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Out of sight, out of mind:

The importance of remote monitoring for off-grid and mini-grid energy systems

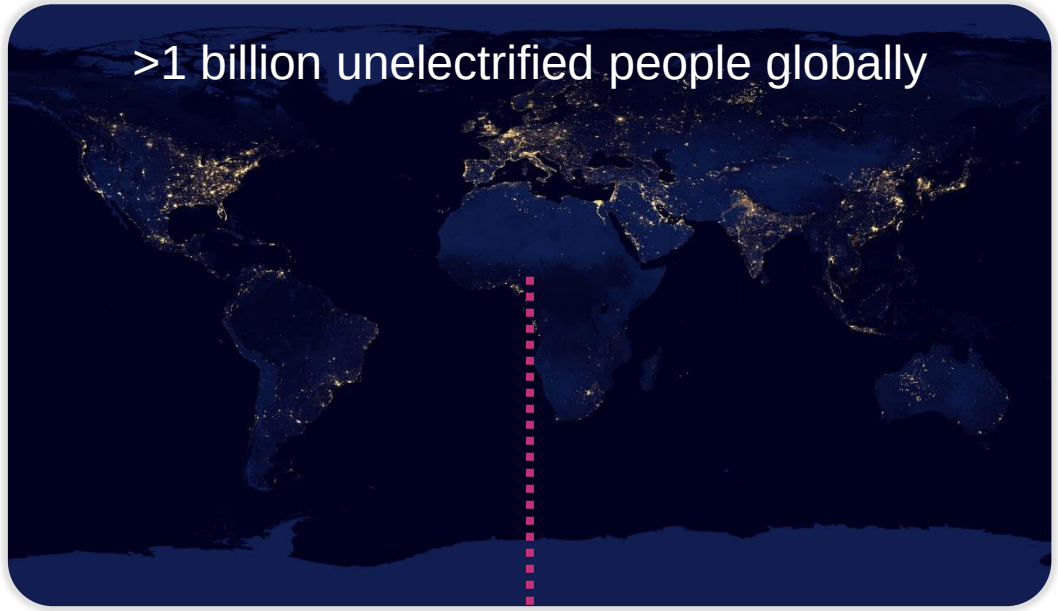
Stine Carlé | Co-founder and VP Business Development

CESP Mini-grid Workshop | 14 November 2018

Outline

- Introduction
- The impact of remote monitoring
- Operational improvement case studies
- Broadening the scope of value
- Examples from AMMP monitoring platform

Bridging the energy access gap is operationally challenging



Increasingly served by off-grid renewable energy systems

Yet running these systems is operationally challenging

Complex systems with sensitive components

Remote sites difficult to access

Lack of near-site technical skills

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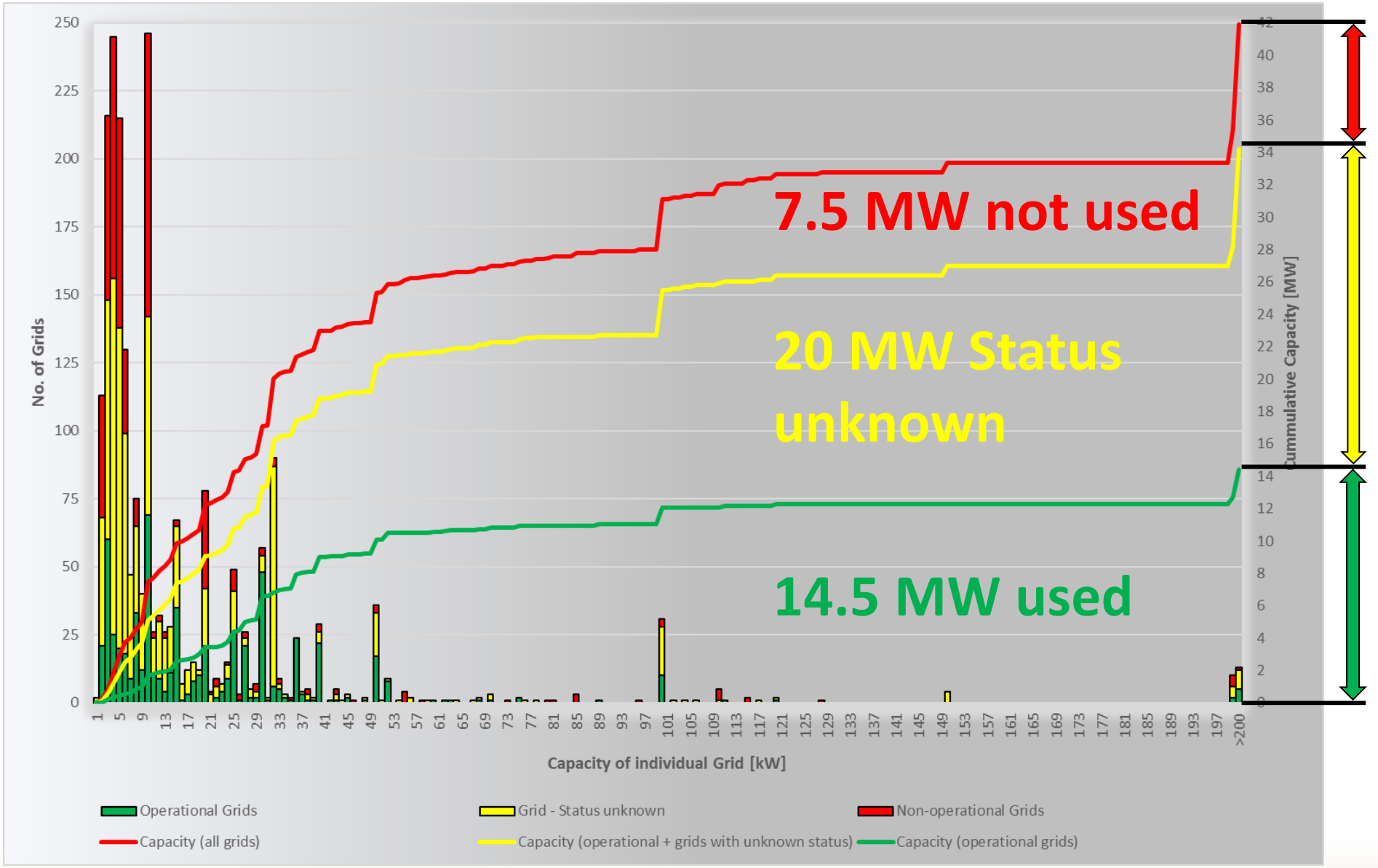
From: Dr. Harald Richter, *Are Mini-grids instrumental in fostering development in India?*, 16 Oct 2018



Effective remote monitoring and management are increasingly within reach, and can have major impact

Owner or operator of off-grid systems

~30% operational cost reduction

Fewer site trips

Longer component lifetime

Improved performance

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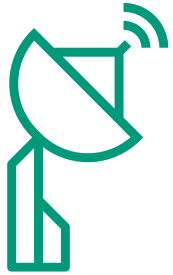
Key drivers of availability of remote monitoring



- Mobile connectivity—and mobile data—increasingly available in remote areas
- Satellite connections increasingly affordable (e.g. ~$50-100/month)

- Availability of data interfaces on inverter systems improving
- In some cases direct cloud connections/online portals

Barriers:

- Not always easy to set up reliable connection
- Lack of standardization of data interfaces across vendors

For effective monitoring, need to acquire data from multiple vendors and device types

Schneider Electric · SMA · victron energy BLUE POWER · SPARKMETER · steama.co · ODYSSEY

OFF-GRID ENERGY SYSTEMS

On-site gateway or API connection

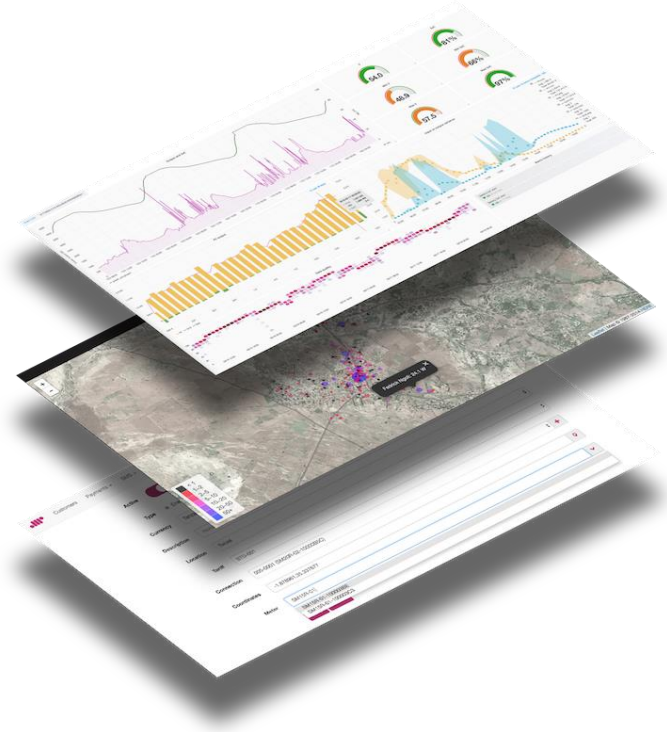
API

Cloud storage and data pipeline

Asset management portal

Machine learning analytics and alerting engine

USER INTERFACES



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The platform contains a rich set of features to assist with streamlining asset operations

