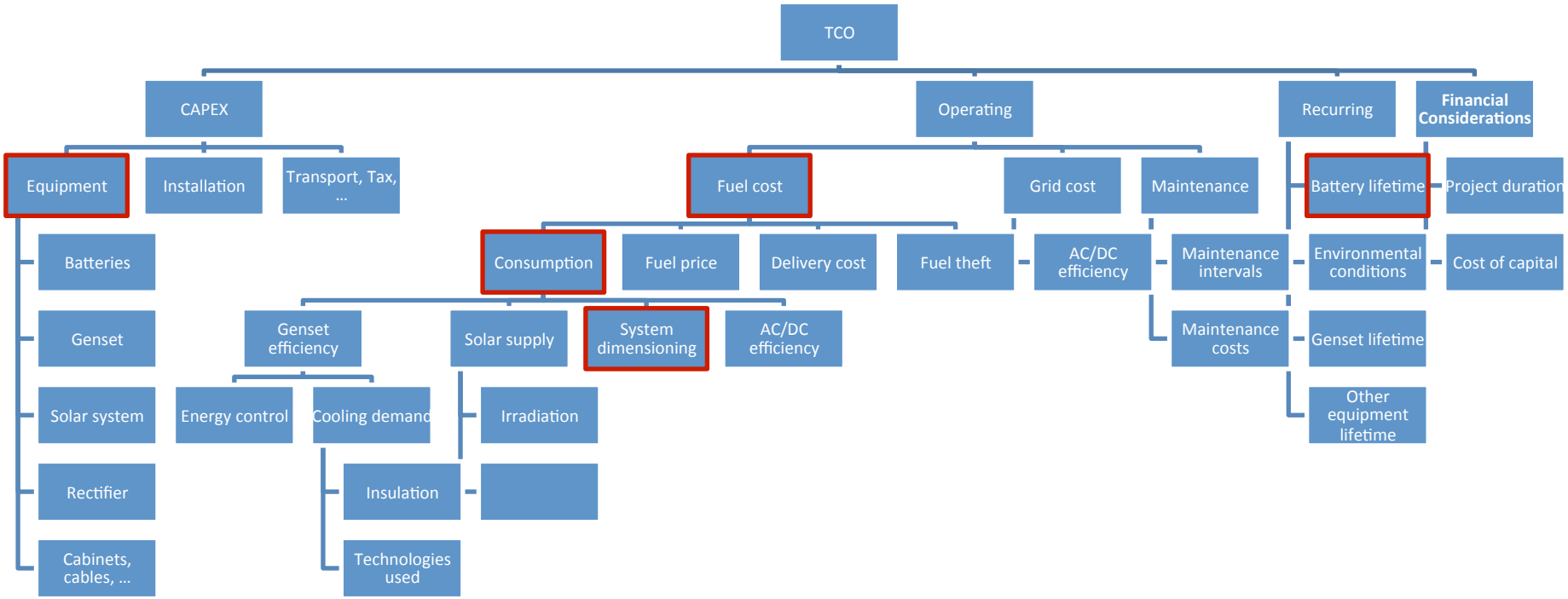
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TCO Considerations for Telecom Power Solutions

