



Performance Monitoring and Evaluation of Mini Grids- A case study of Tsumkwe and Gam

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PRESENTATION OUTLINE



Preface

Sites overview

Operation regime

Performance Monitoring and Evaluation

Conclusion

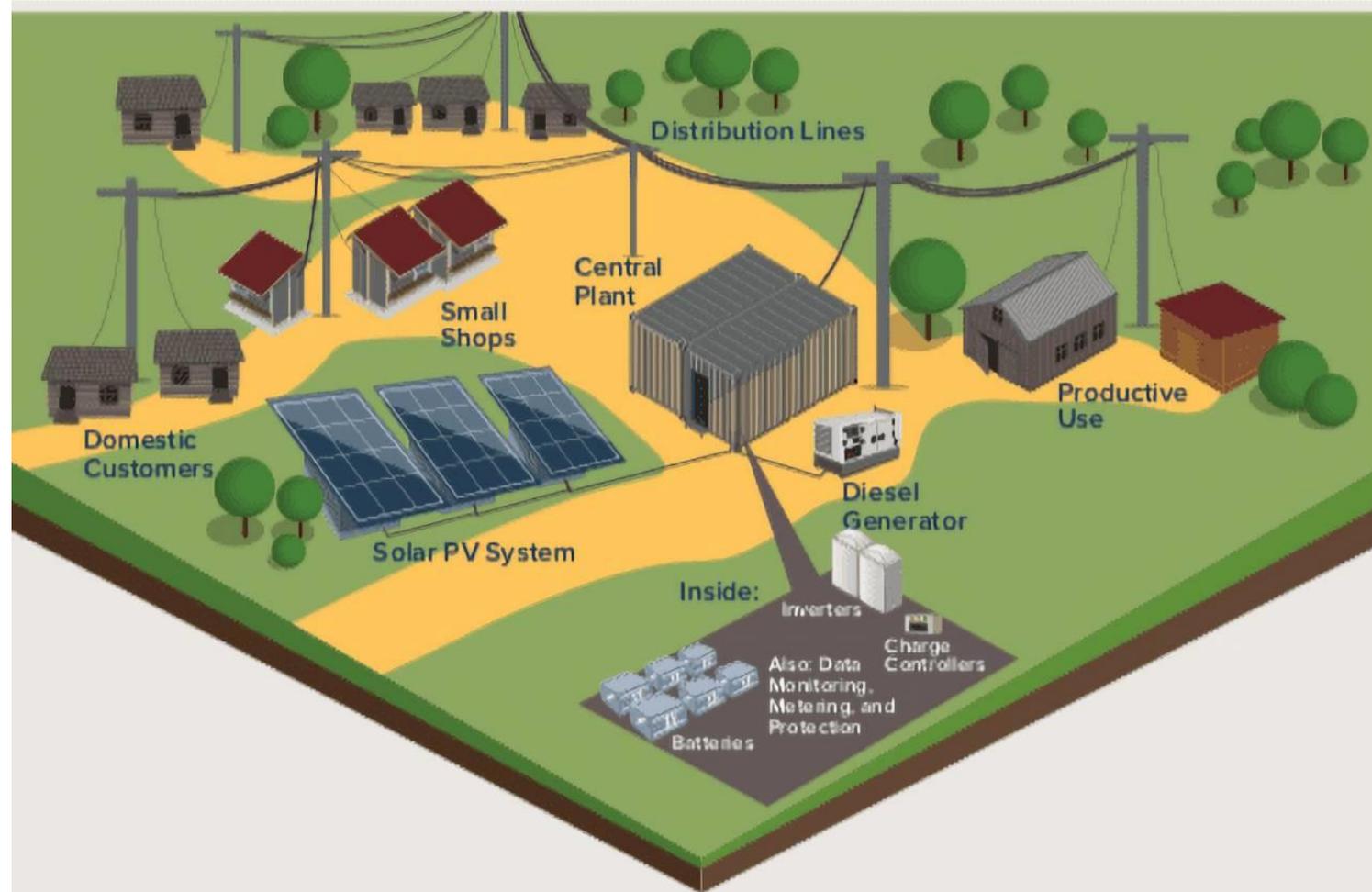
PREFACE

What is Mini Grid?

