Lessons Learnt from a Storage Based Microgrid Application

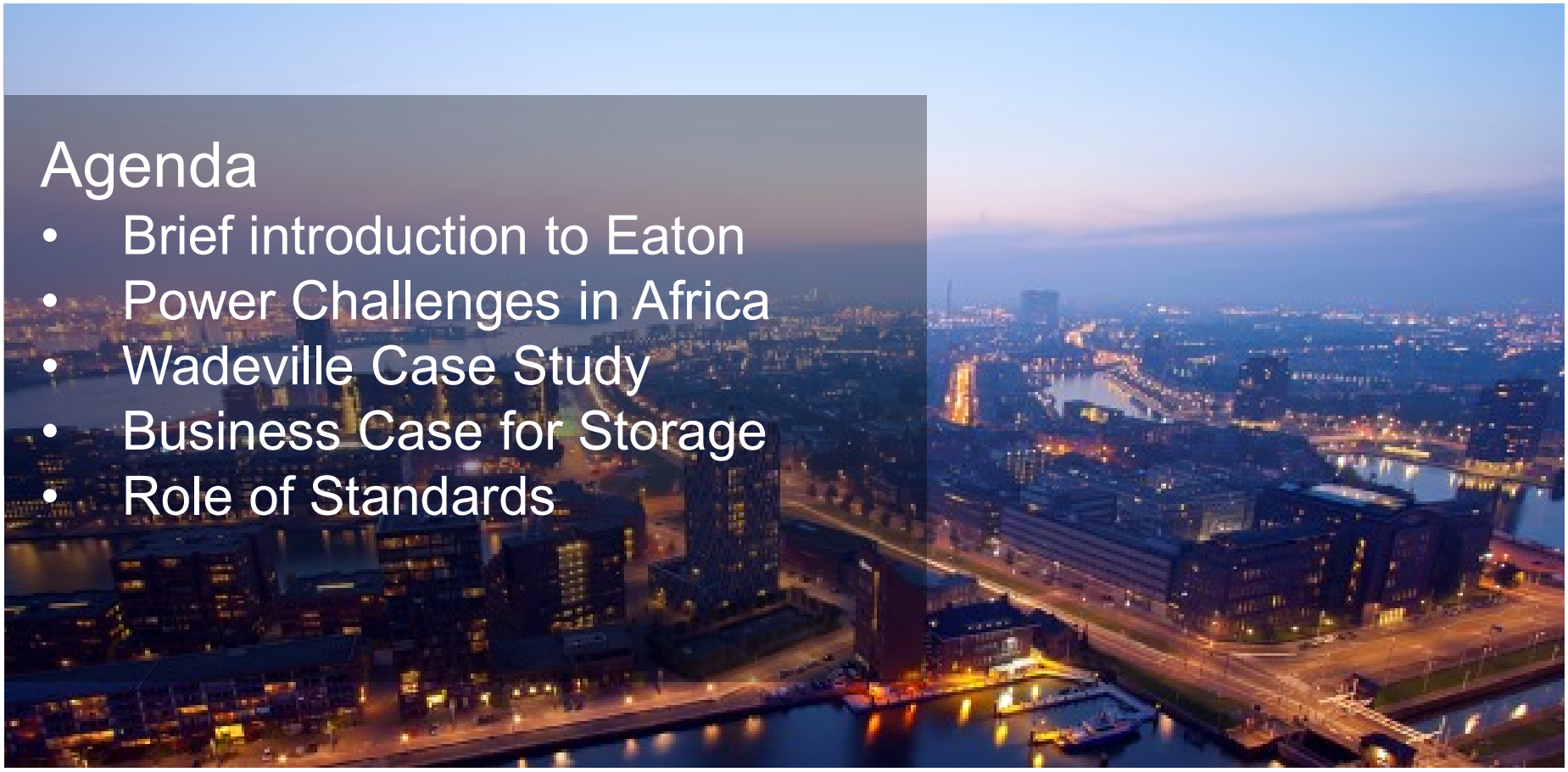
Bunty Kiremire Pr.Eng

Senior Applications Engineer, Microgrid Energy Systems, Eaton

Powering Business Worldwide

Agenda

- Brief introduction to Eaton
- Power Challenges in Africa
- Wadeville Case Study
- Business Case for Storage
- Role of Standards



Powering Business Worldwide

A proudly BBBEE Level 1 contributor

Our **vision** is to improve the quality of life and the environment through the use of power management technologies and services.

Powering Business Worldwide

A proudly BBBEE Level 1 contributor

Electrical Sector

2017 Sales $12.9 B

- Electrical Products
- Electrical Systems & Services

Industrial Sector

2017 Sales $7.5 B

- Aerospace
- Hydraulics
  - Filtration
- Vehicle

- Chairman & CEO – Craig Arnold
- Key locations: Cleveland, Shanghai, Morges (CH), São Paulo
- Regional engineering teams to support products and custom solutions
- Customers in more than 175 countries
- ~98,000 employees

Total sales	$20.4 B
Net income	$3.0 B

Powering Business Worldwide

A proudly BBBEE Level 1 contributor

Eaton's solid presence in Africa

Dedicated diverse team

- **700** employees
- More than 100 distributors throughout Africa
- **5** offices across the continent
- **2** service hubs
- Engineering Services
  - Study | Design | Build | Support

Regional manufacturing capability

- **200k ft²** of manufacturing space in South Africa and Morocco
- Africa based engineering services
- **BBBEE Level 1** certification

A broad portfolio supplemented by "made for Africa" products and services

- **IEC** and **UL** approved products
- Historical brands in Africa since **1927**
- Local manufacturing & engineering of Low Voltage, Medium Voltage and Power Quality products built for Africa

A proudly BBBEE Level 1 contributor

A portfolio designed to meet your power management needs.