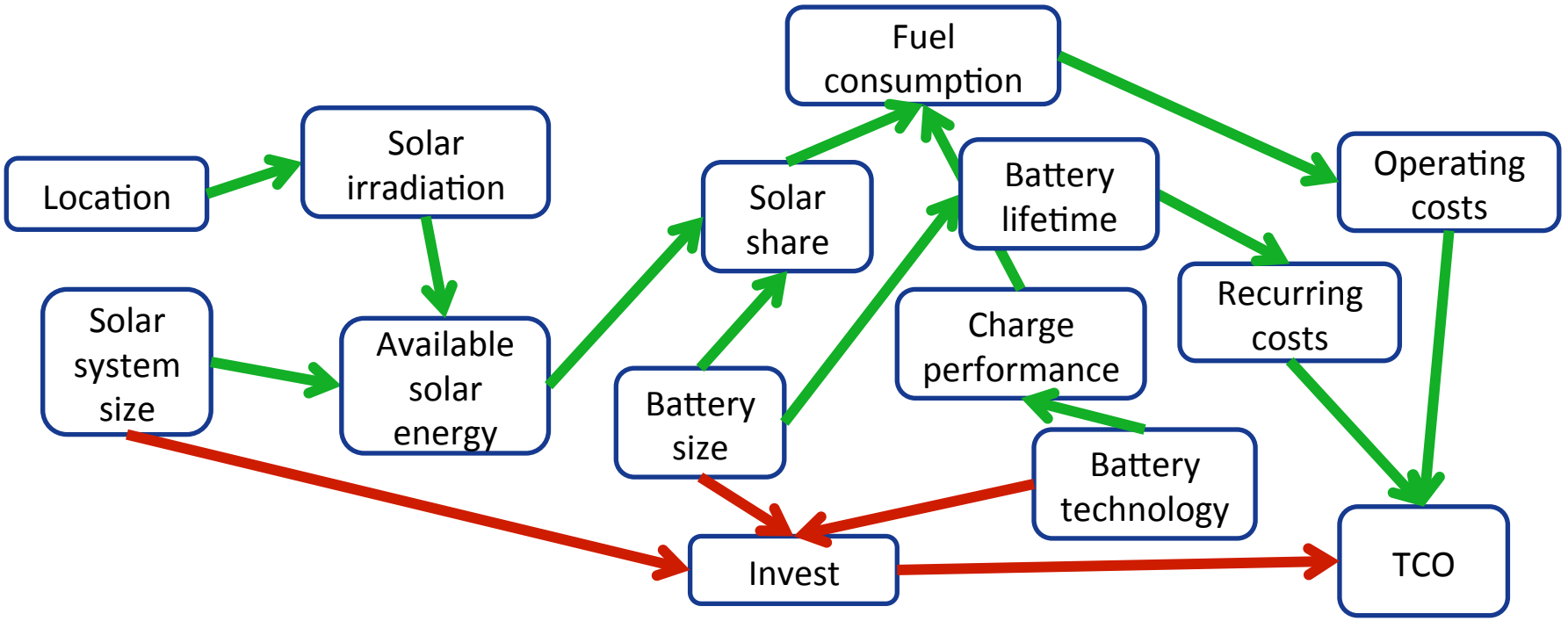


Life Cycle Cost or Total Cost of Ownership (TCO)

- TCO = CAPEX + OPEX + Financing cost + others
- Influencing factors are complex and mostly interdepending
- TCO can be optimized depending on schedule of consideration and may result in different power solutions



Interdependencies in TCO

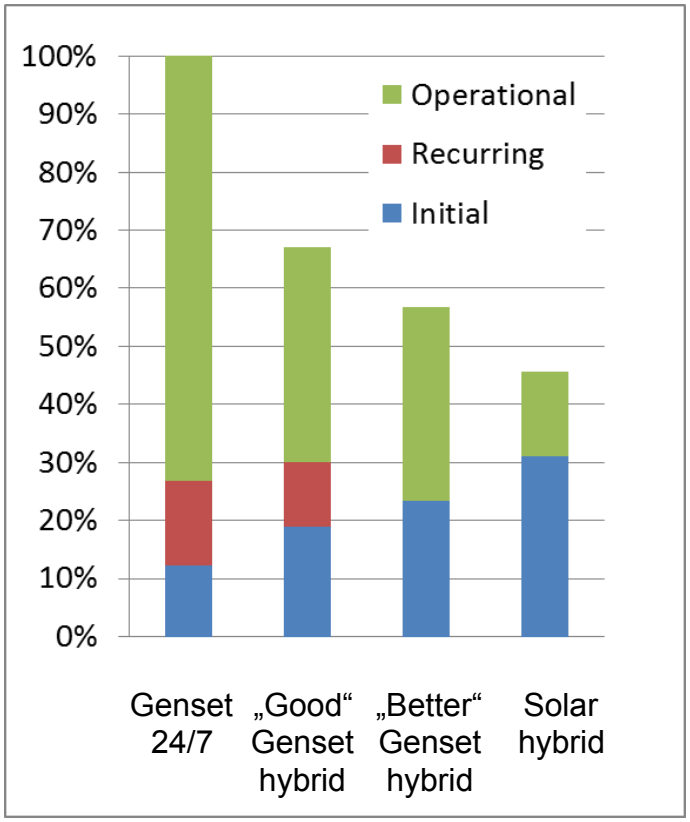


- TCO is determined by a lot of influences and interdependencies
- Several of them are non-linear
- Understanding and quantifying at least the most important factors is crucial for system optimization
- Simulations can reflect the complexity of the system influences
  - Homer / Proprietary dedicated tools

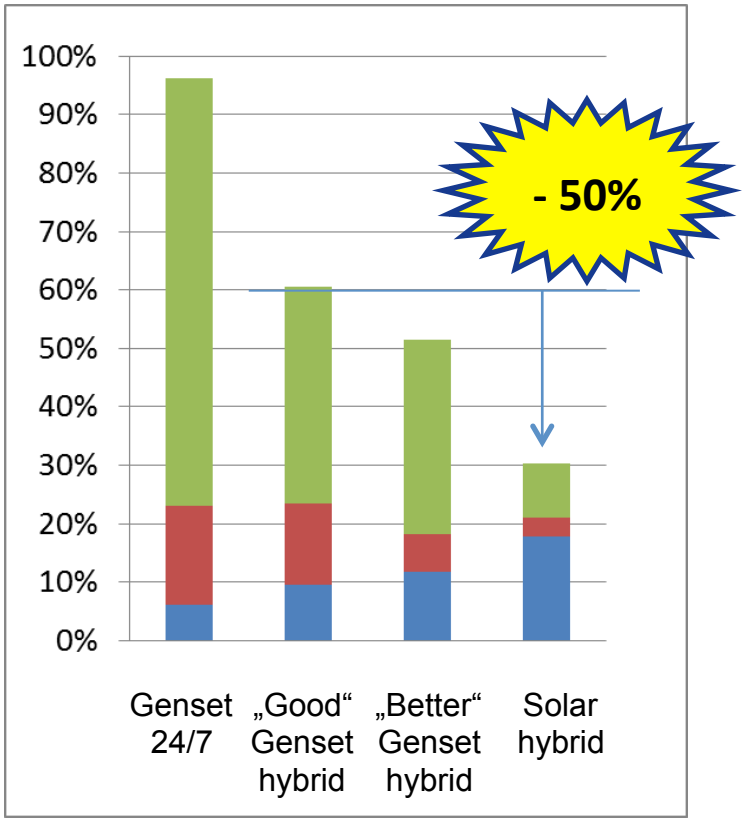
Significant Cost Savings by Optimized Solution Engineering