- A mini-grid refers to a localized electricity distribution network that operates independently from the national transmission grid.
- It involves one or more small-scale electricity generation units or micro-sources, such as photovoltaic (PV), generators, and energy storage systems (batteries).
- They supply electricity to a diverse range of customers, including households, businesses and semi industrial facilities at grid quality level.

PREFACE cont...

MINI GRID STRUCTURE



SITES OVERVIEW



Tsumkwe Plant



Battery Room



Gam Plant



SITES OVERVIEW cont...



TSUMKWE:

- Solar/Diesel Hybrid System
- 300 kWp, made up of 1302 panels rated @ 230W
- 3 MWh Battery Storage
- 300 kVA Scania Genset
- 2 x Step-Up transformers (160 and 315 kVA)
- 16 Distribution transformers of varying sizes

Serving: 405 Household, 11
Institutions & 46 Businesses



SITES OVERVIEW cont...



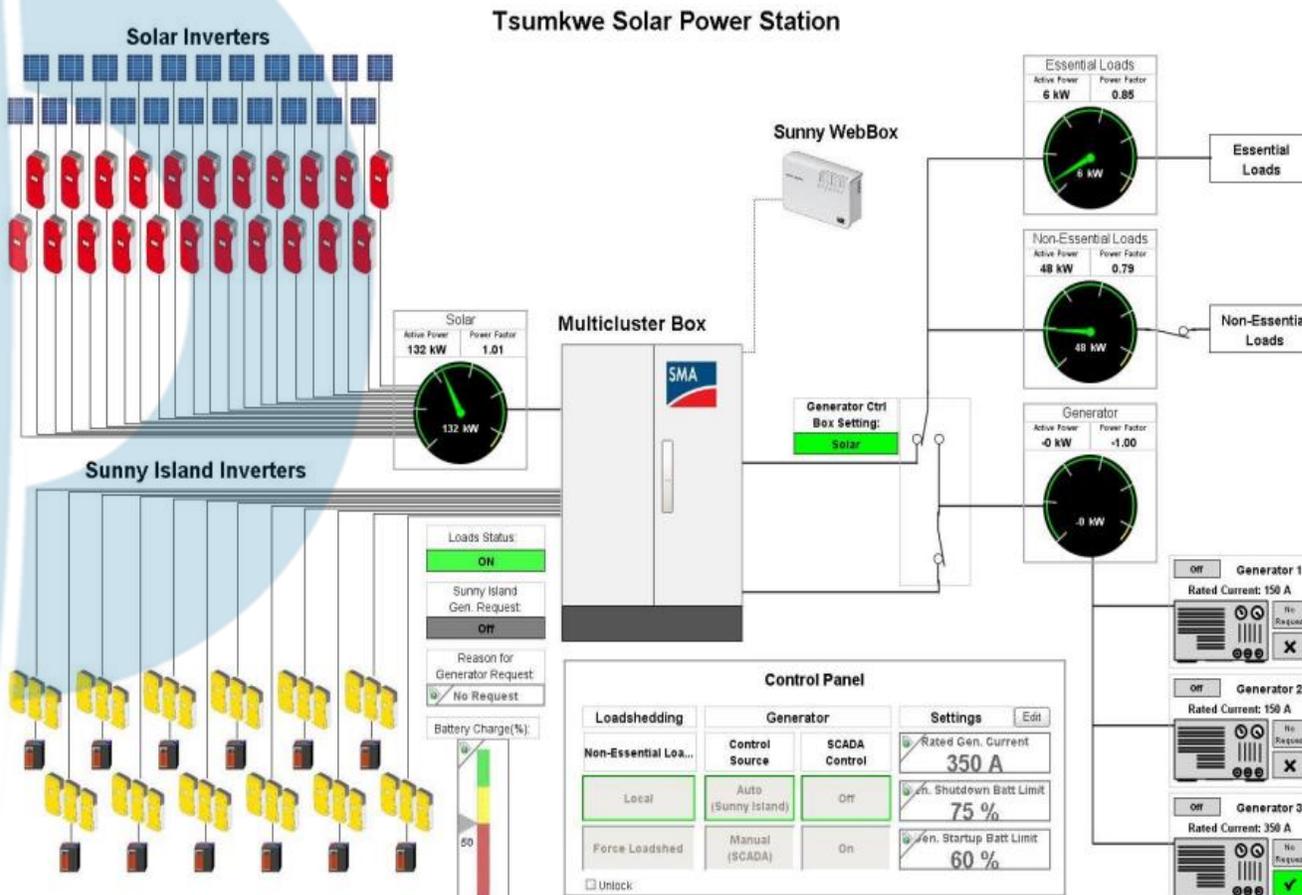
GAM:

- Solar/Diesel Hybrid System
- 292 kWp, made up of 2016 panels rated @140W each
- 2.6 MWh Battery Storage
- 300 kVA Marelli Gensets
- 2 x Step-Up transformers (100 and 315 kVA)
- 10 Distribution transformers of varying sizes

Serving: 639 Households, 5
Institutions & 32 Businesses



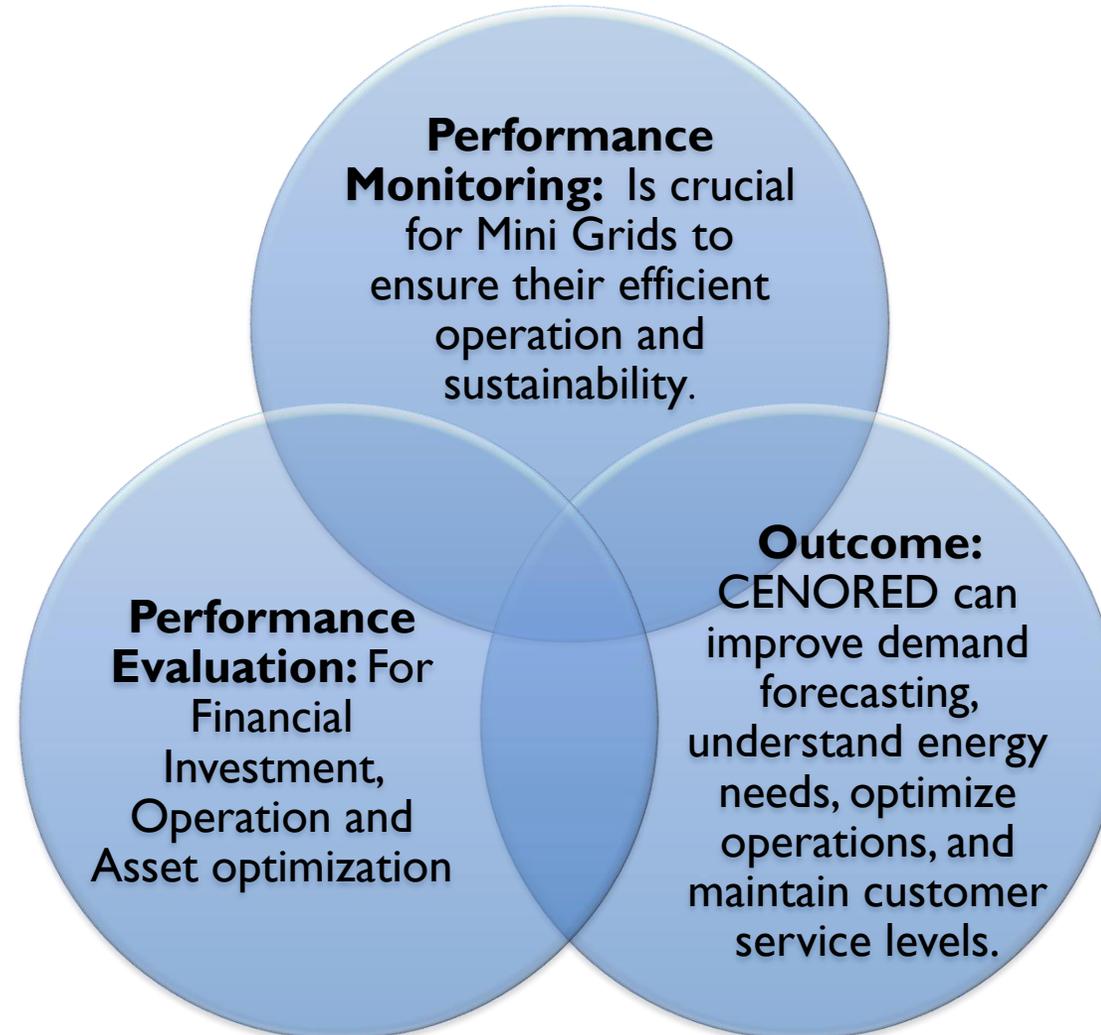
OPERATION REGIME



Areas of commonalities for both sites:

- Two loads classifications: Essential (i.e. hospital, police, communication towers) and Non-essential loads (i.e. domestic).
- Automated charging
- Backup Diesel Generator
- Distribution network at 11 kV

PERFORMANCE MONITORING AND EVALUATION



PERFORMANCE MONITORING

cont...

Monitoring and Evaluating aspects:

- **Environmental, Health, and Safety monitoring:** Visual site inspections, Quality testing, Community feedback mechanism
- **Technical monitoring:** Automated data collection, manual data collection, comparisons and baselines
- **Financial monitoring:** Budget tracking, cost-effectiveness analysis, cash flow management