ELECTRICAL

Power distribution and circuit protection

Backup power protection

Lighting and security

Control and automation

Structural solutions and wiring devices

Solutions for harsh and hazardous environments

Engineering services

INDUSTRIAL

Aerospace – Hydraulic and fuel systems

Automotive – Engine air mgmt., traction control and fluid products

Truck – Commercial vehicle clutches and transmissions

Filtration – Liquid filtration solutions

Hydraulics – Fluid conveyance and power and motion control products

EATON
Powering Business Worldwide

A proudly BBBEE Level 1 contributor

Power Challenges in Africa

Powering Business Worldwide

A proudly BBBEE Level 1 contributor

Low Access and Reliability

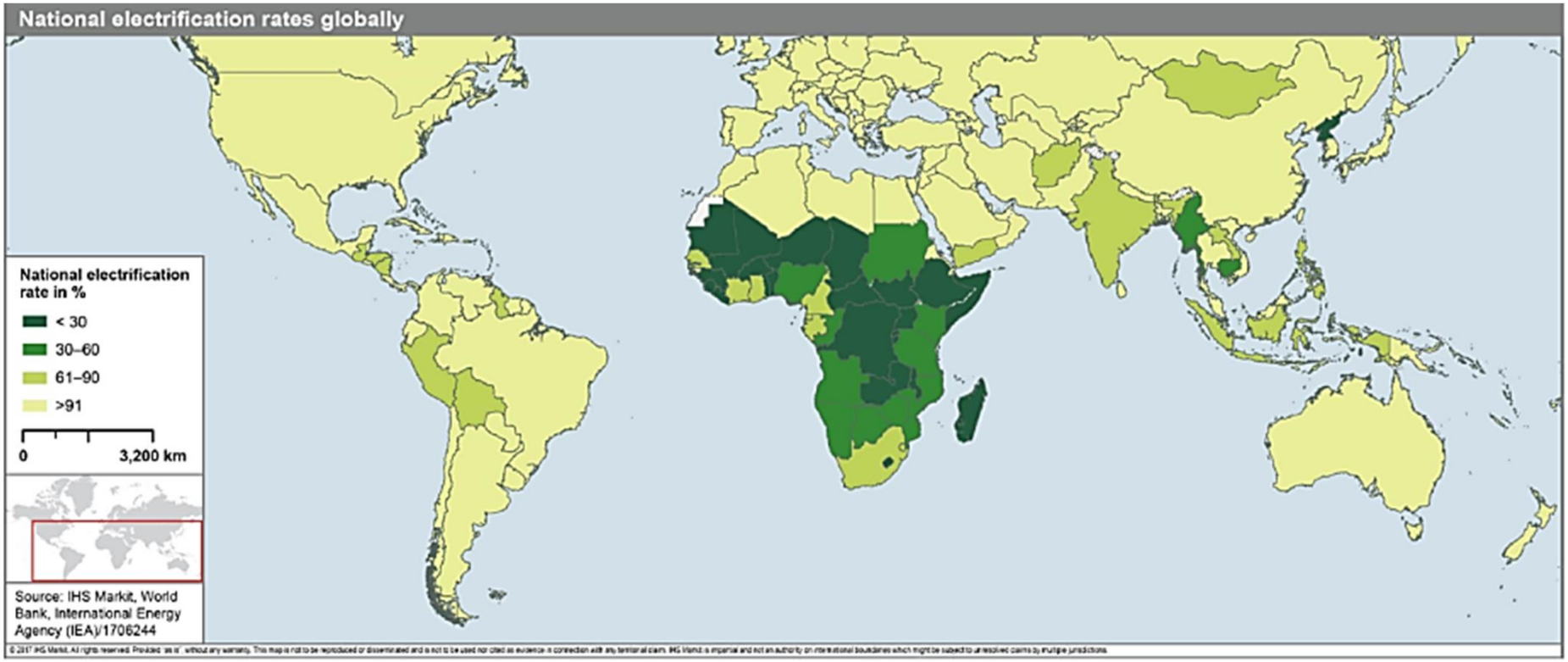
	Electricity access %	Avg outage hours/year
Côte d'Ivoire	61.9	230
DR Congo	13.5	830
Ethiopia	27.2	570
Ghana	78.3	790
Kenya	36	420
Mozambique	21.9	80
Niger	15	1,400
Nigeria	56.4	4,600
Senegal	61	130
South Africa	86	50
Tanzania	18.9	670
Zambia	27.9	180

Source: https://qz.com/africa/1431213/africas-electricity-shortages-have-health-and-economic-costs/

Source: https://qz.com/africa/1431213/africas-electricity-shortages-have-health-and-economic-costs/