Data visualization

High quality time-series data visualization

Remote meter controls

For advanced demand side management

Asset portfolio monitoring

Algorithms based on more than 30 performance indicators

KPI reporting

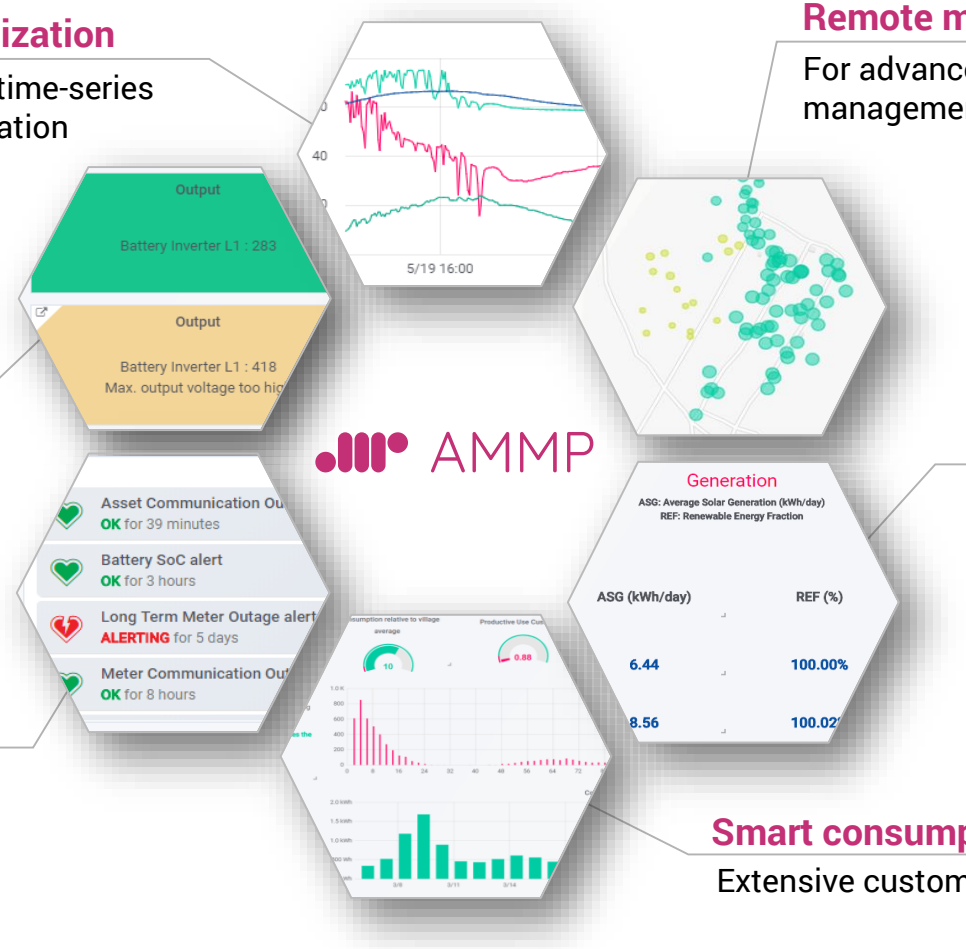
Identification of long-term trends

Dynamic alerting

SMS/e-mail based for fast response times

Smart consumption analytics

Extensive customer insights



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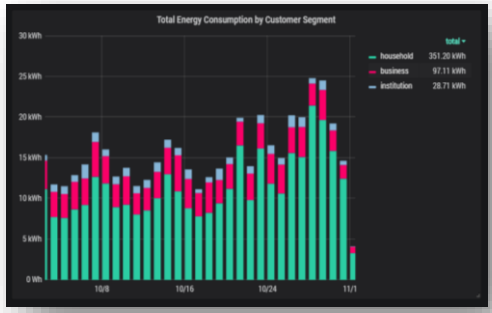
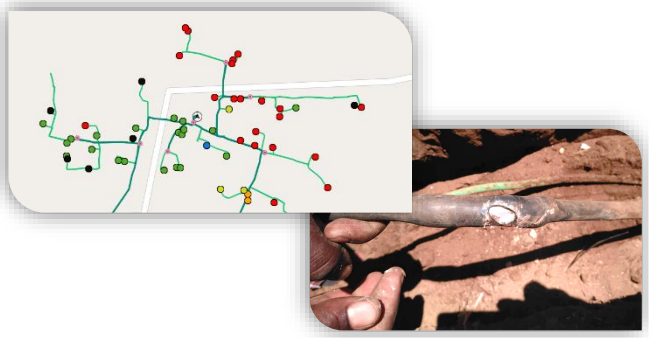
AMMP creates business value instead of just gathering data

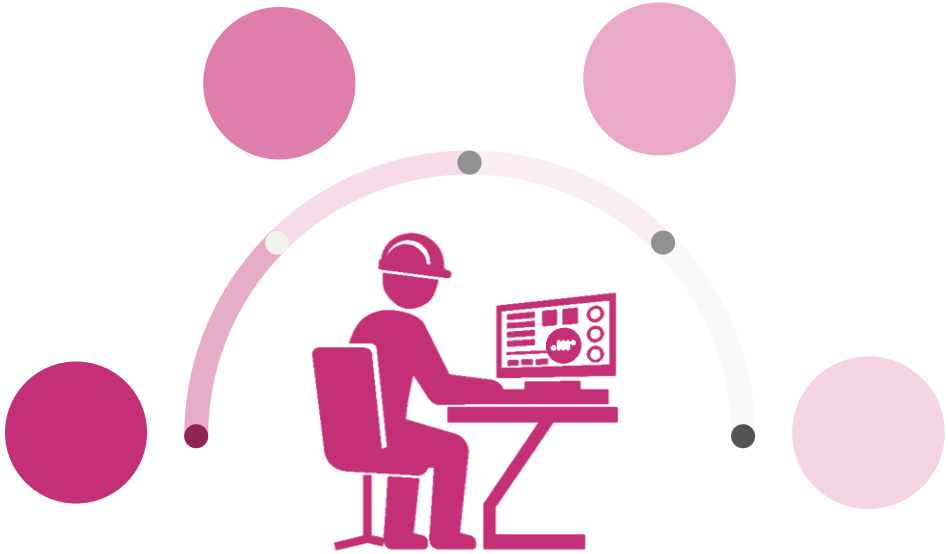
Higher end-customer satisfaction ***through better customers service***



Reduction in system design costs ***through improved load estimations and system benchmarking***



Reduction of O&M costs ***through system monitoring***



More transparency for project stakeholders and financiers ***through automated reports***

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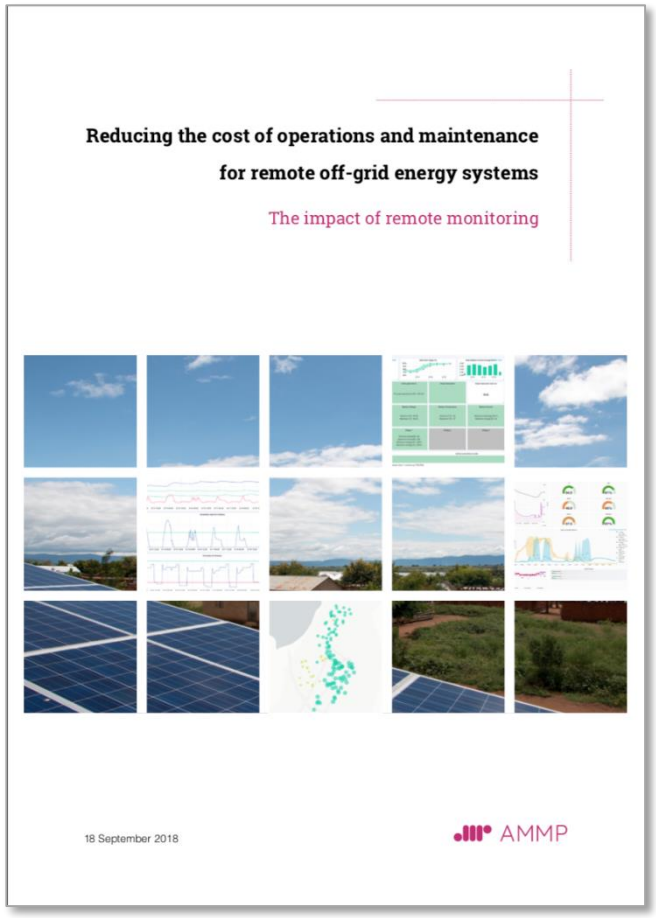
Recently published white paper on impact of remote monitoring