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- **5 years**



- **10 years**



- Mostly OPEX is determining total cost
- Higher CAPEX for optimized solutions pays back in lower OPEX which is more significant than others
- Solar can further reduce cost

Battery Considerations

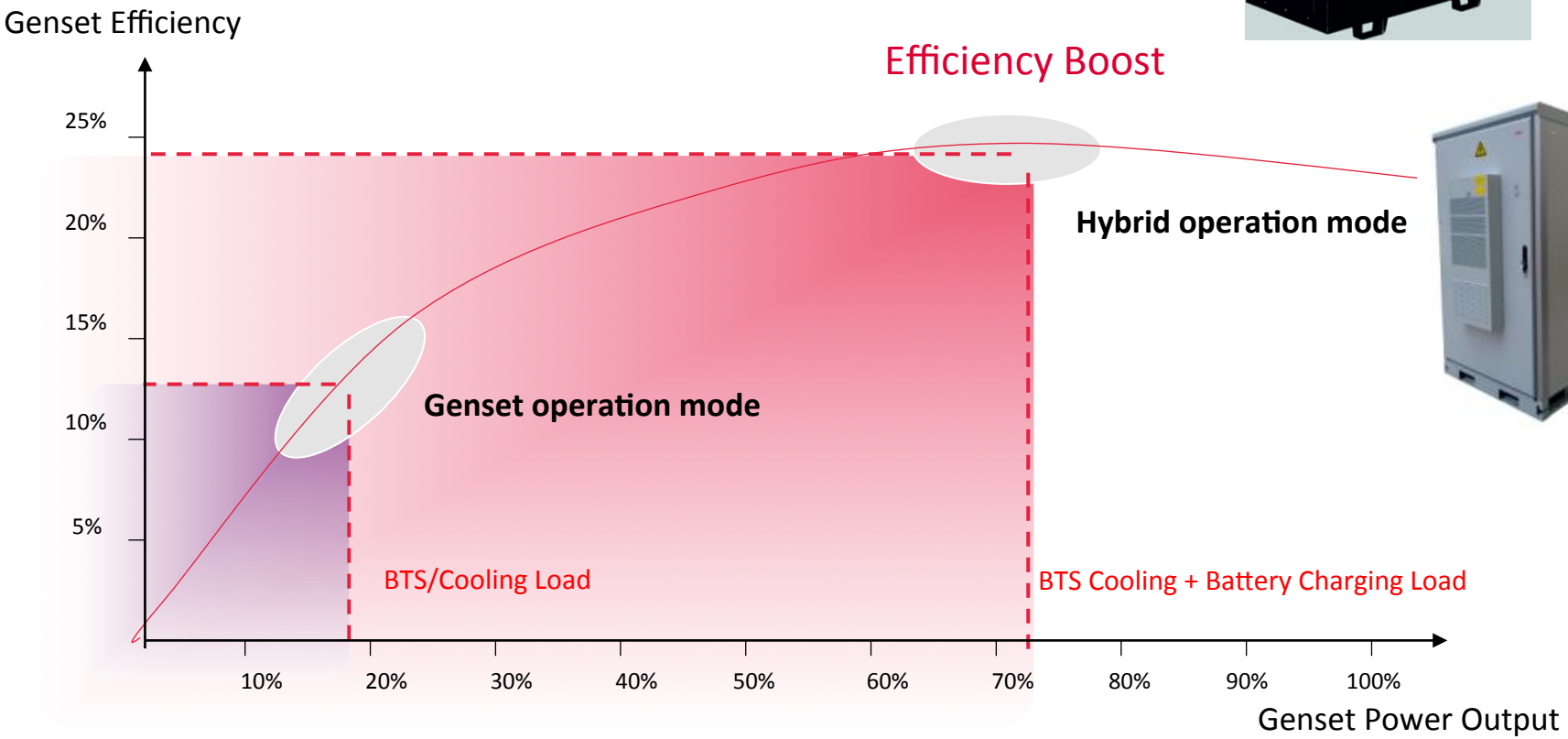


Genset Efficiency

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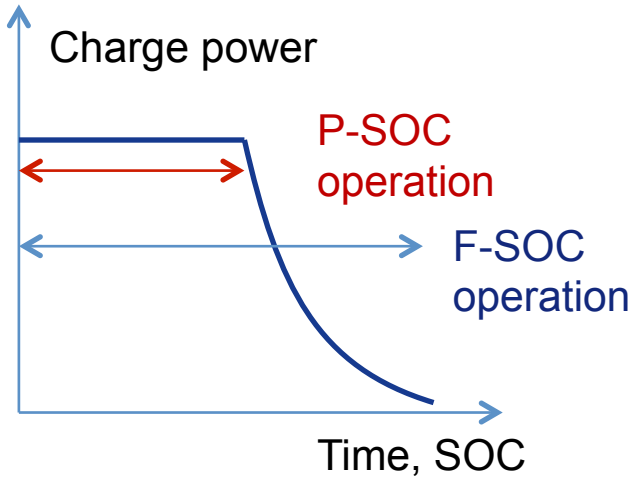
- Boosted efficiency of a Genset in hybrid operation mode