Powering Business Worldwide

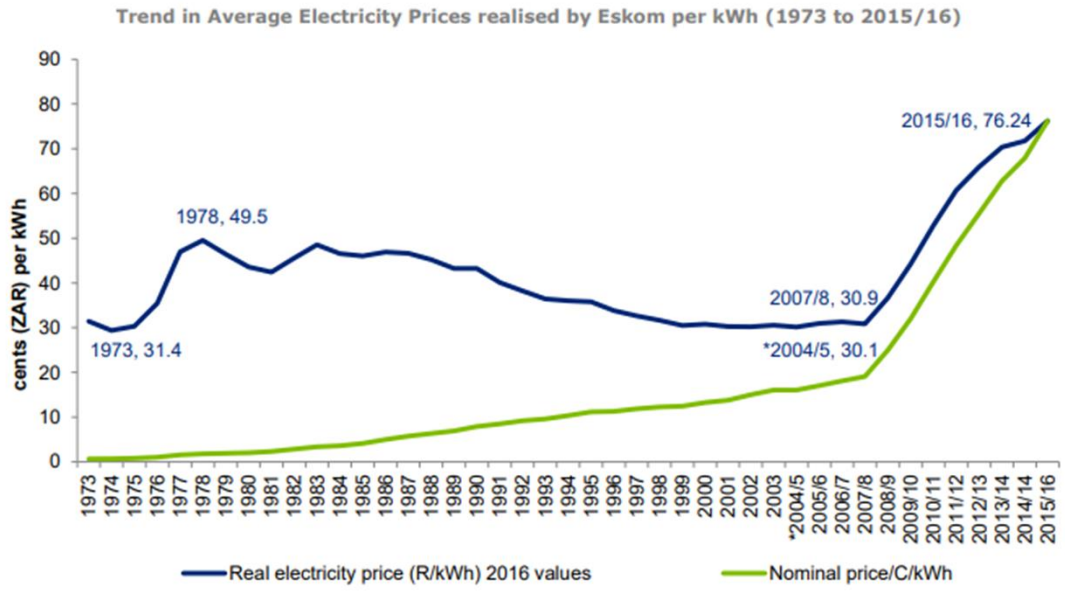
Global Energy Access



EATON
Powering Business Worldwide

A proudly BBBEE Level 1 contributor

Rising Costs of Electricity

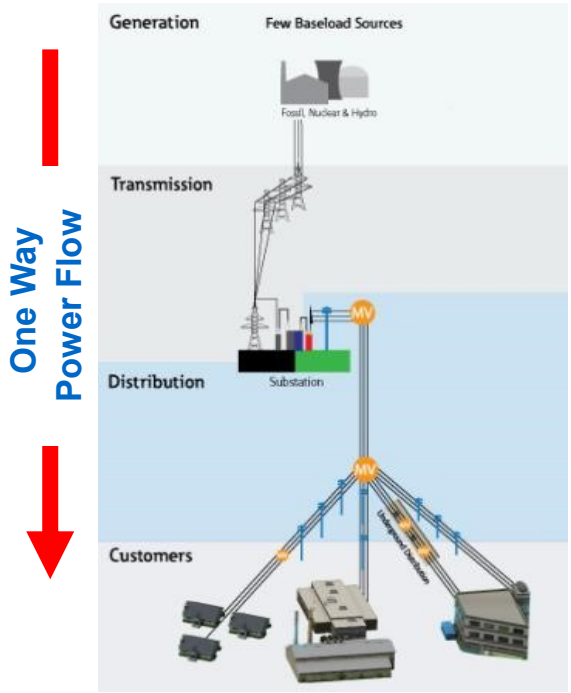


Source: Deloitte Analysis, Eskom data and 2011 annual report

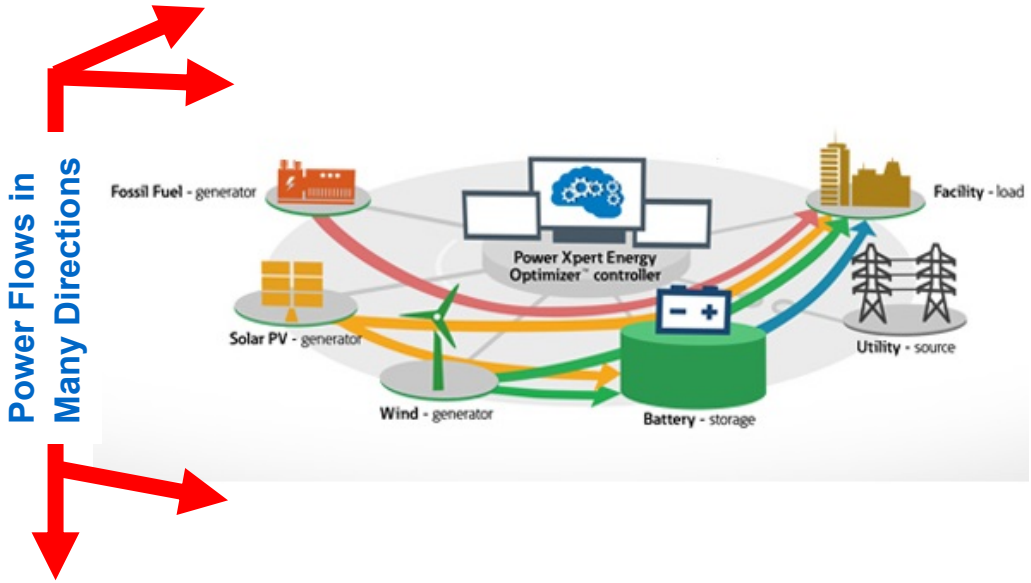
Note: In 2004/5 Eskom change financial year from calendar year (year-ending 31 December) to year-ending 31 March

Evolving Power Sector Landscape:

Historical Typical Power Grid



Decentralized Grid



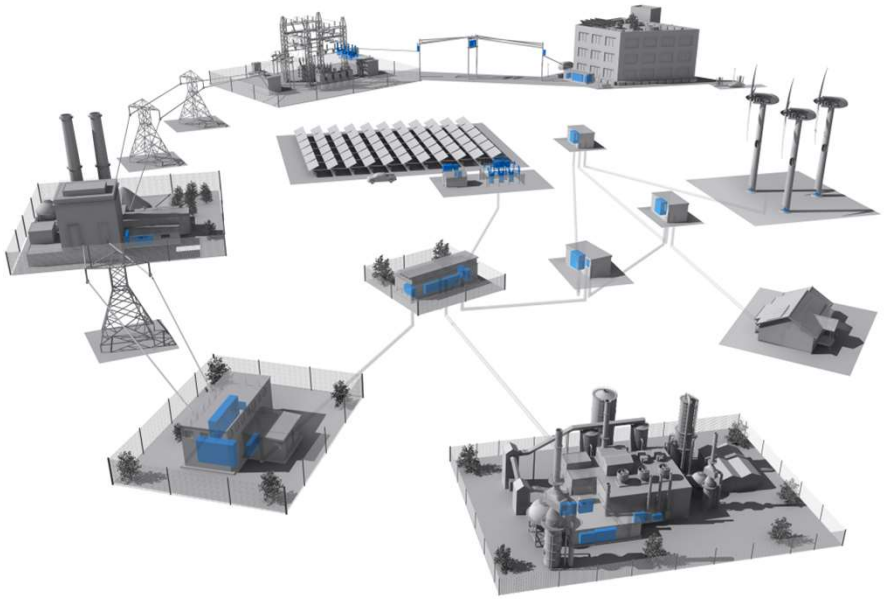
EATON
Powering Business Worldwide


Case Stud

What is a Microgrid?

Microgrids are stand-alone power generation, distribution and storage systems that work with or independently from the main utility grid to help businesses, campuses and communities to:

- Maintain reliable supply of power
- Reduce operating costs
- Optimize energy usage
- Reduce carbon emissions



Powering Business Worldwide

A proudly BBBEE Level 1 contributor

Key Challenges at Eaton's Wadeville facility:

Unreliable Energy Supply

High Cost of Electricity

Due to ageing infrastructure we experienced increased in load shedding due to:

- Cable faults
- Scheduled maintenance of the grid

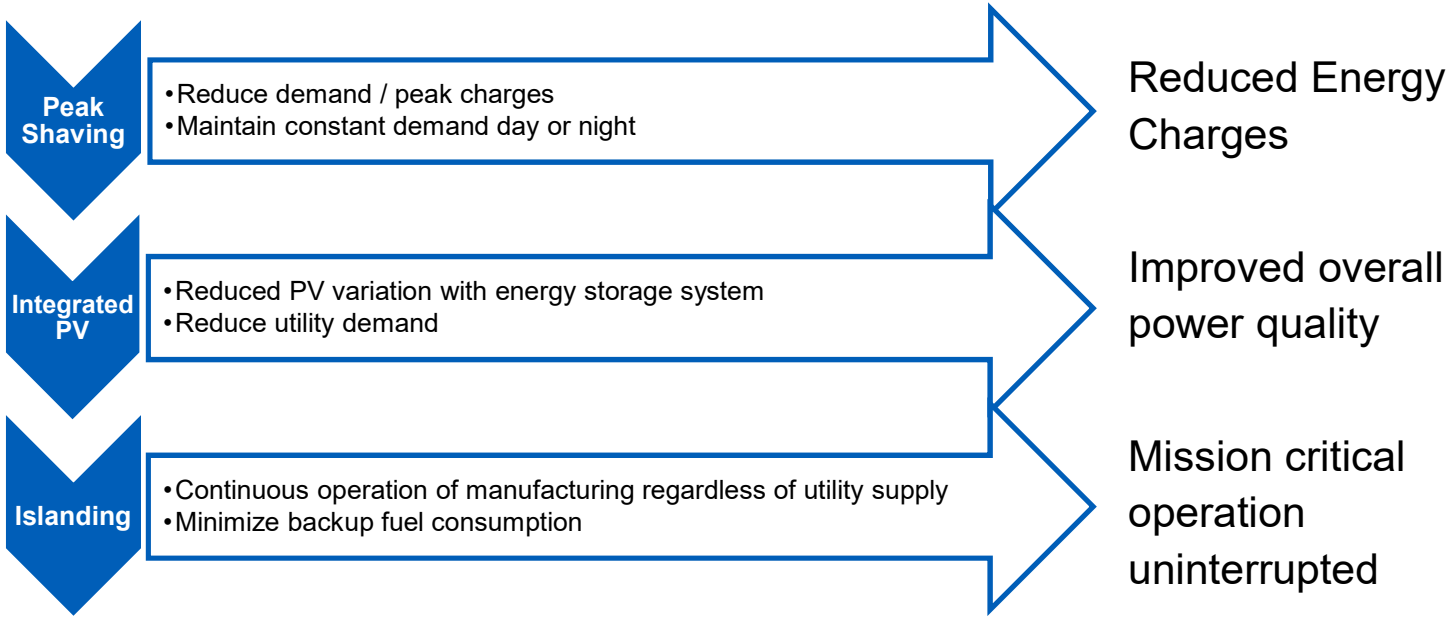
As a manufacturing facility we faced:

- Increase energy charges impacted by seasonality and peak time
- Network demand charges

EATON
Powering Business Worldwide

Business Case for Wadeville Plant

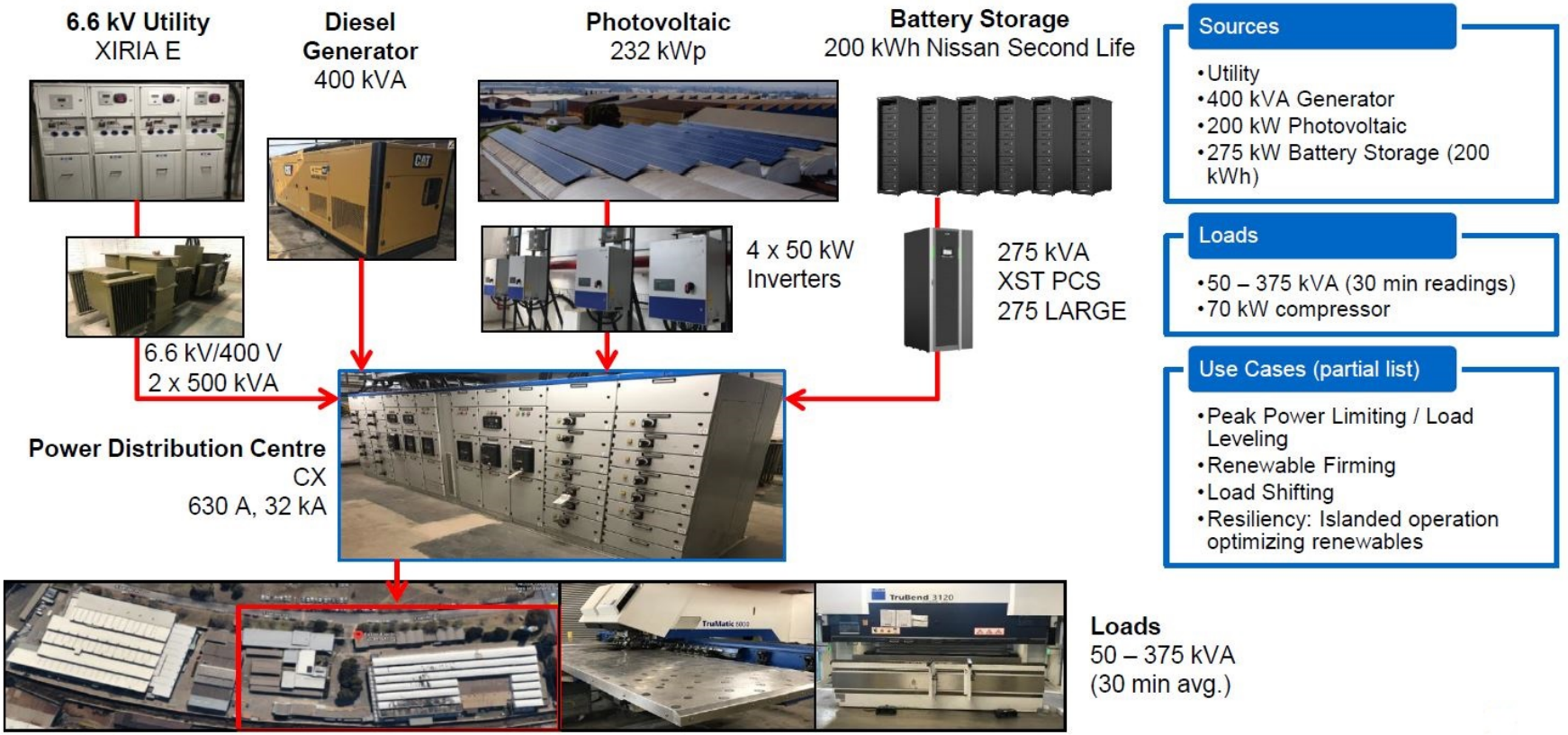
Three main use cases enabled by storage:



Powering Business Worldwide

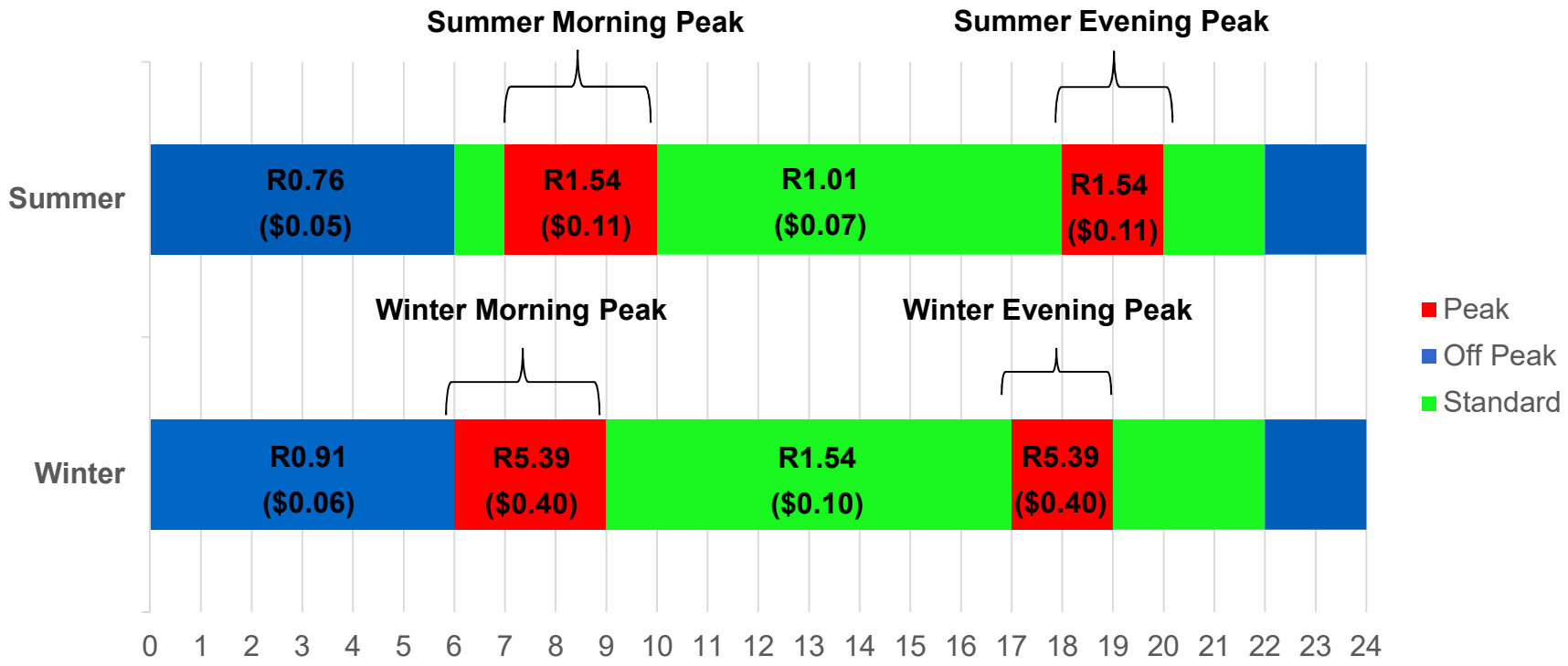
A proudly BBBEE Level 1 contributor

Key Hardware Components of the Wadeville Microgrid



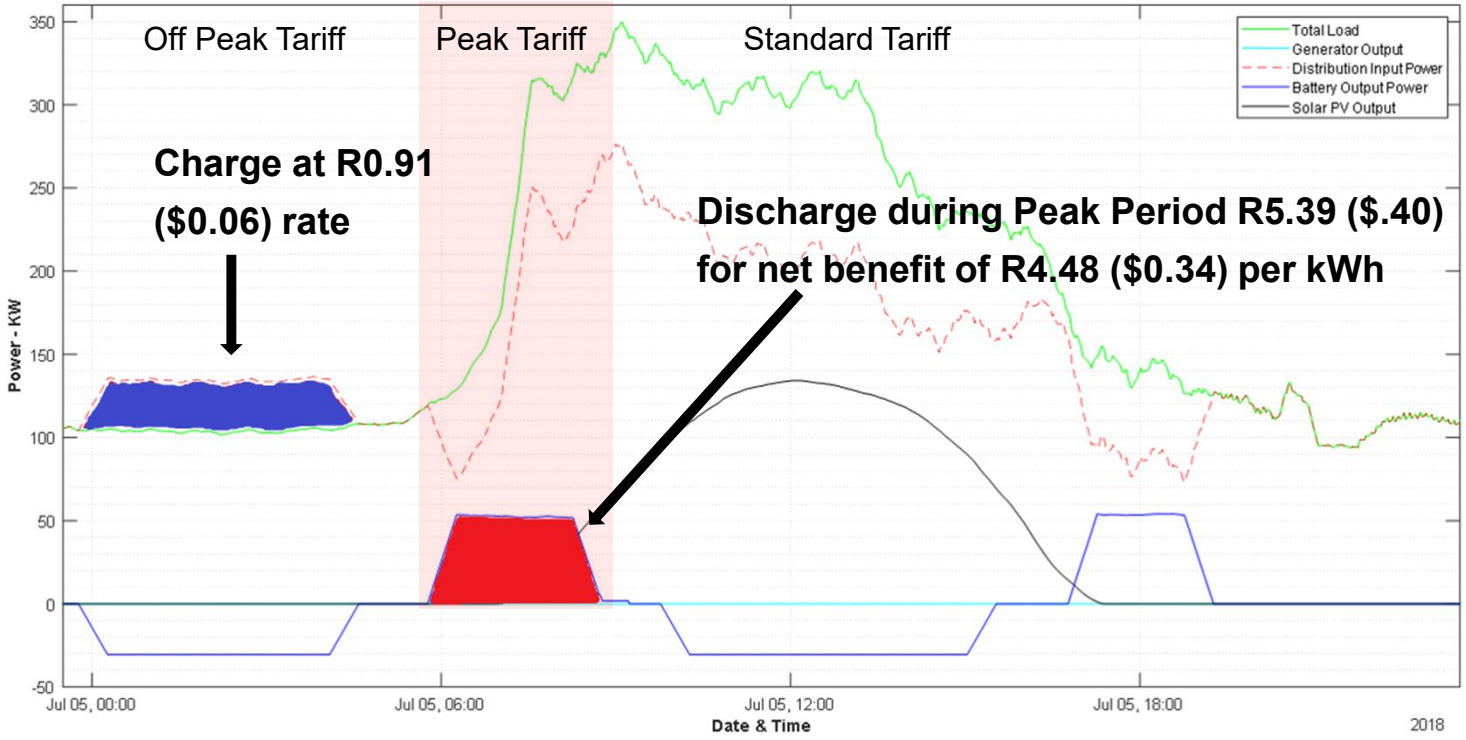

Business Case for Storage