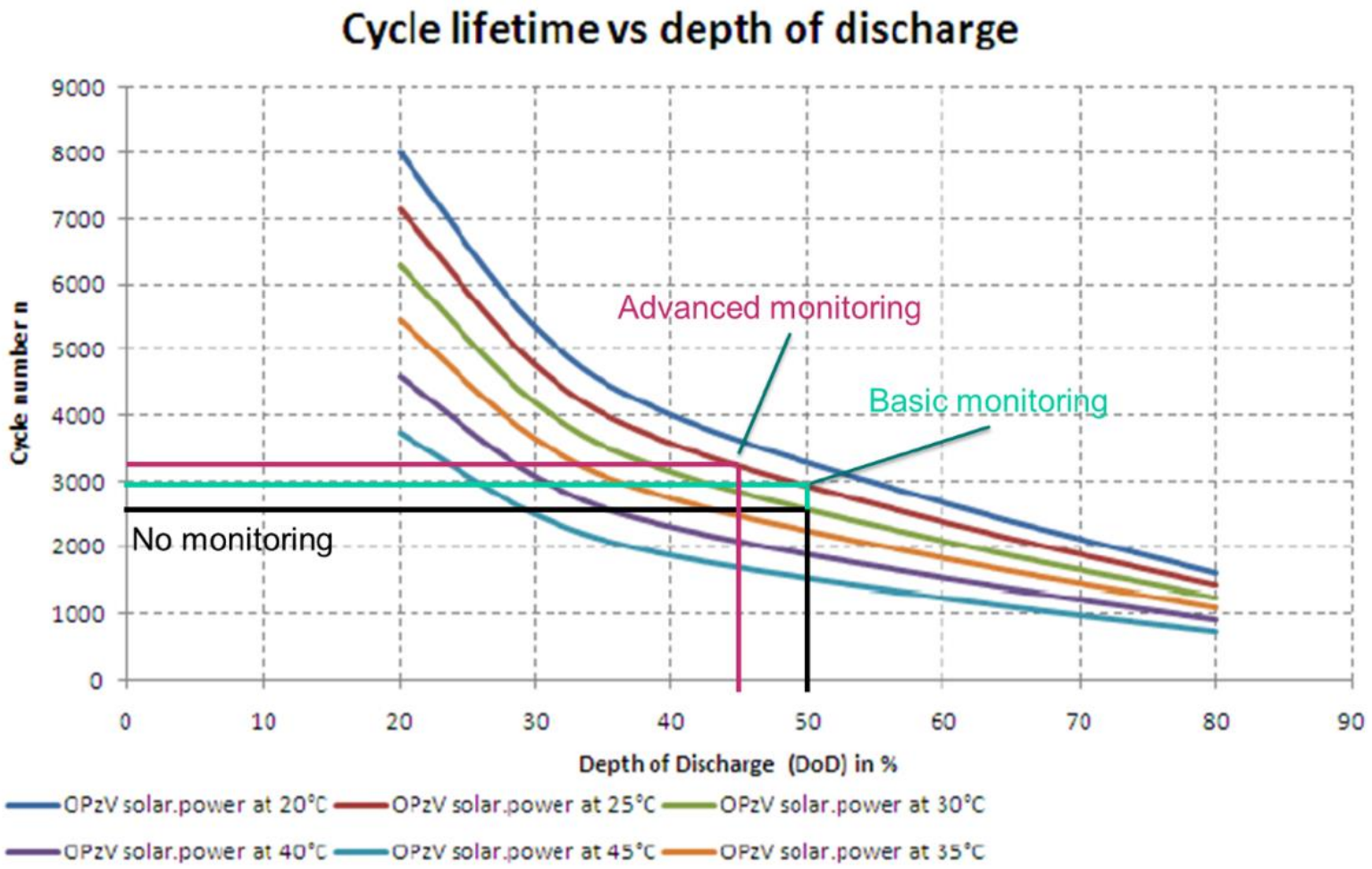
Reducing the cost of operations and maintenance for remote off-grid systems —*The impact of remote monitoring*

- Impact analysis based on Rafiki Power grids in Tanzania
- Assessed impact on three O&M cost components:
  - **Labor** (44% of costs; **20–45%** saving)
  - **Logistics** (30% of costs; **10-20%** saving)
  - **Component replacement** (26% of costs; **10–20%** saving)

→ Overall: **15–30% of O&M costs saved**

https://www.ammp.io/remote-monitoring-cost-reduction/

Impact on component replacement costs driven by battery lifetime



- Operating temperature reduction of 5°C extends lifetime by 10%
- Reducing average depth of discharge by 5% extends lifetime by 10%

- 10–20% benefit overall

Source: Hoppecke installation, commissioning and operating manual

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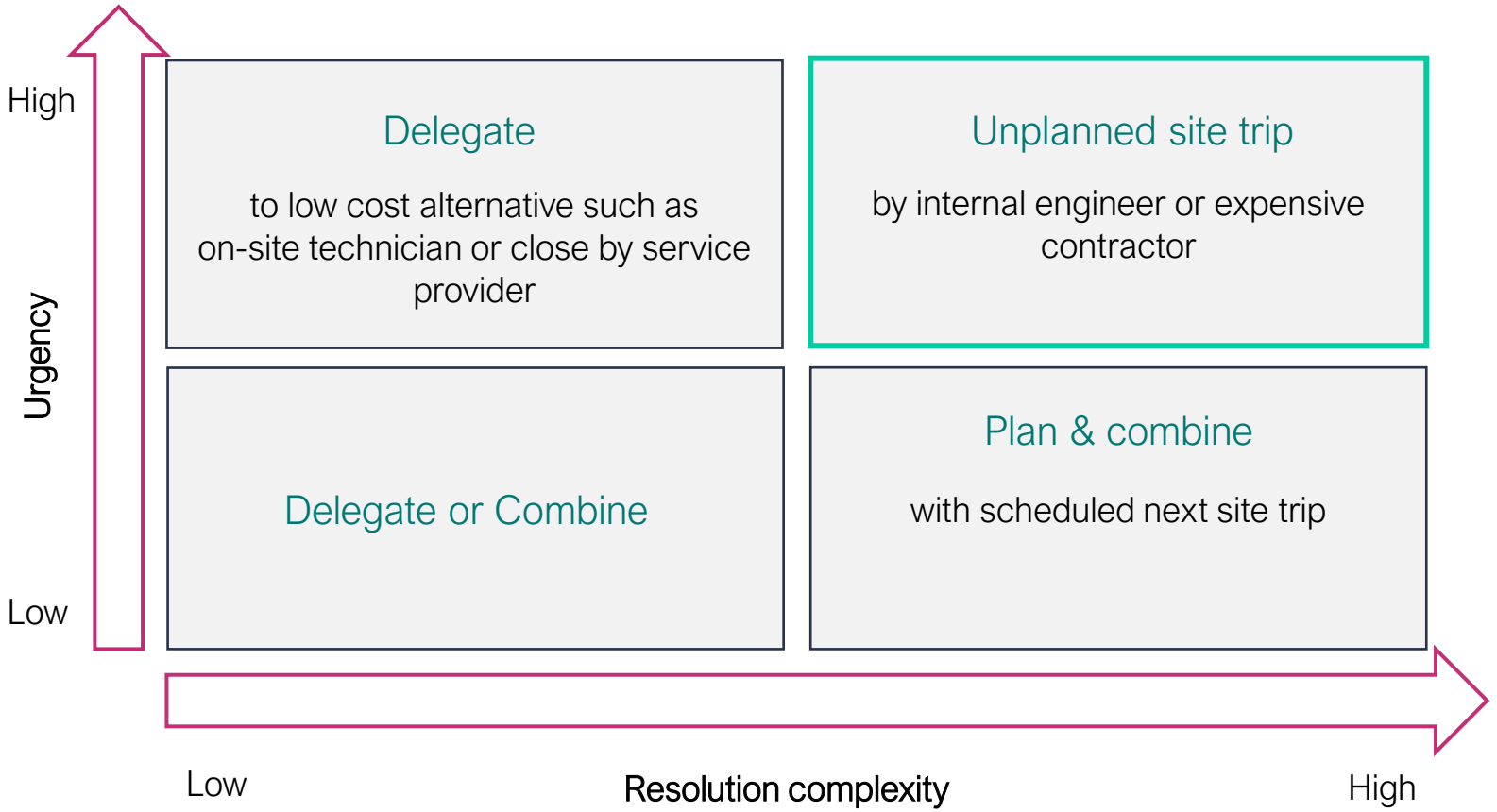
Logistics costs reduced by cutting down technical site trips



- Enhanced remote analysis and troubleshooting of issues
- Possible to delegate to local tech
- Can intervene remotely to set operating parameters