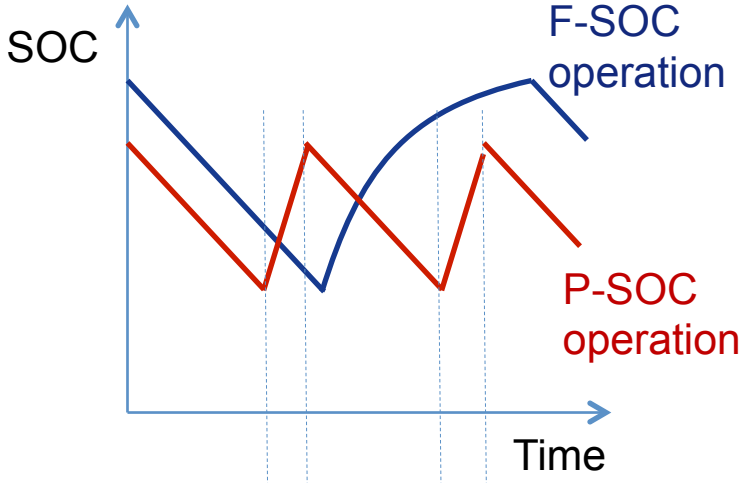


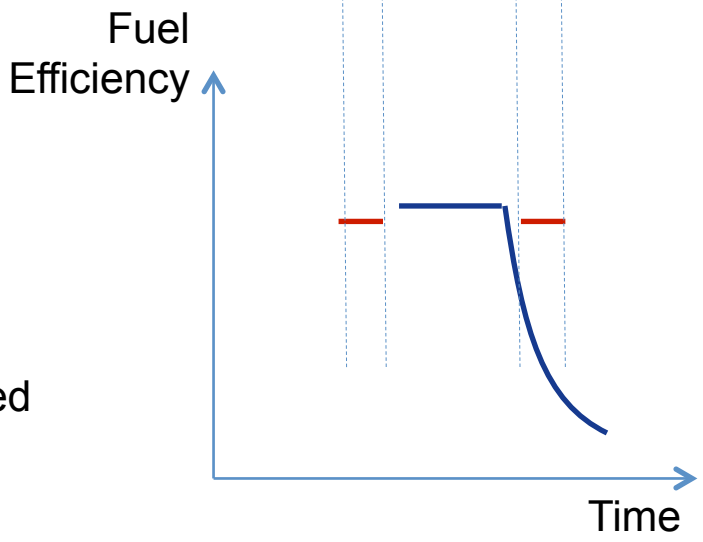


Making your Battery Choice Right

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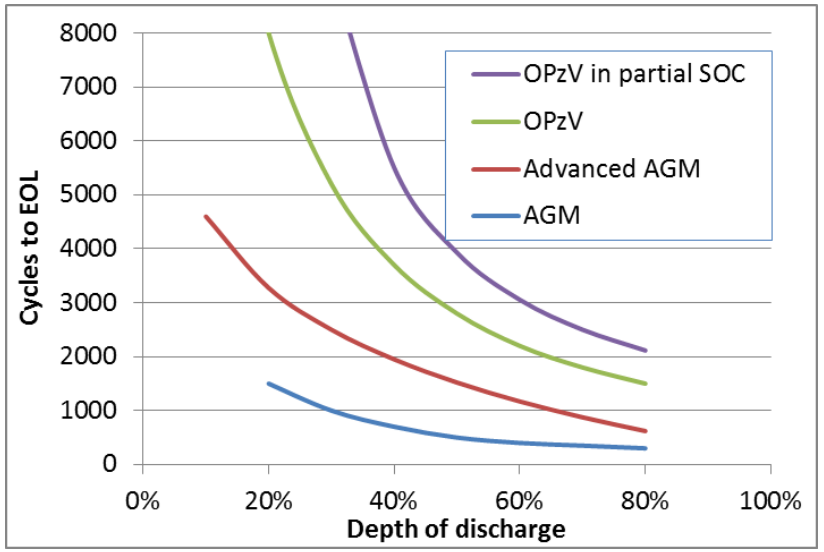