PERFORMANCE MONITORING

cont...

Automated
Data Recording
Instruments

Energy
System

Energy Management Systems: This system automatically collect data on energy production, consumption, and system health

Smart
Metering

➤ Smart Meters: They record electricity usage data and can communicate this information for remote monitoring

String
Inverters

➤ Inverters: Have inbuilt capabilities to track performance and energy output

PERFORMANCE MONITORING

cont...

CENORED uses software platforms for data analysis:

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graph TD; A[CENORED uses software platforms for data analysis:] --- B[ECWIN-Silk software: To analyze data from ELSTER smart meters]; A --- C[ACE Vision: To analyze data from Itron smart meters]
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ECWIN-Silk software: To analyze data from ELSTER smart meters

ACE Vision: To analyze data from Itron smart meters

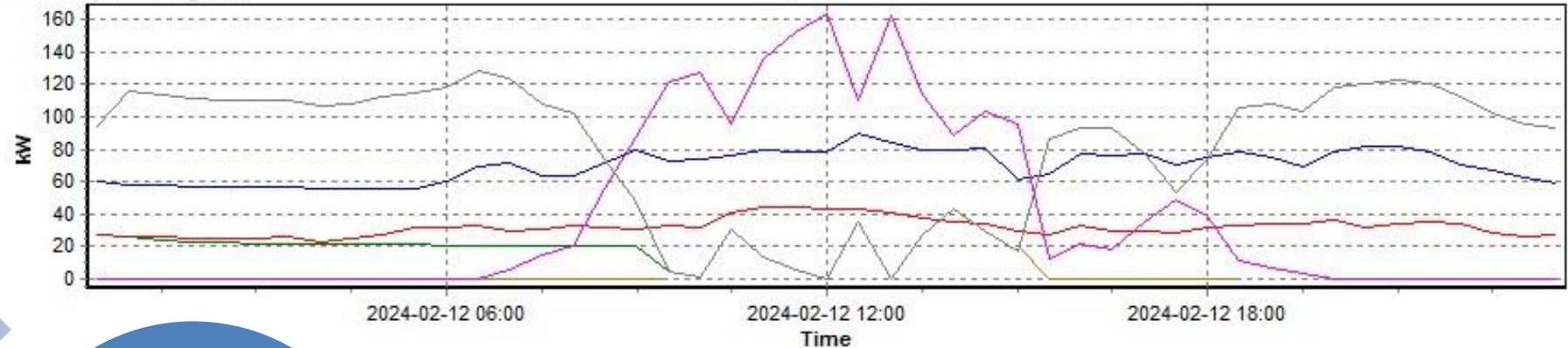
PERFORMANCE MONITORING

cont...