10–20% site trips avoided

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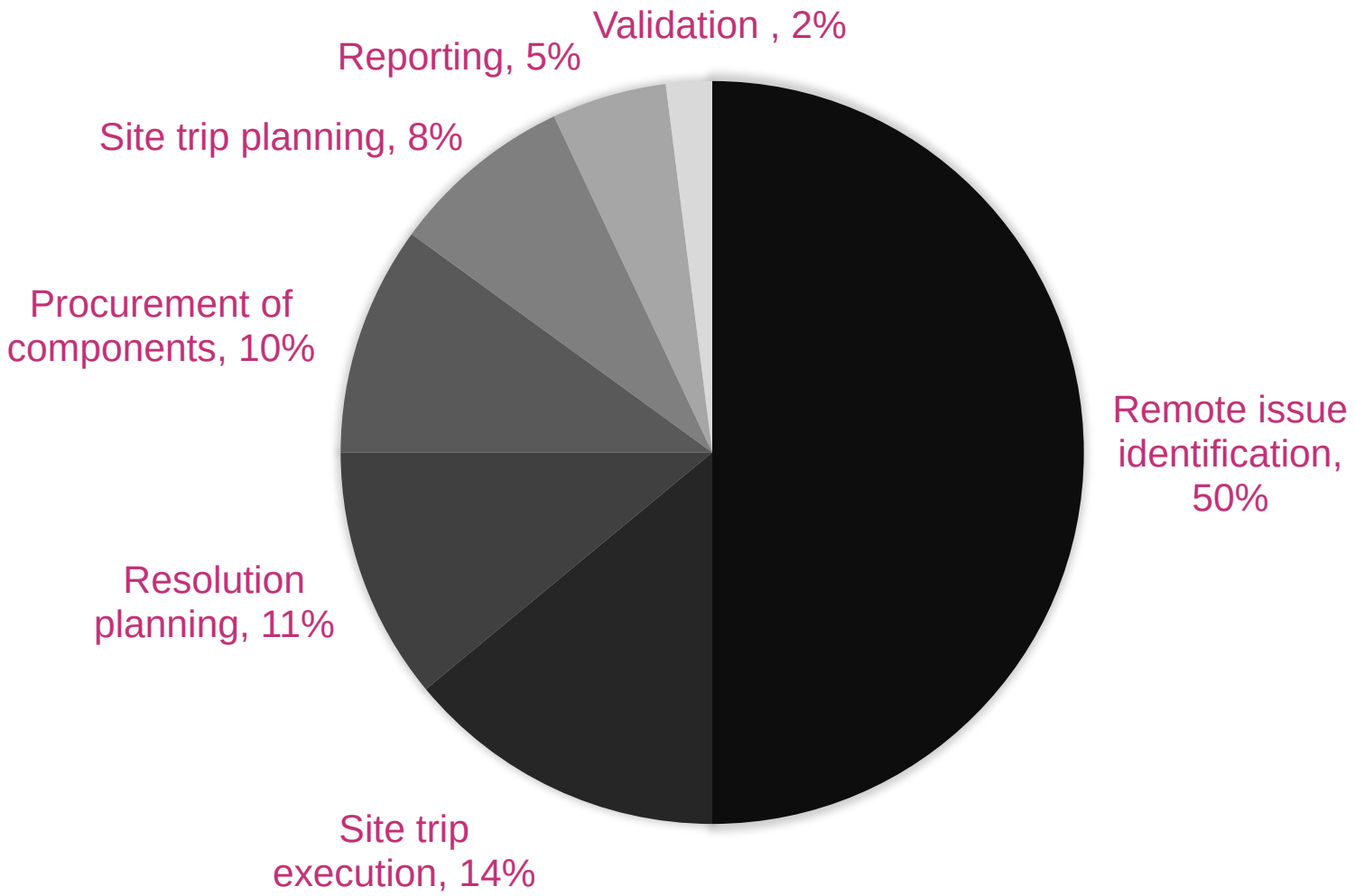
Labor: Break down of man-hours spent by an operations engineer, in the absence of remote monitoring (baseline scenario)



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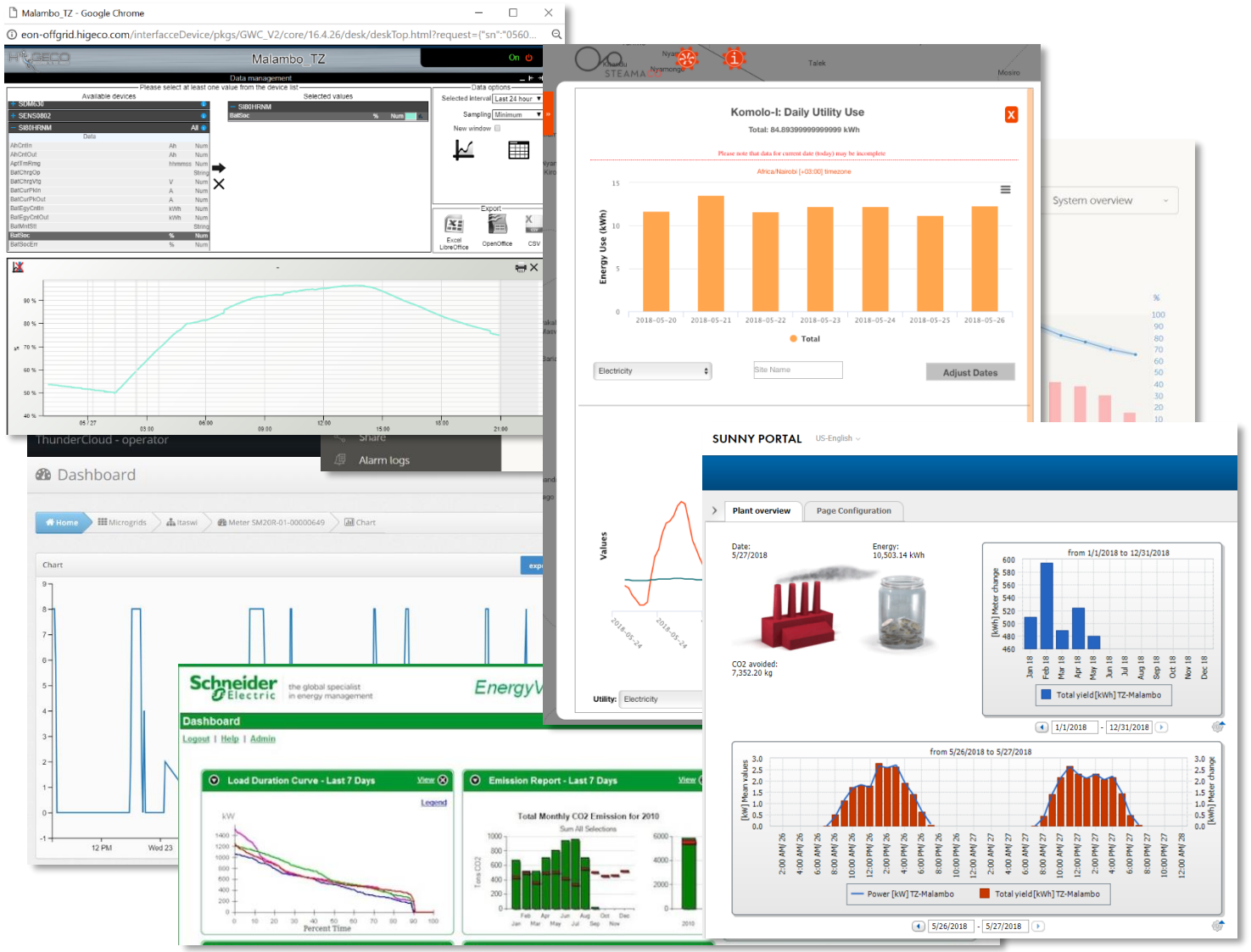
Labor costs reduced by cutting down time spent on issue detection and troubleshooting



- Monitoring allows easier remote issue analysis; less time interfacing with local tech
- Though even when remote monitoring is present, hard to obtain single source of truth; value in unified monitoring

20–45% overall time saving

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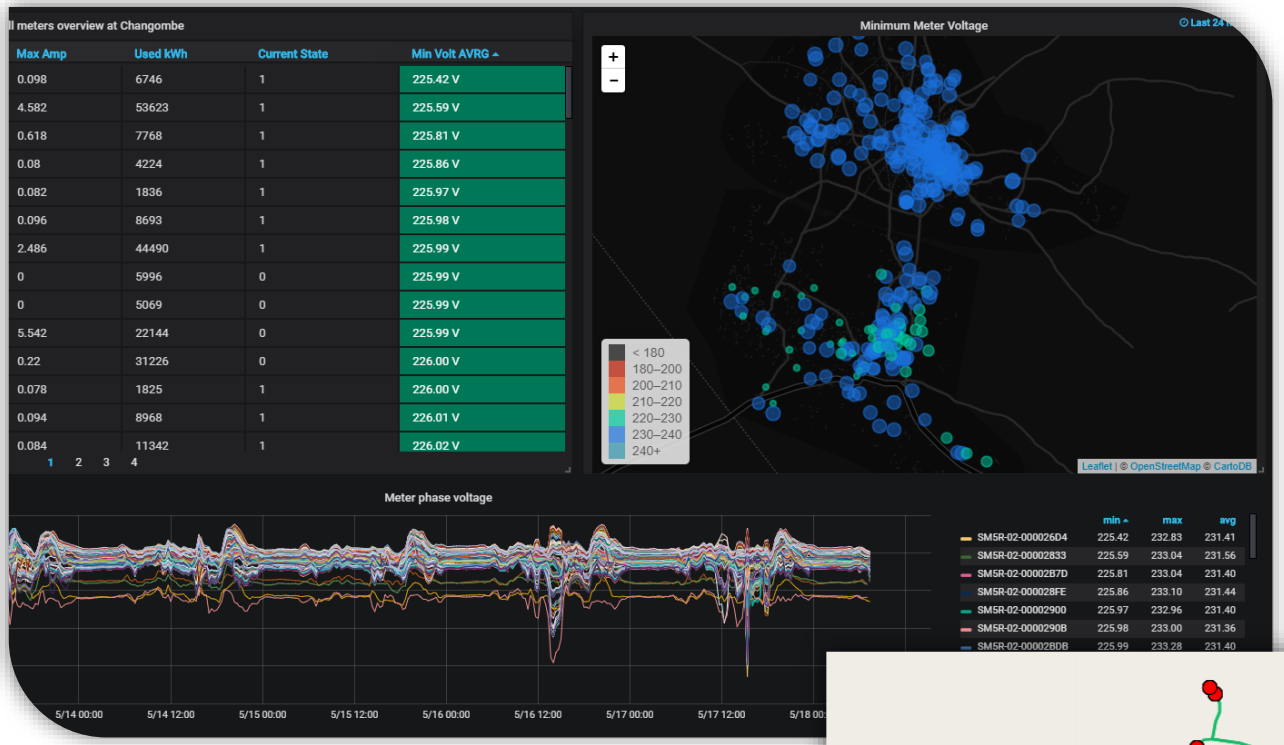
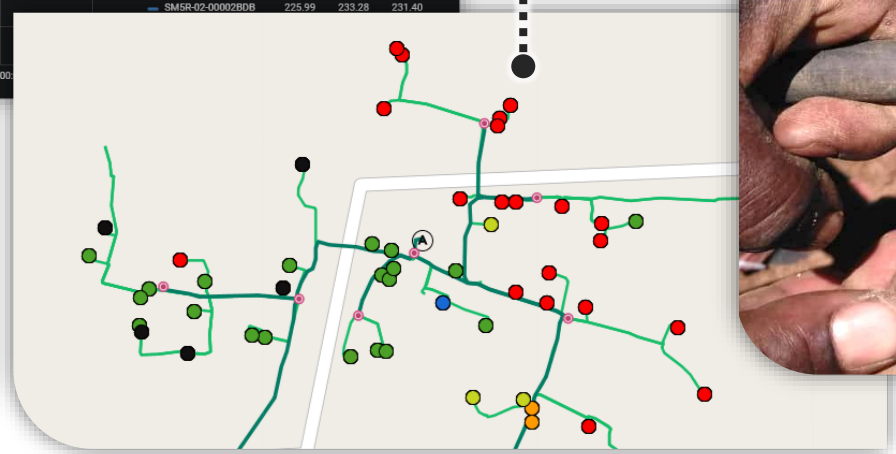
Case 1: Remotely and proactively pinpointing fault location in distribution grid