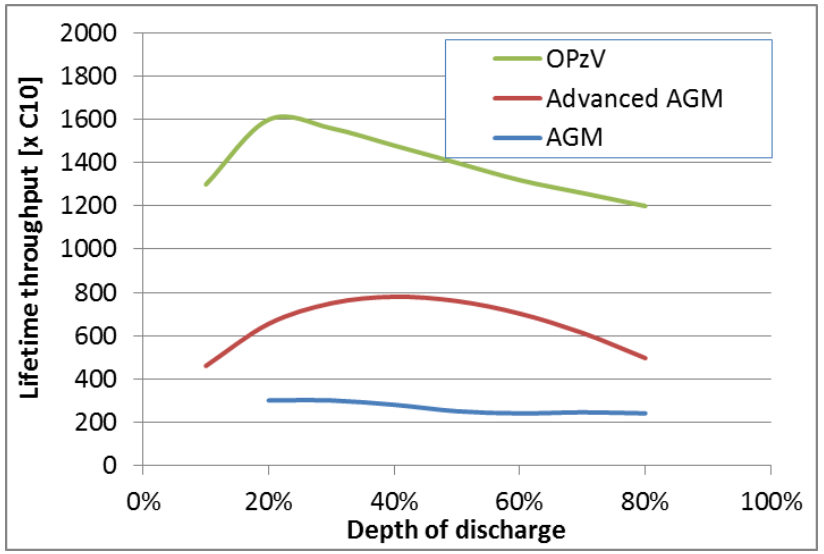
- Partial SOC operation allows for highest fuel efficiency
- Batteries requiring frequent full recharge will reduce efficiency
- Partial SOC operation is usually not qualified through supplier testing
  →internal qualification is mandatory

Battery lifetime and Selection Criteria

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- Cost of energy stored is one of the key factors in energy cost $/kWh
- Main TCO contributors for the batteries are Capex, Lifetime, Charge performance
- Selection criteria for battery technology & models are:
  - Cycles to EOL
  - Charge performance (charge rate and SOC-regime)
- Even including cooling power demand, high-quality OPzV batteries usually result in lowest TCO



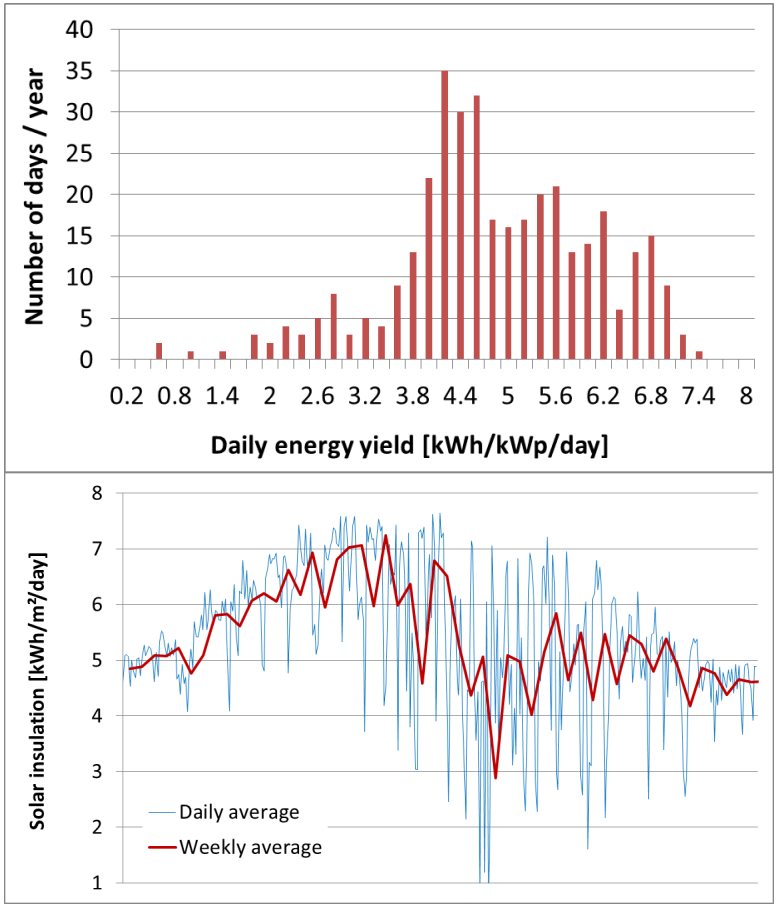


Solar - Free Energy utilized



Solar - Free Energy utilized

- Solar system offer another degree of freedom in system design:
  - Batteries, solar system, genset & rectifier must match in size
- Detailled and time-resolved irradiation data are the basis for any calculations:
  - Daily variations / Annual variations
- 3 sunny days followed by 3 cloudy days require a different dimensioning and results in different TCO than 144 average hours
  - However, in system dimensioning, average values are widely used

