Enabling a Total Microgrid Solution for Expeditionary Applications

May 3, 2017

Prepared For:

2017 Joint Service Power Expo

AGENDA

- Who Is LexTM3?
- Tactical Microgrid Definition
- Tactical Power System/Microgrid Evolution
- Enabling a Total Microgrid Solution
  - Intelligent Distribution
  - Energy Storage
- Questions

Company Overview

PARENT COMPANY (formed 2015)
SMART & HYBRID POWER SYSTEMS

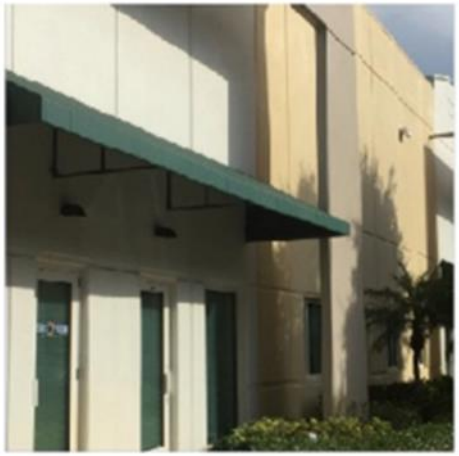
Formerly UEC – **MILITARY**: Connectors, Cable Assemblies, PDUs

Lex Products– **ENTERTAINMENT & COMMERCIAL**: Cable Assemblies, Specialized PDUs, Lighting




Company Overview





Manufacturing

- Shelton, CT (2 X Facilities)
- Sun Valley, CA
- Davie, FL

Smart Power Systems Research & Development

- Royal Oak, MI

LexTM3 is ISO 9001:2008 certified across its four U.S. manufacturing facilities and MIL-STD790 Complaint and AS9100 certified at its military facility in Davie, FL.

Working Definition for Tactical Microgrid

"Warfighter operated and maintained, mobile, flexible group of interconnected sources and loads ~~with a power generation capacity range of less than 1.5 MW~~ that acts as a single controllable entity, which can be organized as a system, intended to be self-contained, readily deployable, may utilize alternative energy resources and power storage, and is capable of interfacing with other grids."

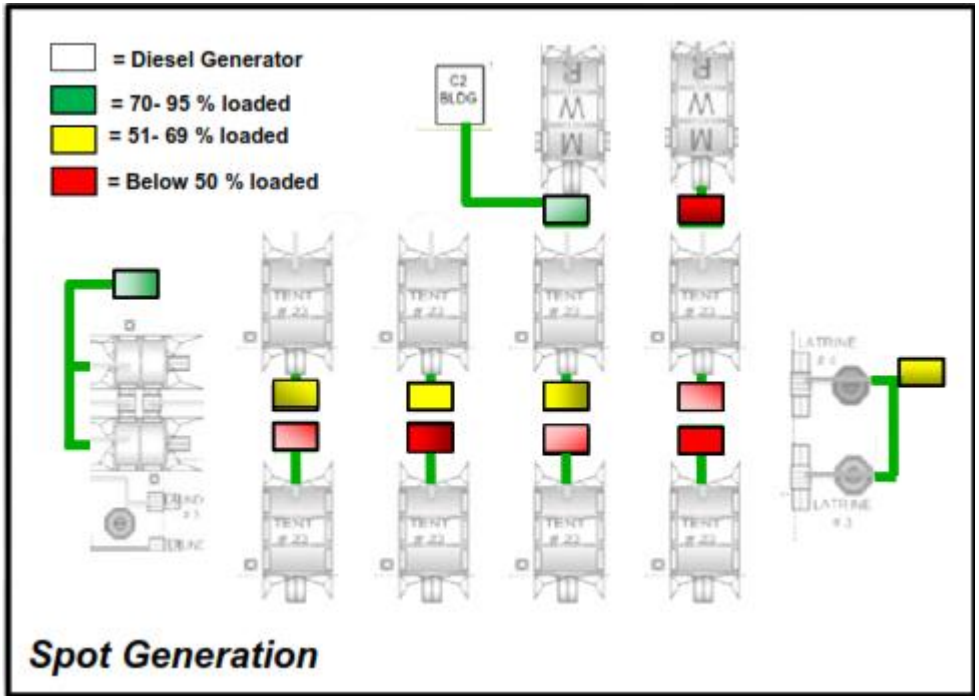
Source: TMSC Update to the EGSA Government Relations Committee 20 March 2017