Data Analysis:

ecwin by Powertech System Integrators

Int Period, Standard



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Generation:

Solar production is 163.47kW

From the generator is 128.40kW

From the batteries is 20.32 kW

Diesel: 621L – N\$12 202.65

➤ Why are the batteries not fully charged?

➤ Human factor

➤ High diesel cost

Generator was never switched off. Generator started idling, at Solar peak.

Batteries were barely charged.

System load

Essential and Non-Essential is 134.04kW

Batteries charging at 25.70kW

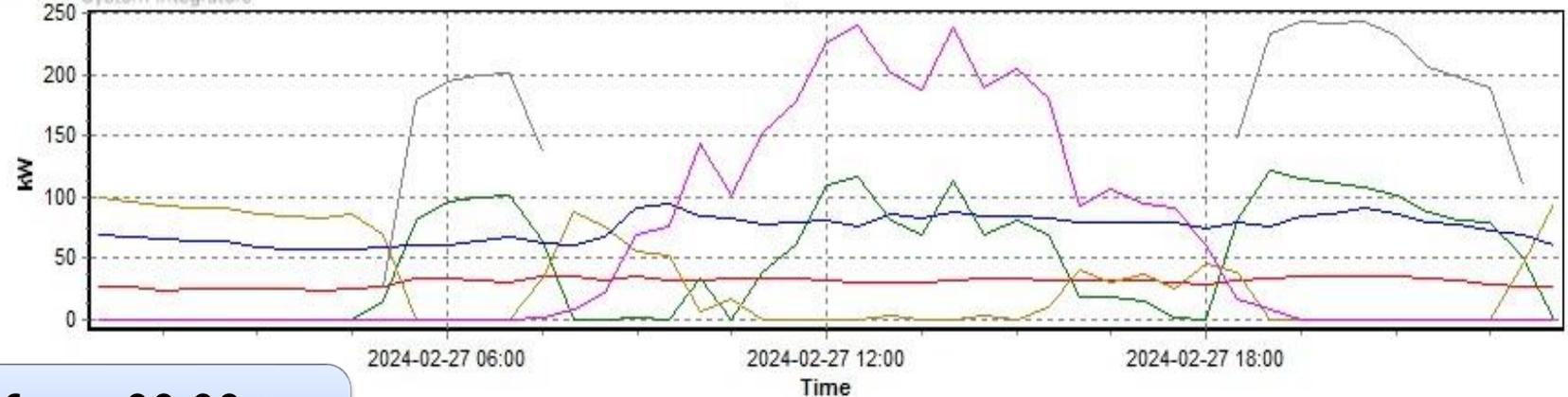
PERFORMANCE MONITORING

cont...

Data Analysis:



Int Period, Standard



On this day, the batteries ran from 00:00 to 05:00. A great performance

During morning peak, the generator ran for 3 hours and evening peak

There was also good production from the solar.

System loads:

**Essential and Non-Essential is 124.20kW
Batteries charging at 130.72kW.**

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Generation:

Solar production is 239.23kW.

From the generator is 243.28kW.

From the batteries is 100.16 kW

Diesel: 400L – N\$ 7860

Saved: N\$ 4342.65 ~ N\$ 130 279.50/month

Conclusion

Legacy system :

- ❖ System Design and Capacity Limits
- ❖ Integration with SCADA Software
- ❖ Manual Operation regime
- ❖ High diesel usage by the Generator
- ❖ Utilities need to invest in the right monitoring Technology
- ❖ Remote operation can reduce overheads
- ❖ Training on monitoring systems and operations



Thank you for your participation