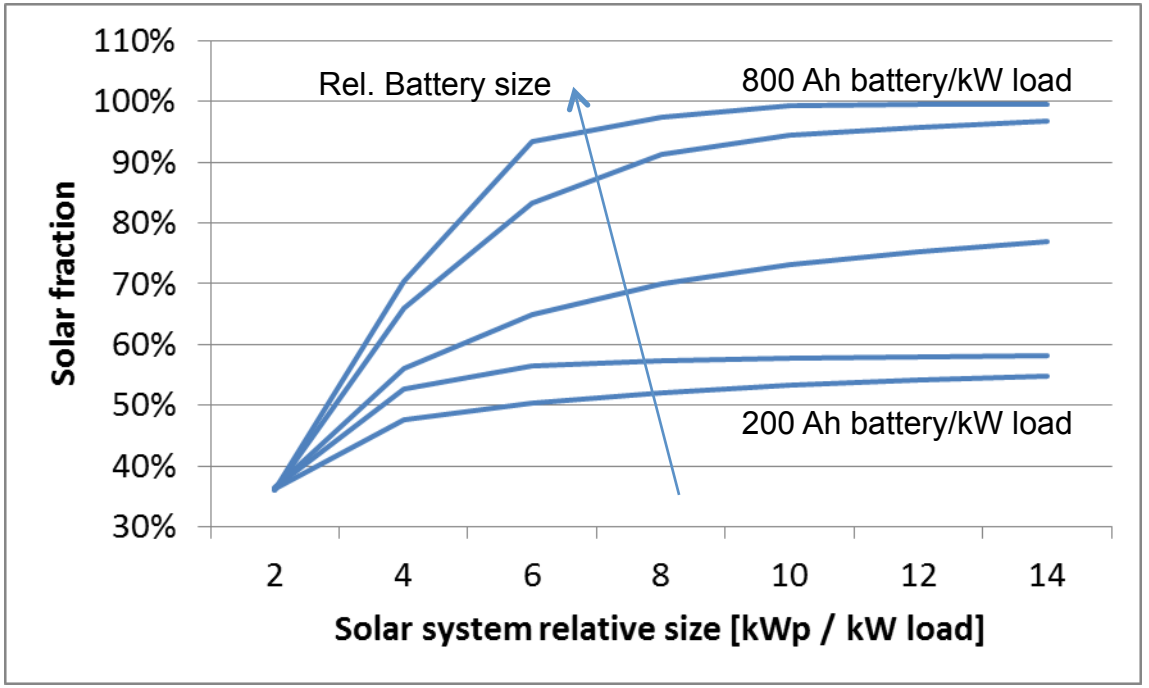


Solar insulation data for Mandalay (MeteoNorm 7)

Storage of Solar Energy

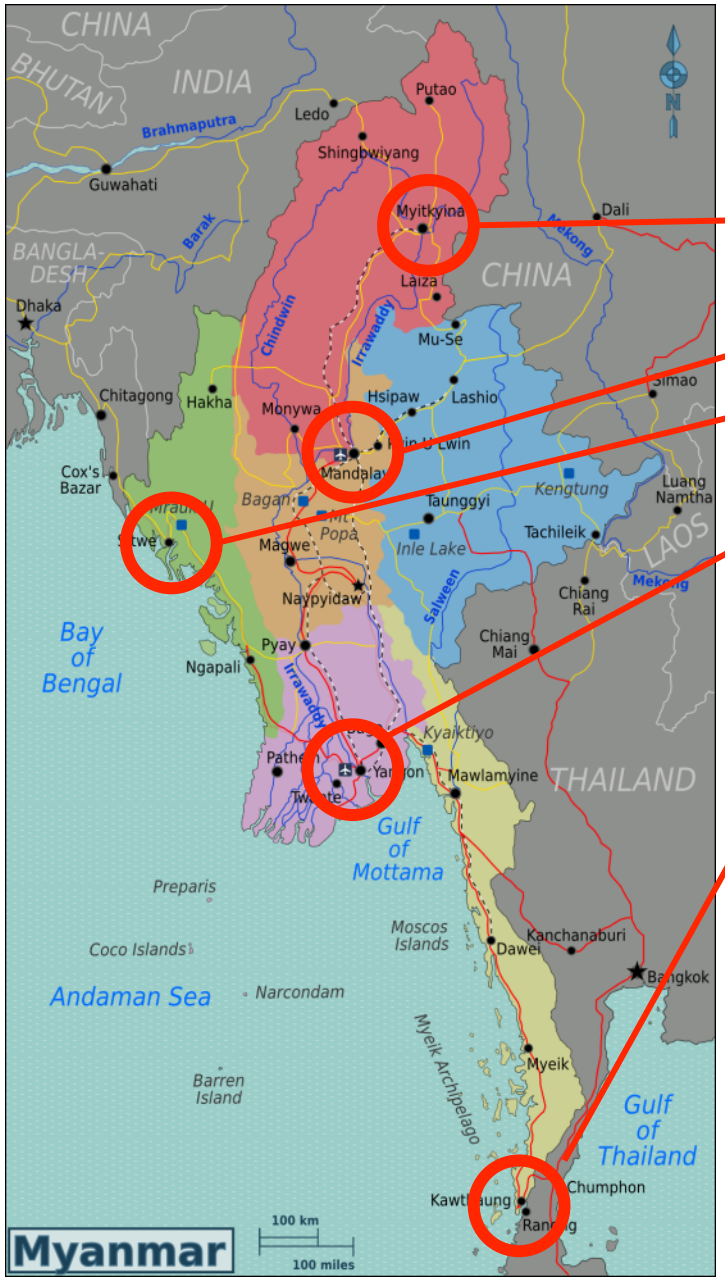
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- To maximize usage of solar energy, the capacity of a battery is crucial
- Solar system and battery capacity must be jointly optimized
- Detailled simulation is highly recommended
- In order to keep cost for batteries and solar panels appropriate a GS backup is mostly recommended