ERDC Microgrid Commonality Matrix

	Design Life	Primary Role	Benefits	Range	Supporting Tech
Off-Grid Microgrid, Distributed Energy Generation for Remote Locations, Disaster Recovery	10-15 Year Life Cycle	Primary Power where no utility power is available	Provide secure, efficient, and reliable power where utility service is not available	800 kW and up	• Open Interoperability Standard • Power Management System • Metering and Monitoring • Fueled Power Generation • Energy Storage • Renewable and Alternative Energy • Intelligent Distribution • Waste to Energy Systems
Contingency Operations / Base Camp Microgrid	Semi-permanent (can be moved)	Primary Power (medium voltage)	Provides secure, efficient, and reliable power to medium and large military base camps	800 kW and up	• Open Interoperability Standard • Power Management System • Metering and Monitoring • Fueled Power Generation • Energy Storage • Renewable and Alternative Energy • Intelligent Distribution • Waste to Energy Systems
Tactical Microgrid	Mobile	Primary Power (User (Low) Voltage)	Provides secure, efficient, and reliable power to very small and small military base camps. Reduces logistics and maintenance.	10 - 800 kW	• Open Interoperability Standard • Power Management System • Metering and Monitoring • Fueled Power Generation • Energy Storage • Renewable and Alternative Energy • Intelligent Distribution • Hybrid Energy Technologies

Source: U.S. Army Engineer R&D Center – Tom Bozada

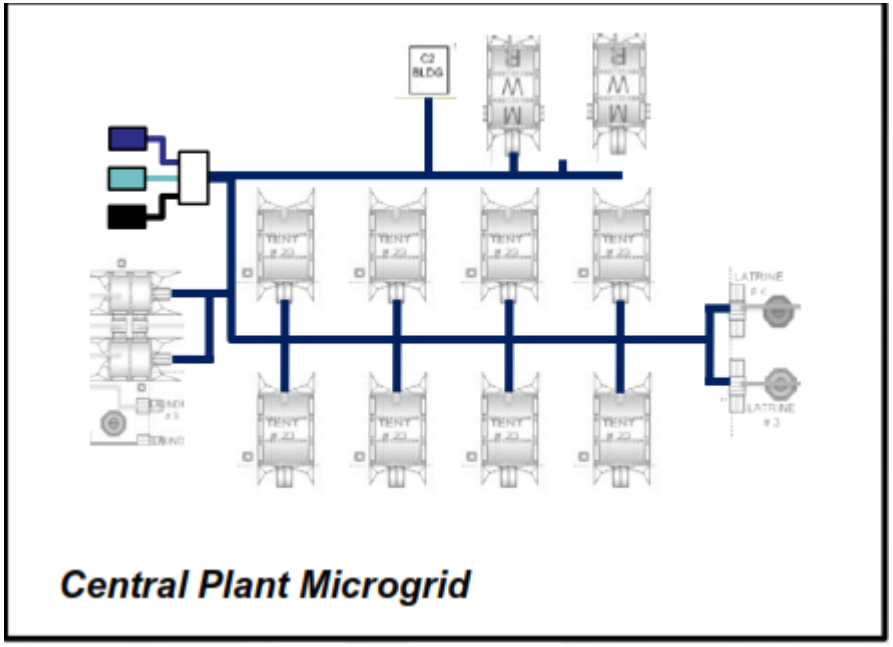
Spot Generation – Inefficient but Works



Source: TMSC Update to the EGSA Government Relations Committee 20 March 2017

Effective and flexible. However, it is remains an inherently inefficient and risky way to serve loads – high fuel usage (i.e. more supply runs), high maintenance (i.e. more time away from supporting mission), single points of failure (i.e. additional generators needed for back up)