Value Stream 1: Energy Arbitrage
Reduce Grid Consumption when Costs are Highest



Powering Business Worldwide

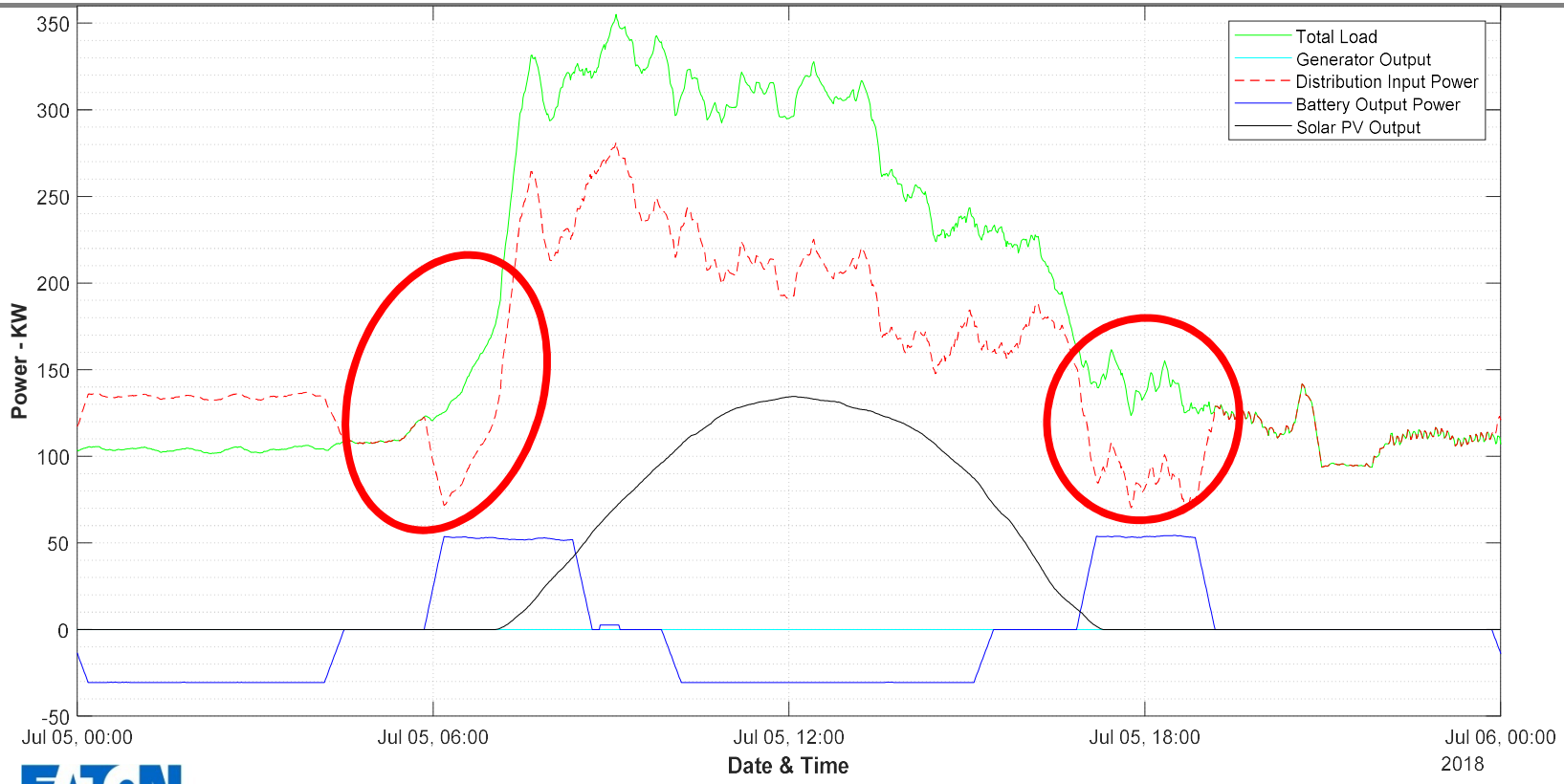
Value Stream 1: Energy Arbitrage
Reduce Grid Consumption when Costs are Highest