- Voltage data from numerous points on distribution grid (e.g. smart meters) monitored
- Mapping over time and across locations allowed central team to detect damaged cable, and **pinpoint location of fault**
- Site team able to quickly carry out repairs



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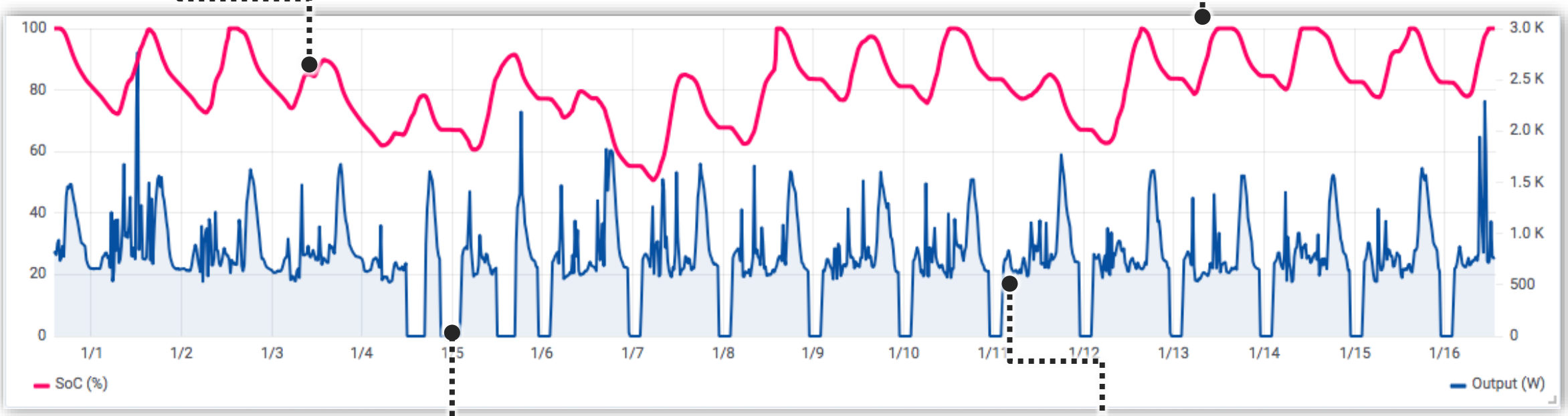
Case 2: Extending battery life through remotely managed, automated load shedding

Low PV output during rainy season leading to **reduced SoC**

Meanwhile, **battery health can be maintained** over long term



Instituted temporary **load shedding** to restore SoC

Scheduled nightly load shedding allows **sufficient charge** to be preserved for power to be turned on from 4am, which is **when customers need it**

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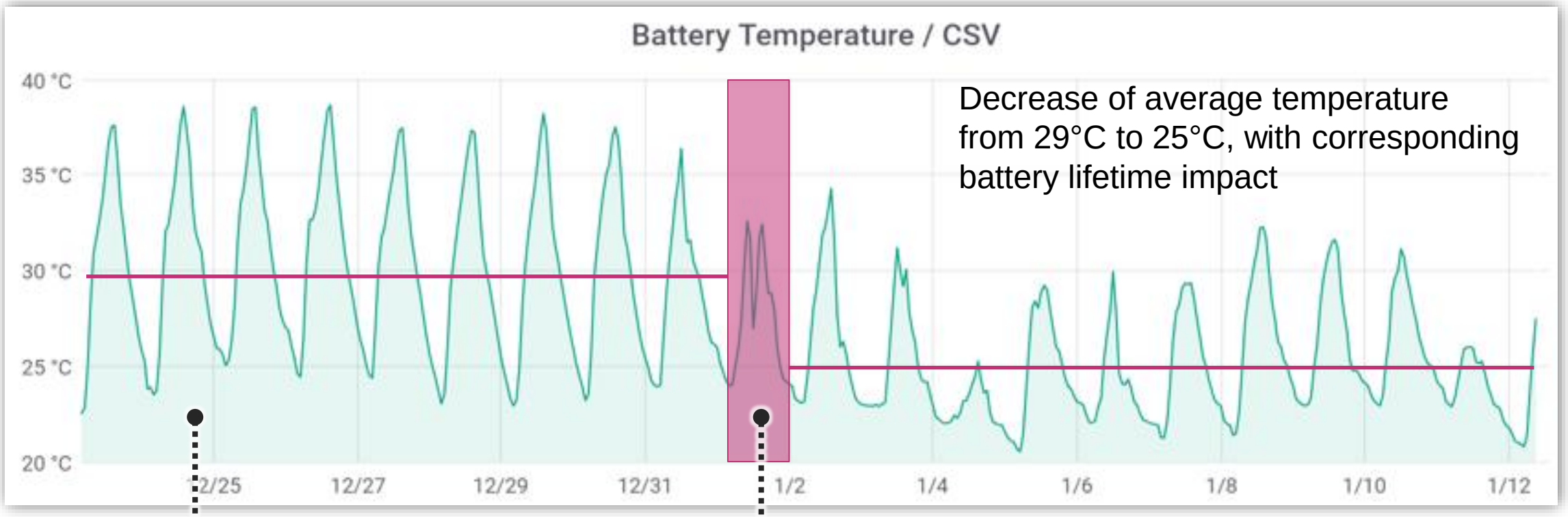
Case 3: Extending lifetime and improving performance through temperature management



AMMP showed high overall battery temperature values

After an on-site investigation, additional shading structure was installed to block previously direct sunshine on one wall of containerized system

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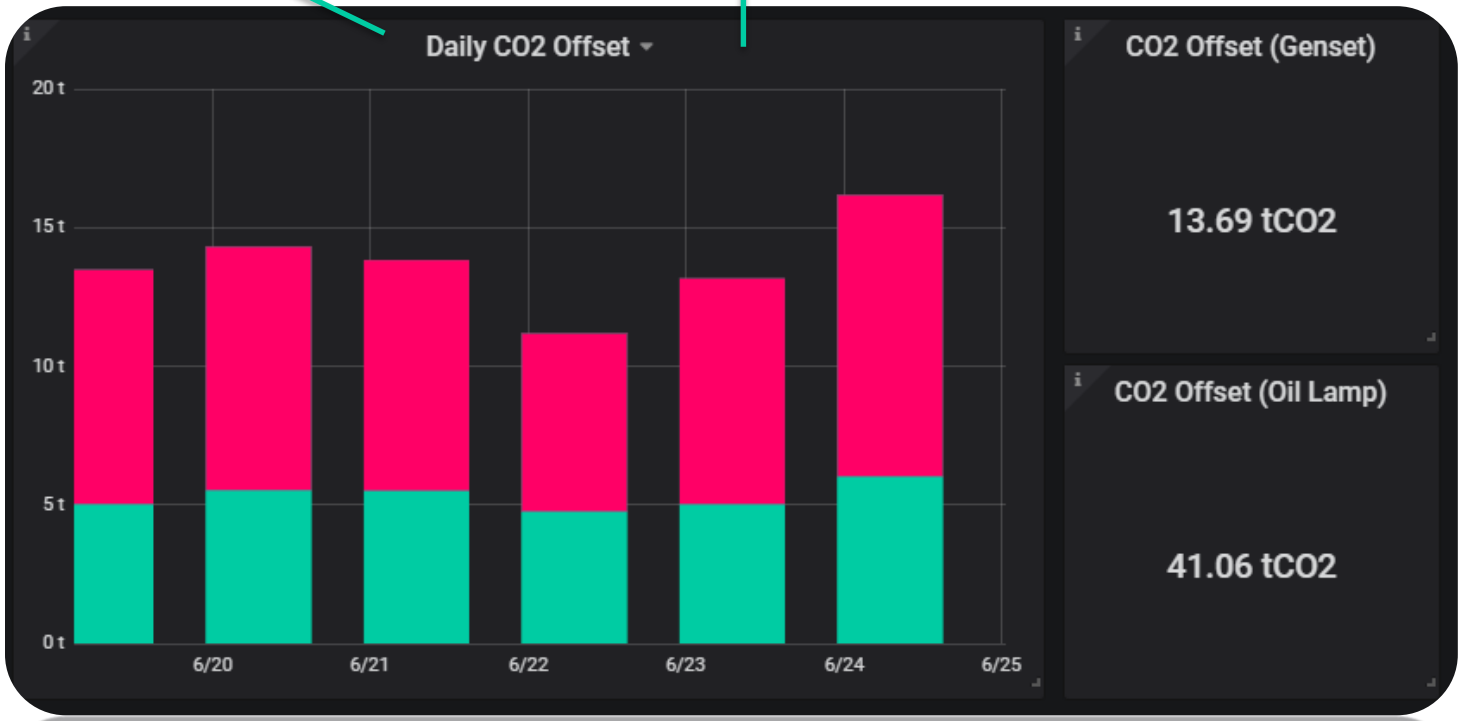
Case 4: Fulfilling reporting requirements by project stakeholders