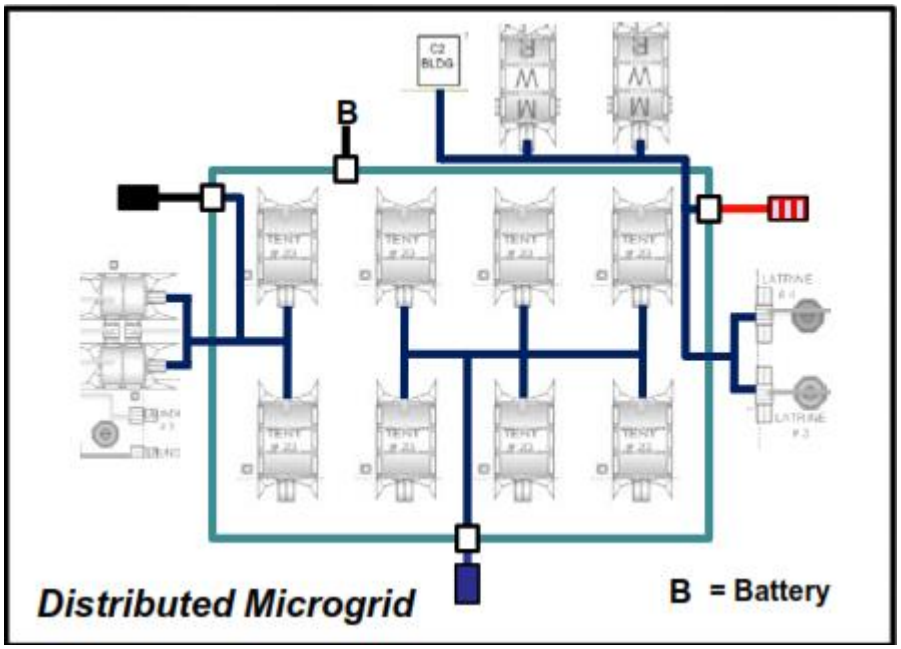
Central Plant Microgrid – Increases Efficiency



Source: TMSC Update to the EGSA Government Relations Committee 20 March 2017

Effective and more efficient (lower fuel usage AND lower maintenance) than Spot Generation. However, the risk of single point failures has not been fully mitigated. An example of this type of microgrid in use today is the AMMPS microgrid (i.e. multiple 30kW or 60kW AMMPS gensets equipped with Advanced DCS)

Distributed Microgrid – Increases Resiliency



Source: TMSC Update to the EGSA Government Relations Committee 20 March 2017

Effective, Efficient and Resilient. Single point failures are mitigated through a variety of means including battery energy storage and intelligent power distribution