Powering Business Worldwide

A proudly BBBEE Level 1 contributor

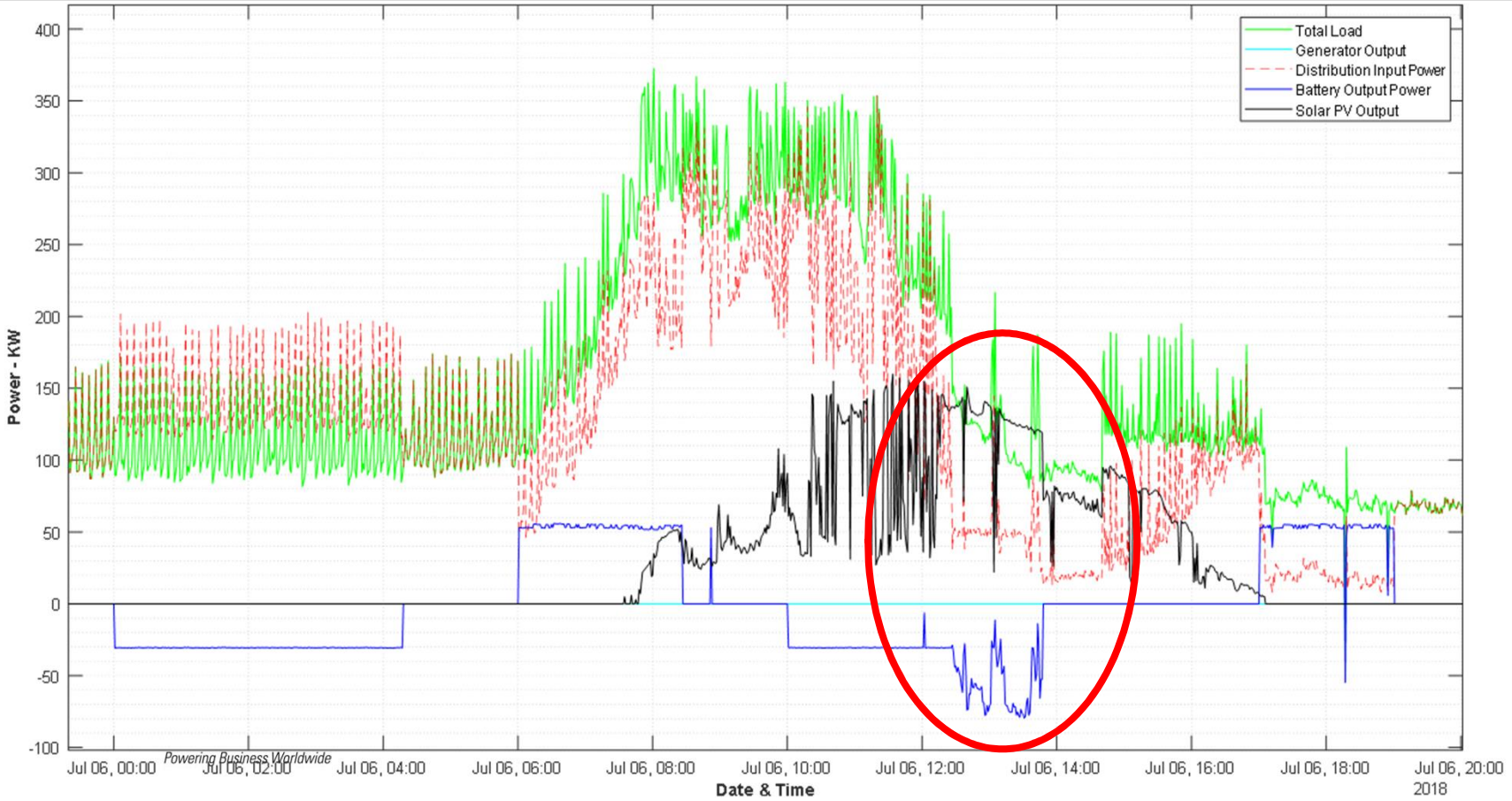
Value Stream 2: Offset Energy Costs
Solar PV and Storage Reduce Total Grid Consumption