Automated and reliable **reporting to stakeholders**

Better chances to **attract investors and win tenders**

Proof of impact



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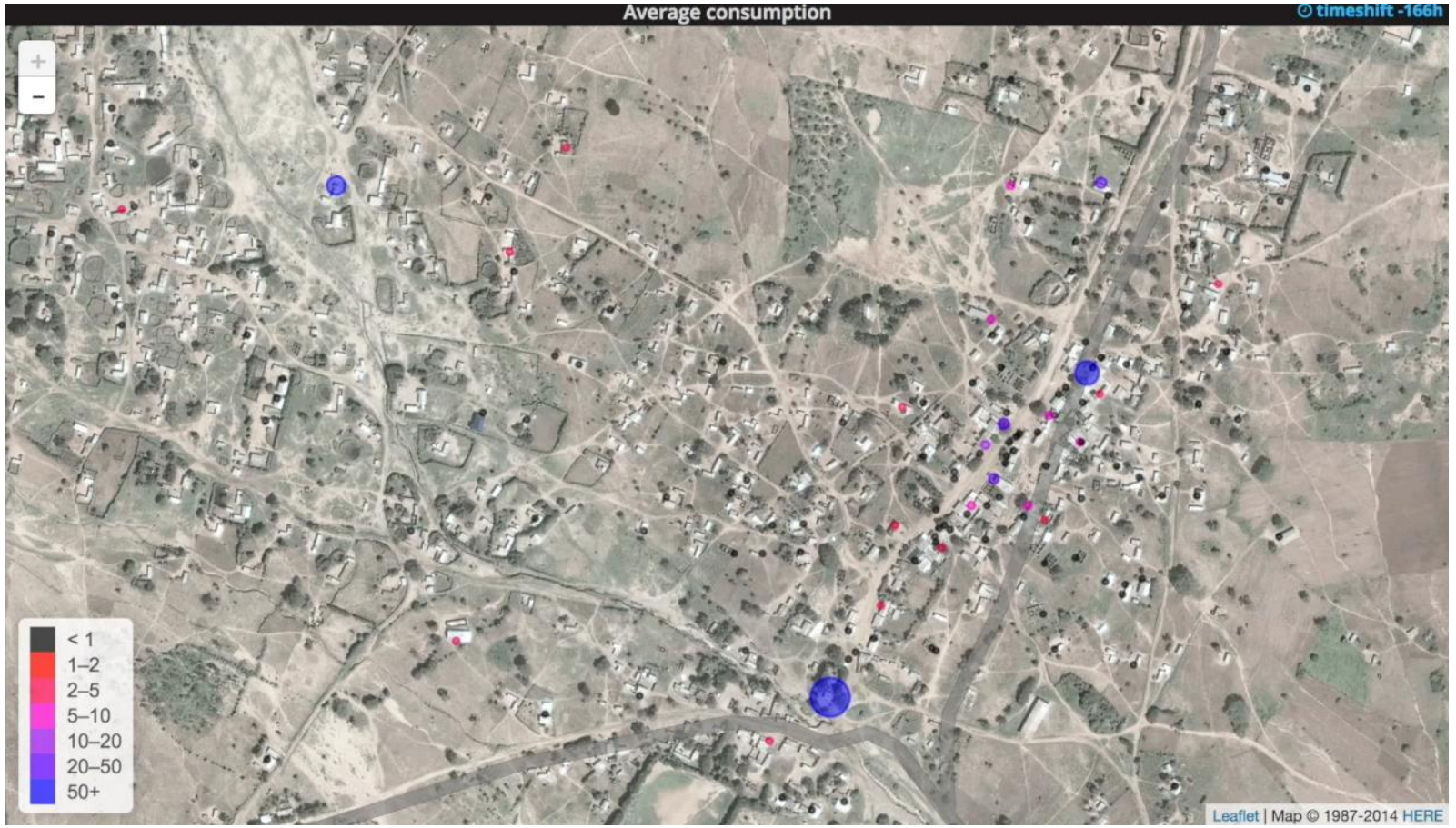
Case 5: Granular consumption data allows better expansion planning



https://www.youtube.com/watch?v=s5f3bdy6rtk&feature=youtu.be

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Outlook / Way forward: More opportunity to recognize value of remote monitoring, by relevant stakeholders

Mini-grid developers & operators	• Issue: Primary focus for optimization is often CAPEX; OPEX often neglected • Investing in monitoring leads to lower operating costs, and thus **better economics** • Ability to make data-driven decisions regarding roll-out
Donors & financiers	• Issue: Subsidies often focus on CAPEX, and are based on e.g. number of connections; should potentially also be tied to longer-term operational quality • Important to have visibility over operations of systems in portfolio
Governments & national utilities	• More transparency over (mini-grid) operations in country/region • Ability to better integrate mini-grids into national electrification plan

Partnership to offer customers a complete, end-to-end solution for financing, developing, operating, and monitoring mini-grid projects

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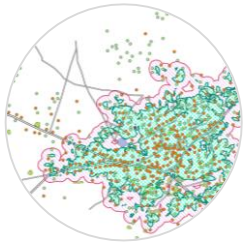
Feasibility assessment

powered by HOMER Energy



System design & engineering

Project finance

Technical operation & maintenance

Reporting to stakeholders

Customer operations

Procurement

Odyssey

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Jointly

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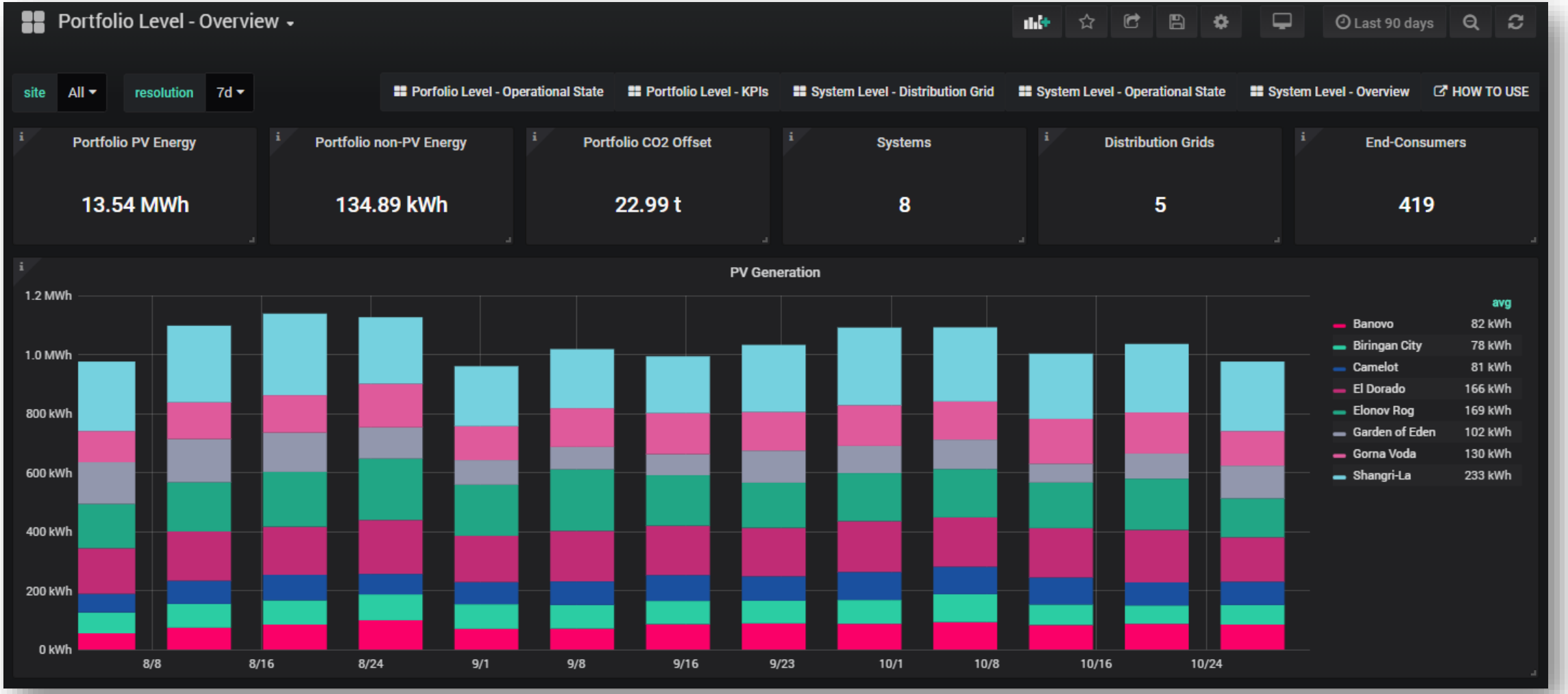
Portfolio Level - Overview