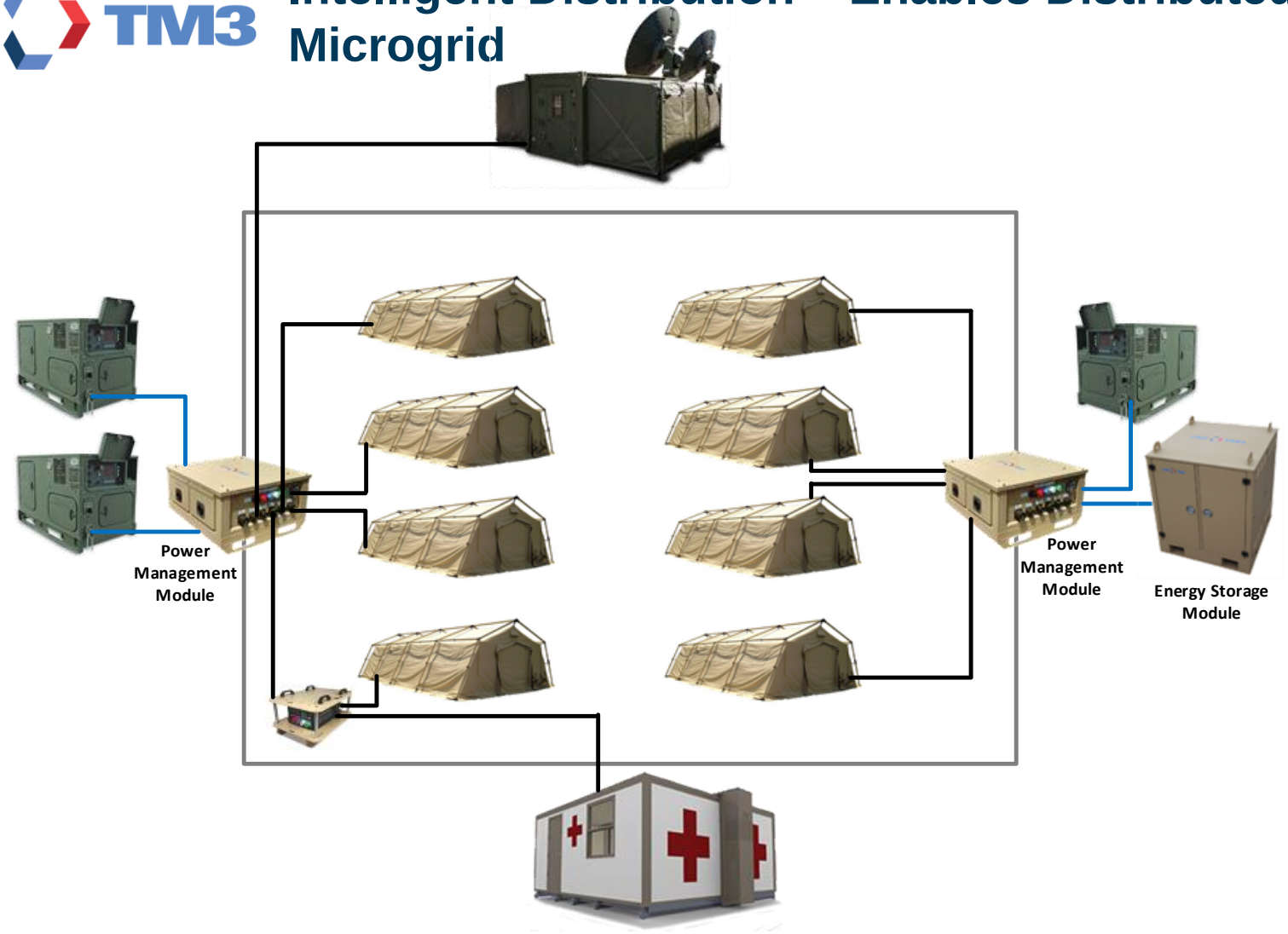
Intelligent Power Distribution

Features & Benefits:

- Designed to intelligently manage, meter and control a wide variety of 208/120VAC, 3 phase, sources and loads for maximum efficiency and reliability.
- Manages AMMPS, TQG, and COTS generators.
- Intelligent controls automatically choose the most efficient power source to serve the loads.
- Output circuits are user-prioritized in order to provide load shedding in situations of low fuel, loss of generation capacity, or unanticipated high load scenarios.
- A Supervisory Control and Data Acquisition system (SCADA) provides real time monitoring, control and data logging for complete microgrid.

Unlike conventional power distribution which effectively and safely accepts electrical power from sources and delivers it to the loads, intelligent power distribution incorporates metering and control of individual circuits maximizing efficiency and resiliency of the entire power system.

Intelligent Distribution – Enables Distributed Microgrid



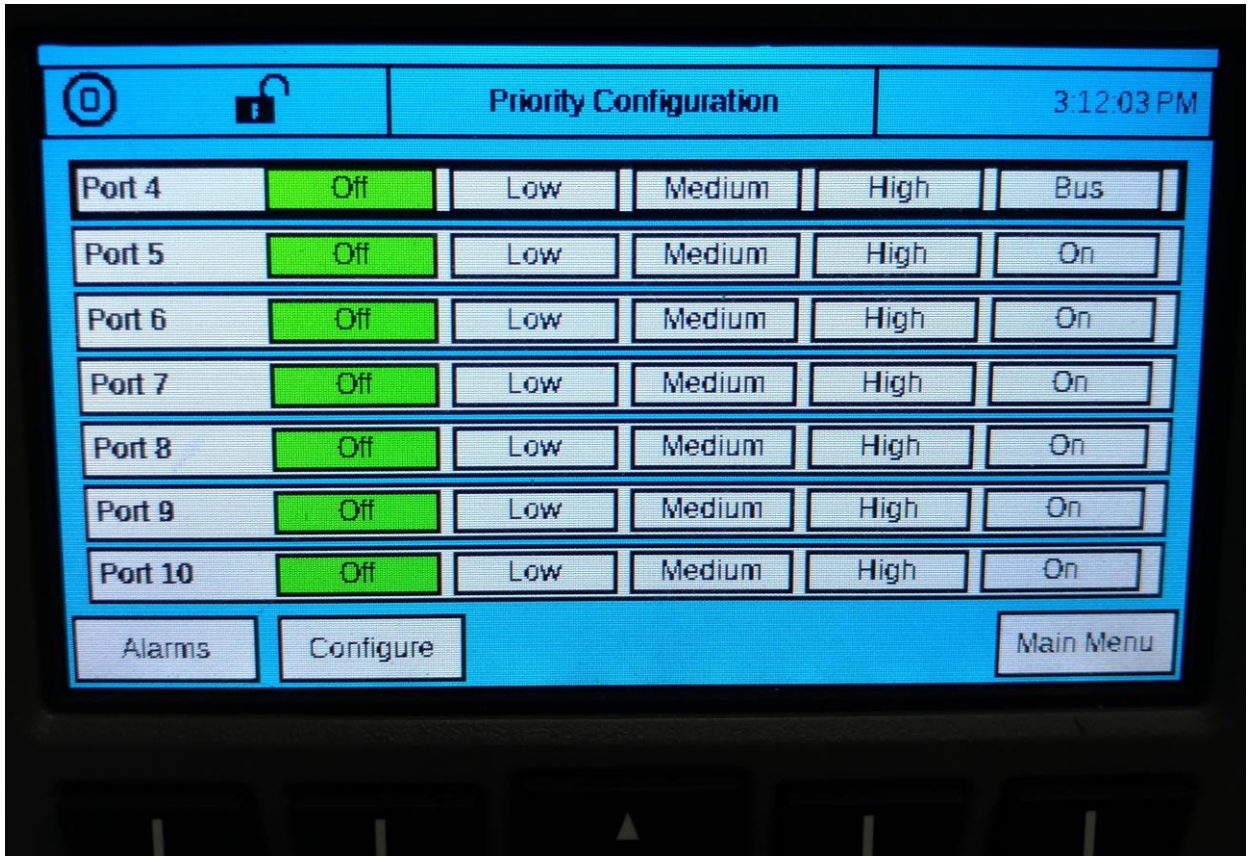
LexTM3's Power Management Module interconnects with both sources (including energy storage), loads and other distribution (both conventional and intelligent) to form and or enable the formation of a distributed microgrid – the most effective, efficient and resilient configuration