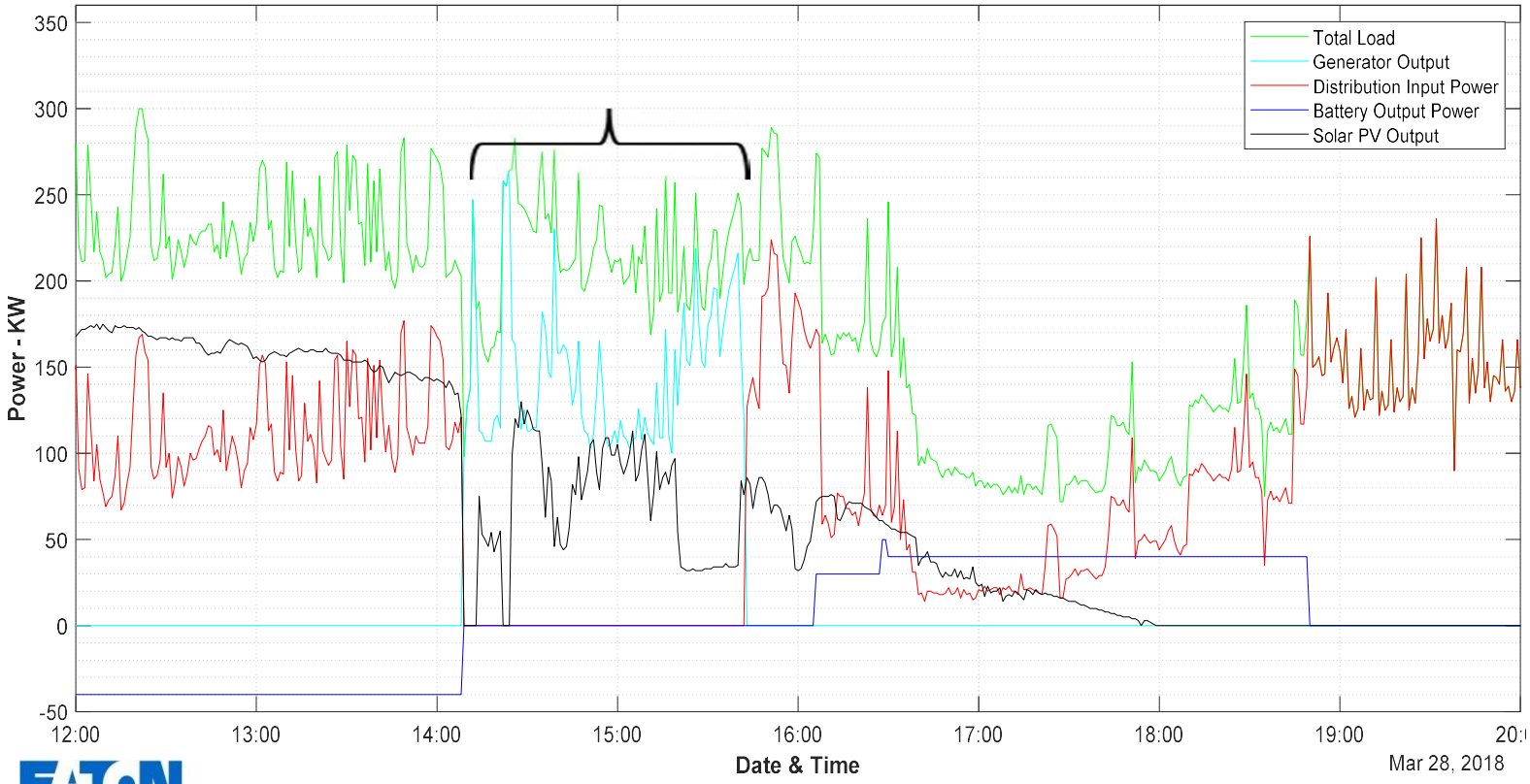
Powering Business Worldwide

A proudly BBBEE Level 1 contributor

Value Stream 3: Renewable Maximization
Storing Excess Solar

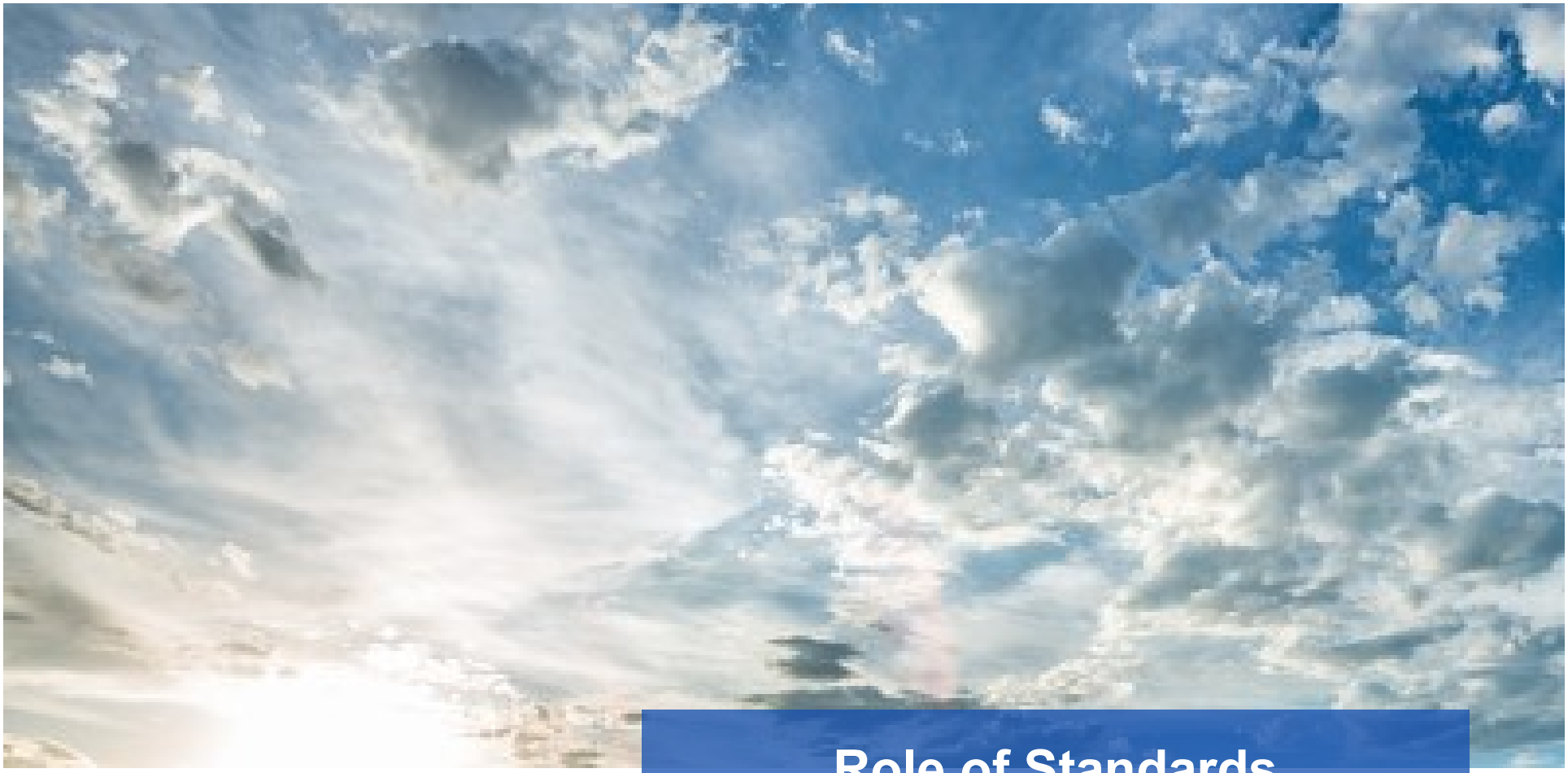


Value Stream 4: Outage Avoidance
Eliminate Production Losses Due to Power Outages



Powering Business Worldwide

A proudly BBBEE Level 1 contributor



Role of Standards

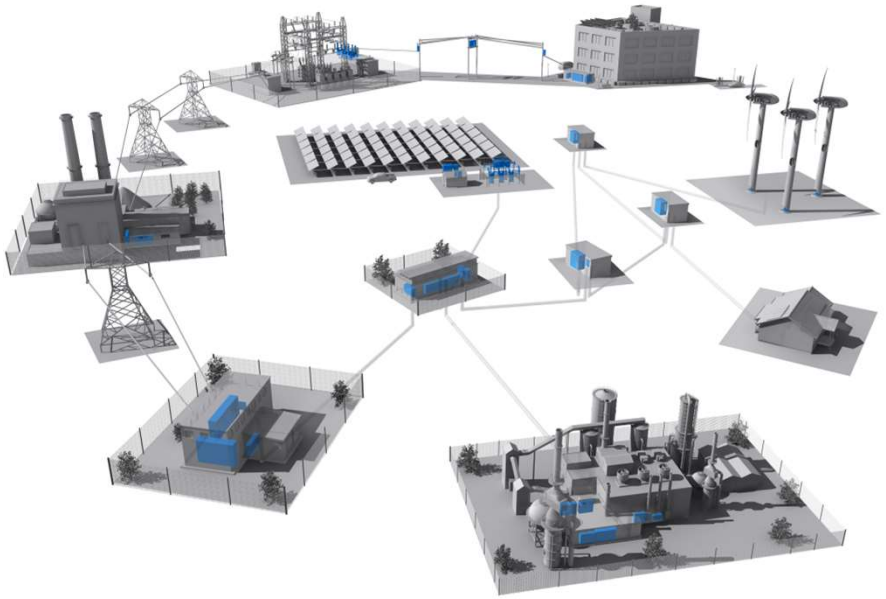
Powering Business Worldwide

A proudly BBBEE Level 1 contributor

Microgrid Standards & Guidelines

Standards play a key role in the design, installation, and operation of Microgrids and Embedded Generation Systems

- IEEE 2030.7; 2030.8
- IEEE 1547.3; 1547.4
- SANS 10142
- NRS 097



Powering Business Worldwide

A proudly BBBEE Level 1 contributor

Implications of Limited Standards in Storage

- Difficulty for customers to align needs with suitable battery technology for application
- Challenges with regulation and compliance
- Push for commoditization of energy storage systems based on price not function

Powering Business Worldwide

A proudly BBBEE Level 1 contributor

Conclusion: We Need Standards

- Ensure consistency
  - Quality assurance
  - Safety
- Increase consumer and utility confidence
- Assess different energy storage offerings against a common benchmark

Powering Business Worldwide

A proudly BBBEE Level 1 contributor


Powering Business Worldwide