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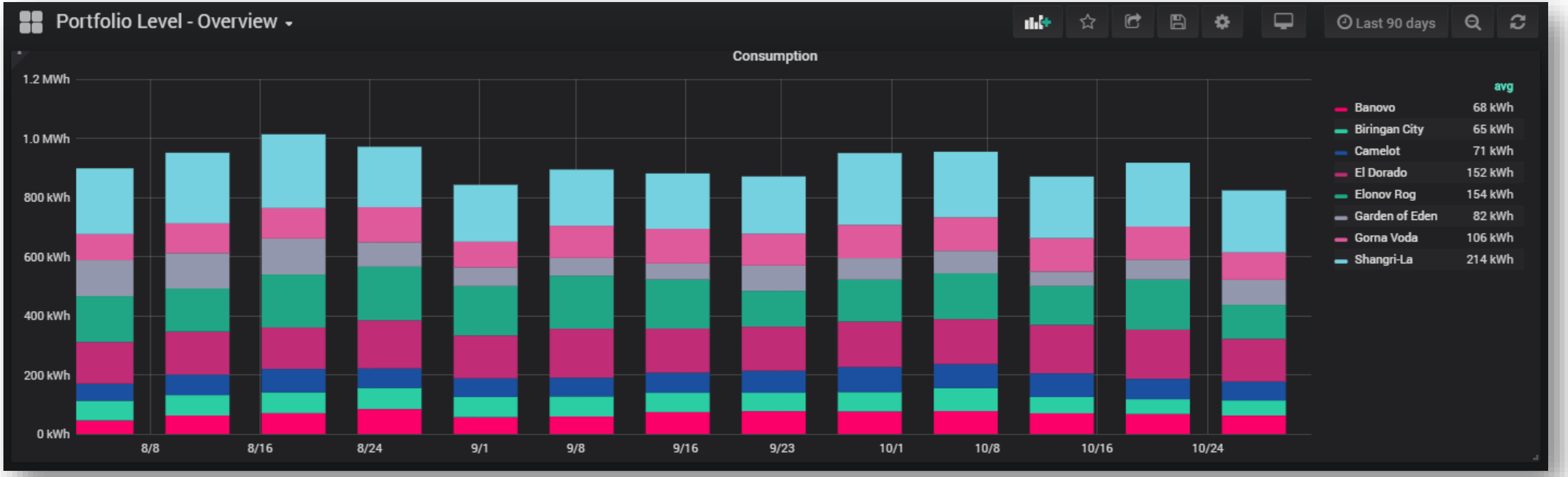

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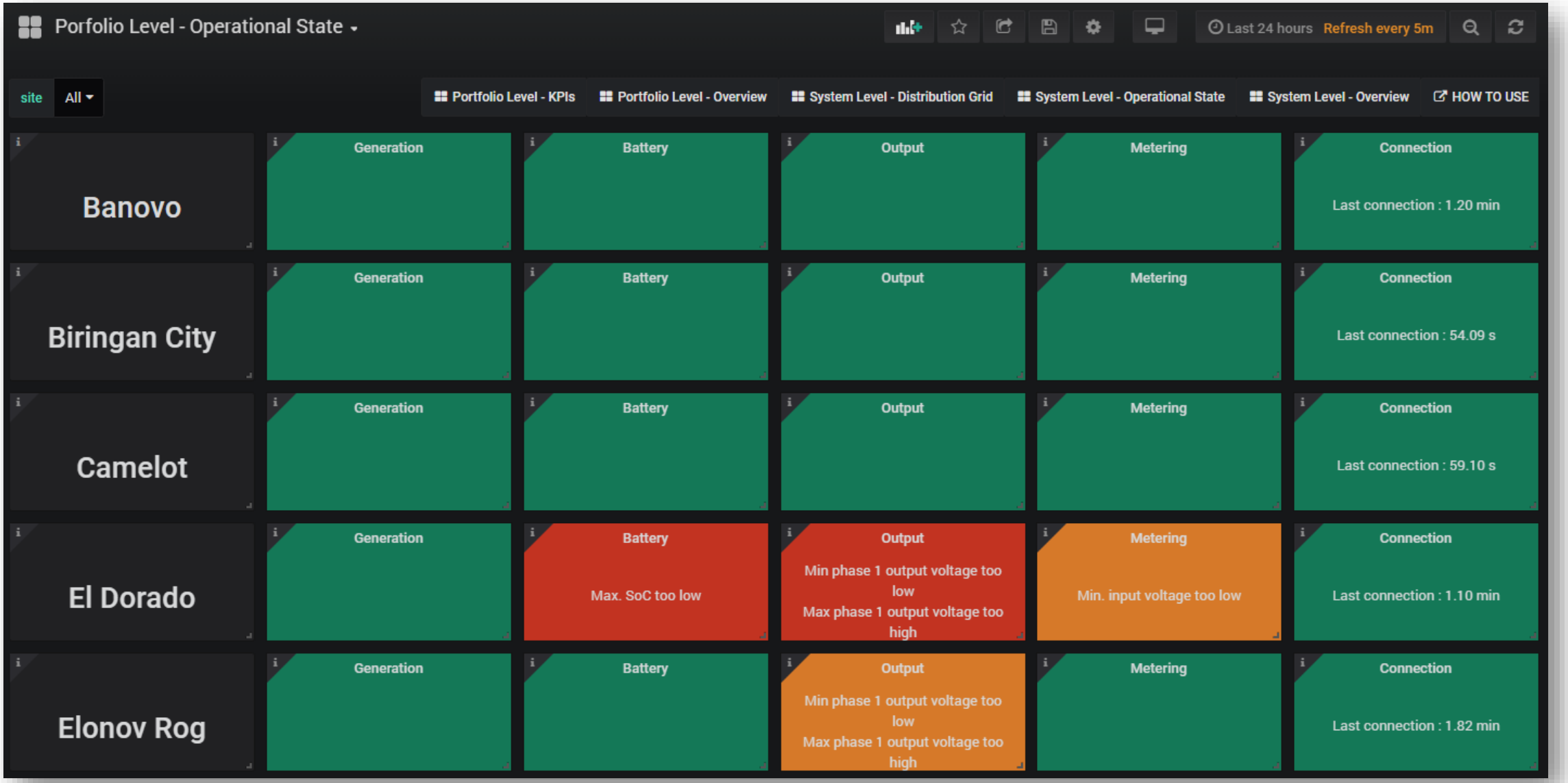
Portfolio Level – Operational State



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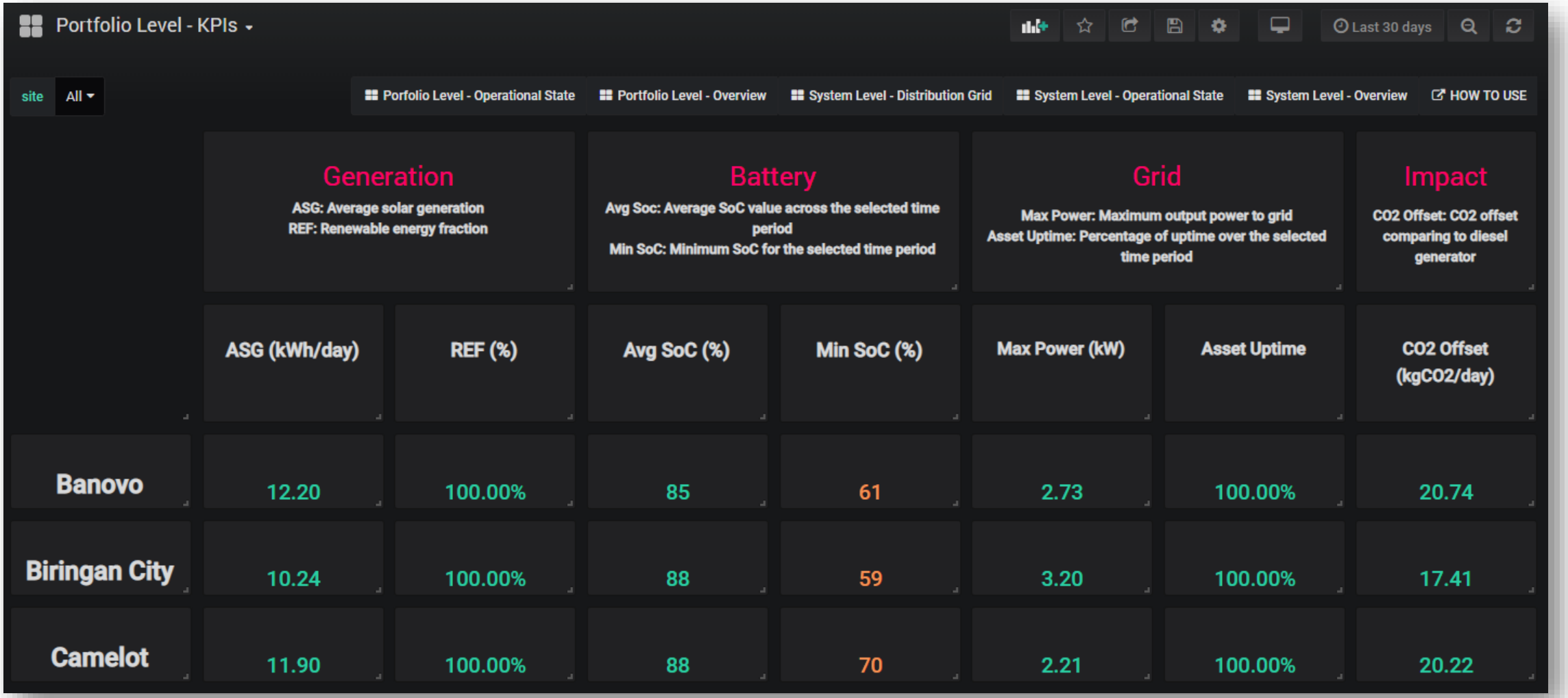
Portfolio Level - KPIs