Intelligent Power Distribution - Interoperability

ENHANCE Electrical Interconnection & Communications

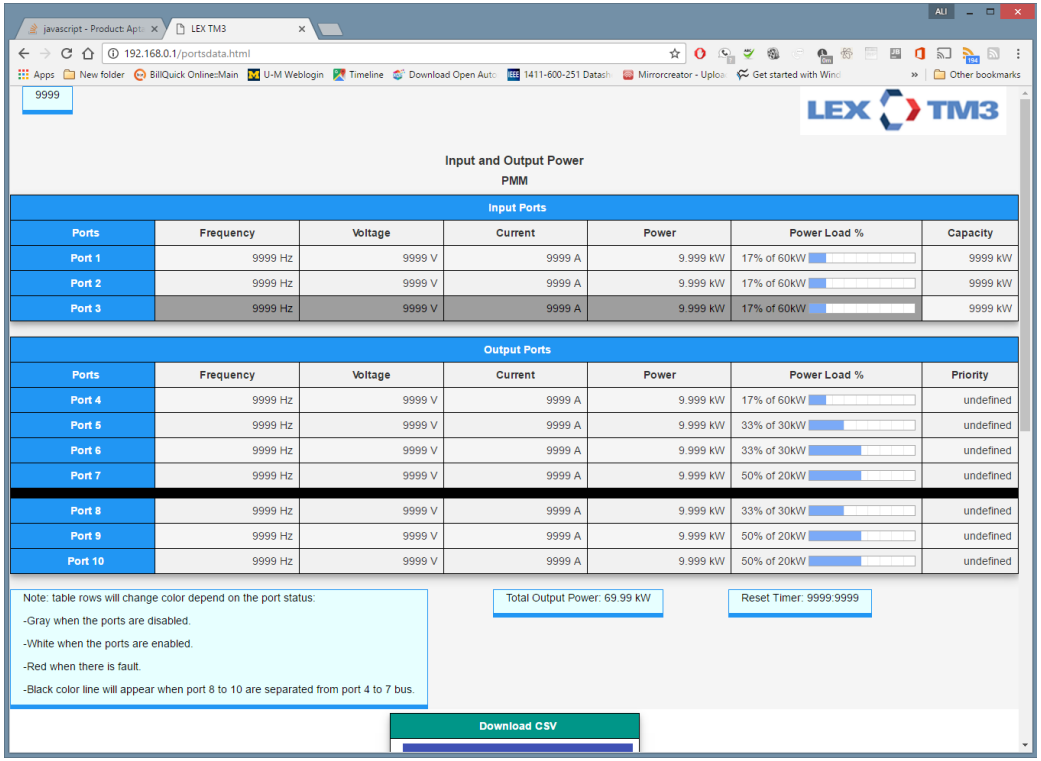
- Microgrid Connect/Disconnect Process
- Microgrid System Performance
- Degraded Operations – Load Shed/Restore
- Support DDS Communications
  - Configuration Management
  - Grid Management
  - Grid Operation
  - Data Collection