Solar Contribution Across the Country Suitable for Power

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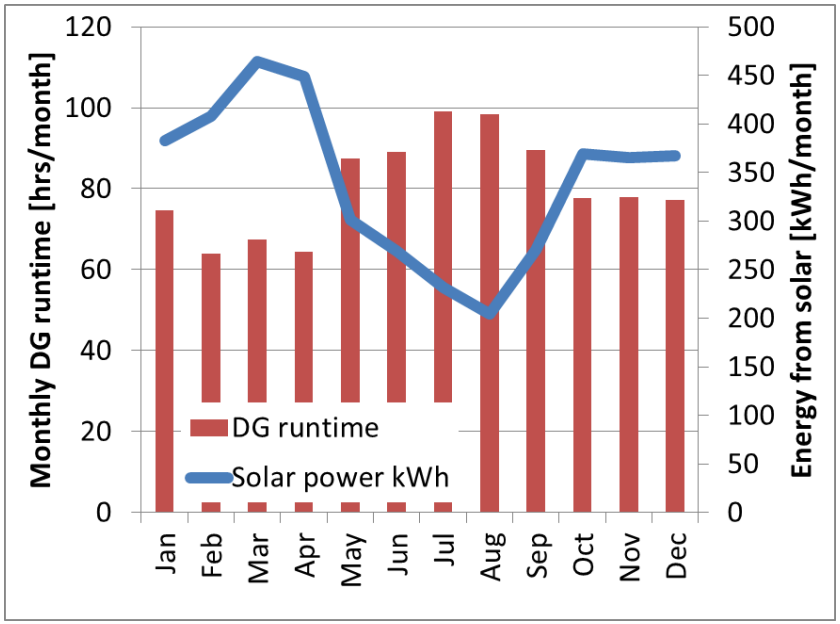
Mytkyina: 4.5 kWh/m²/d