System Level – Overview

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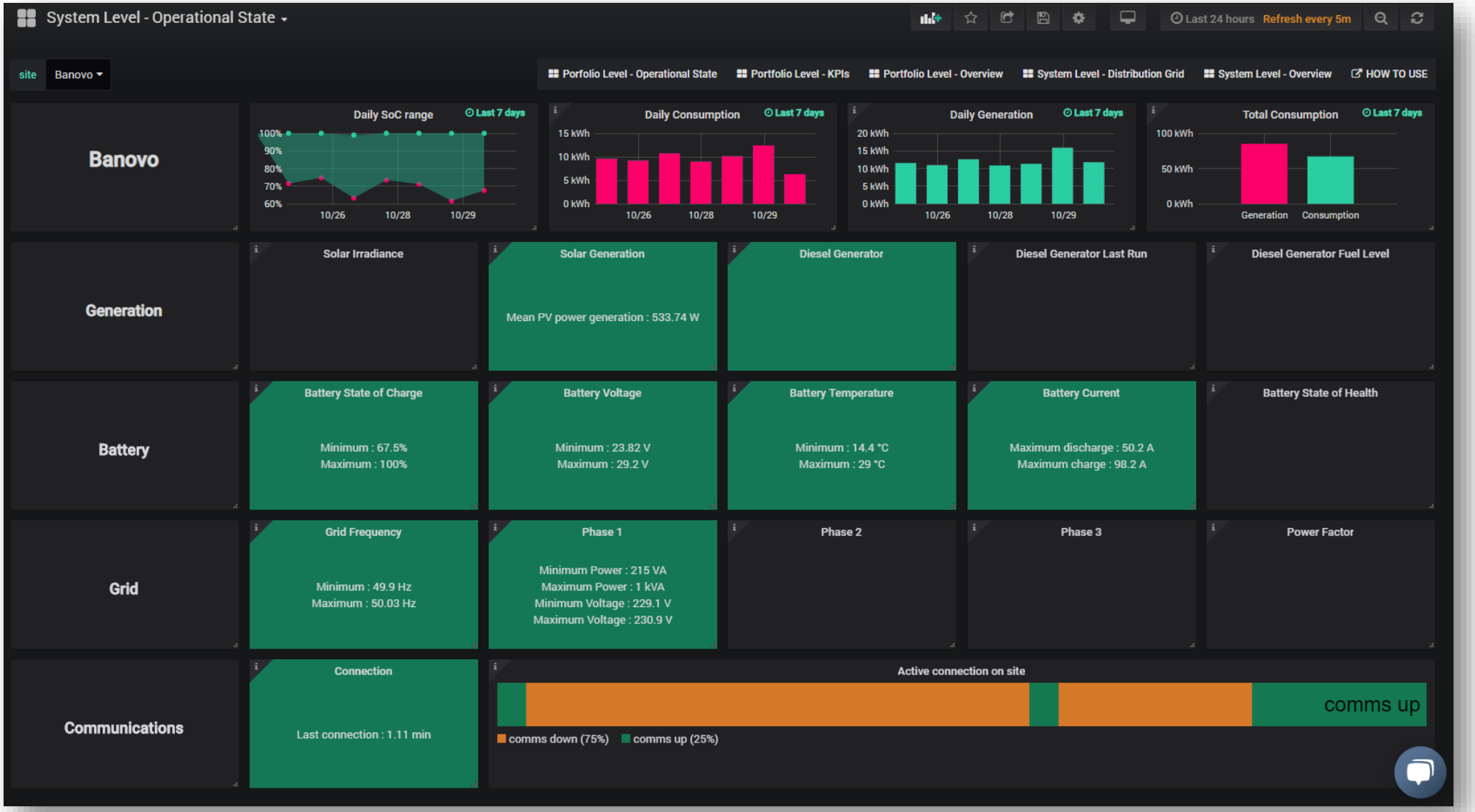
System Level – Operational State



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System Level – Operational State

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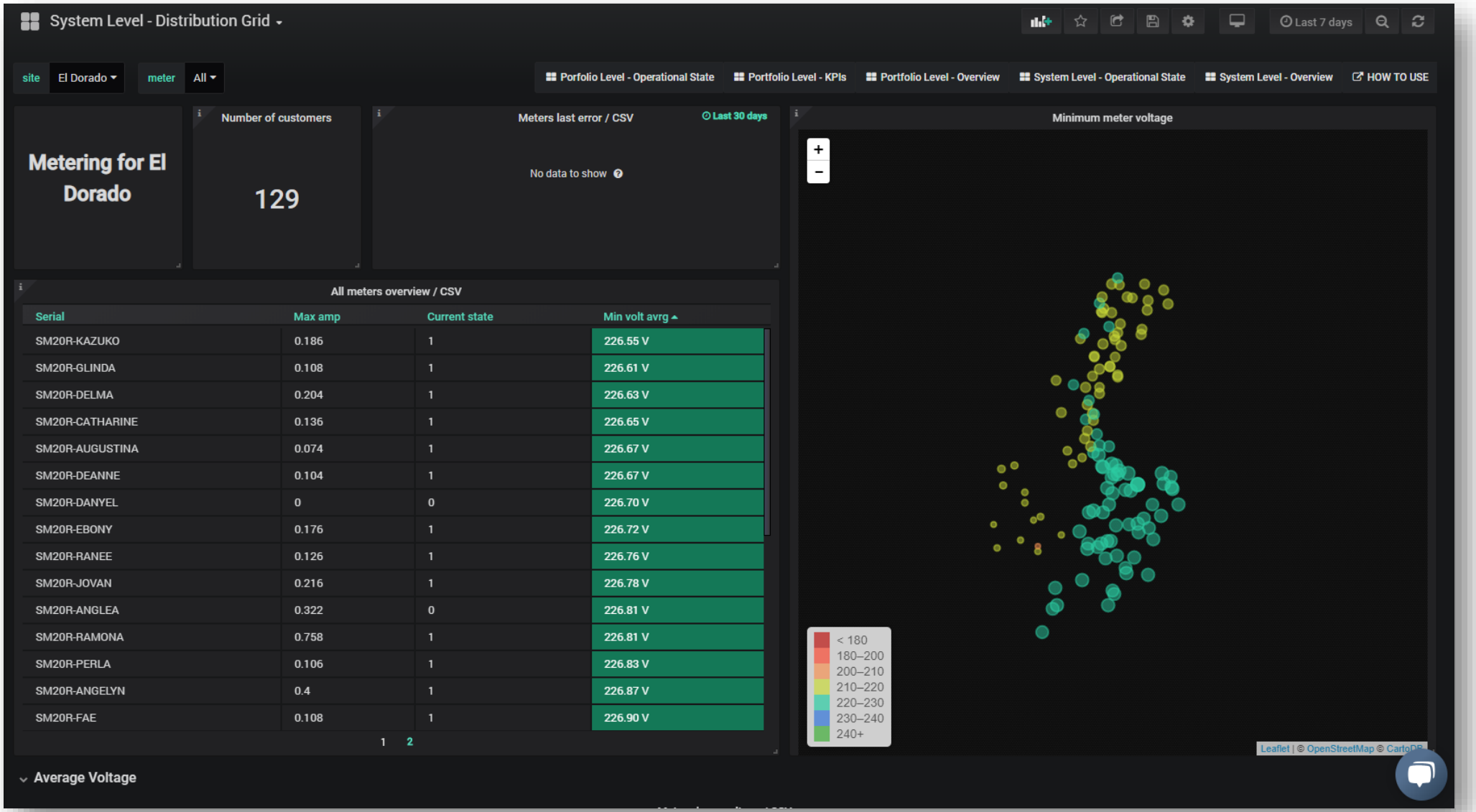
System Level – Distribution Grid



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