Mandalay: 5.4 kWh/m²/d

Sittwe: 5.3 kWh/m²/d

Yangon: 4.4 kWh/m²/d

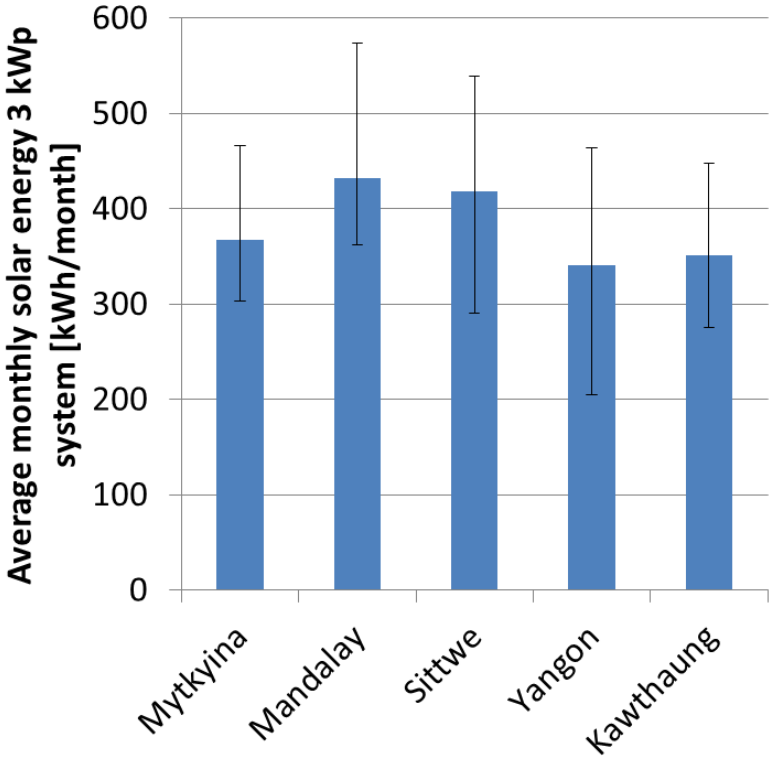
Kawthaung: 4.6 kWh/m²/d

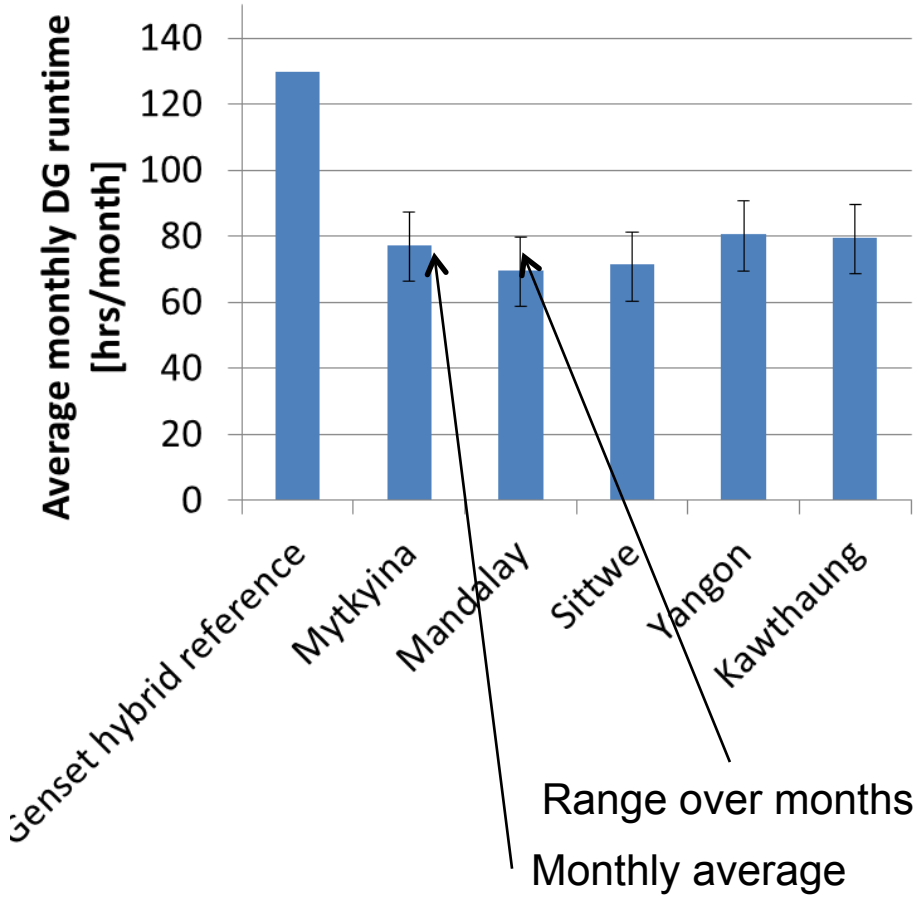


www.worldofmaps.net

Mandalay

Solar Production at Sites





- Seasonal variations (rain/dry season) exist, but are moderate
- Monthly average of solar energy of best vs worst month is 2:1

Remote Energy Management Systems and Site Transparency



Remote EM Systems – Site Transparency in NOC

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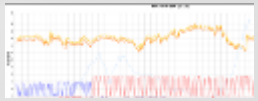
Maintenance On Demand | Asset (Health) Management | System Uptime | Fuel Management | Alarm Tracking | SLA/Performance Management

Enables Smart Operations Features

Presentation Layer



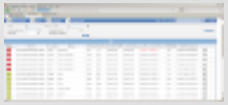
Dashboard Monitoring



Report Analytics



SMS Alarms



Integrated Incident Management



Automated Event Management

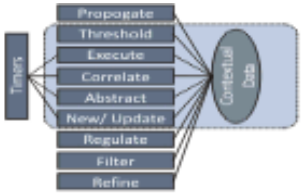
Evaluation Layer



Server



Database



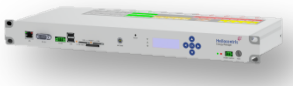
Correlation Engine



Analyst

Data Source Layer

GPRS (UMTS)
Ethernet



Site 1 (EM)



Site 2 (EM)

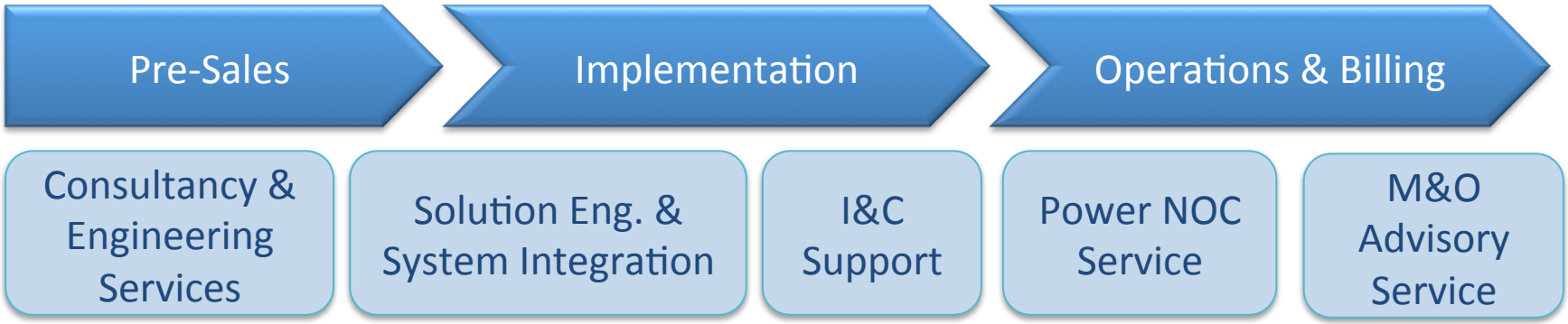


Site XXX (EM)

Summary

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- Power systems can be engineered for high efficiency and high availability
- Use of free renewable energies reduces overall cost for power
- Selection of power components needs to fit the overall solution
- To enable lowest TCO - Managed Power Solutions should be considered from Solution engineering all the way to smart operations
- Managed Power Solutions improve reliability and uptime, reduce maintenance effort and operational cost



Thank you

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