Intelligent Power Distribution – Load Prioritization, Shedding & Restoration



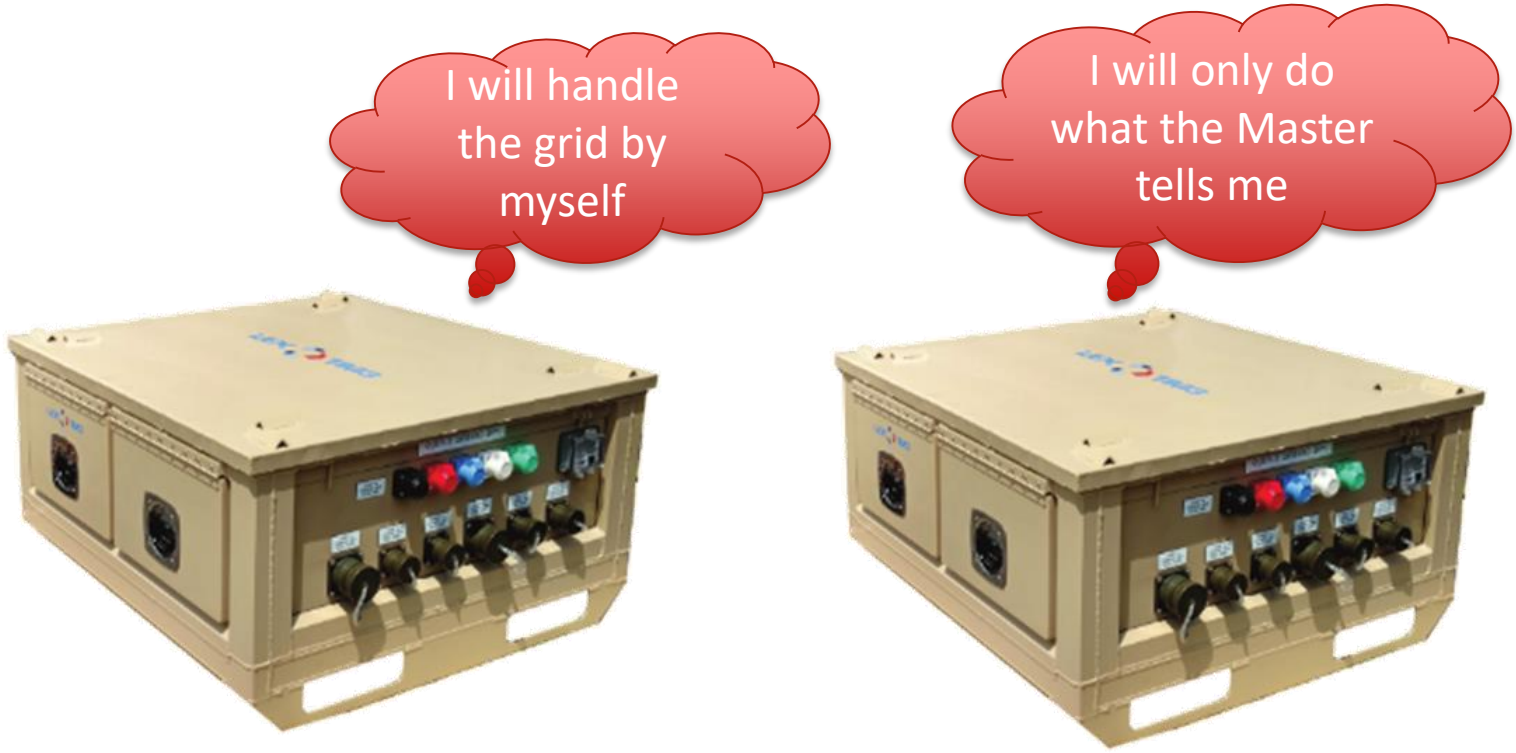
LexTM3's Power Management Module (PMM) provides the ability to prioritize individual circuits (ports) so that if load shedding is required the lowest priority loads are shed first. Shed loads are automatically restored based on local controller algorithm

Intelligent Power Distribution – Remote & Local Monitoring



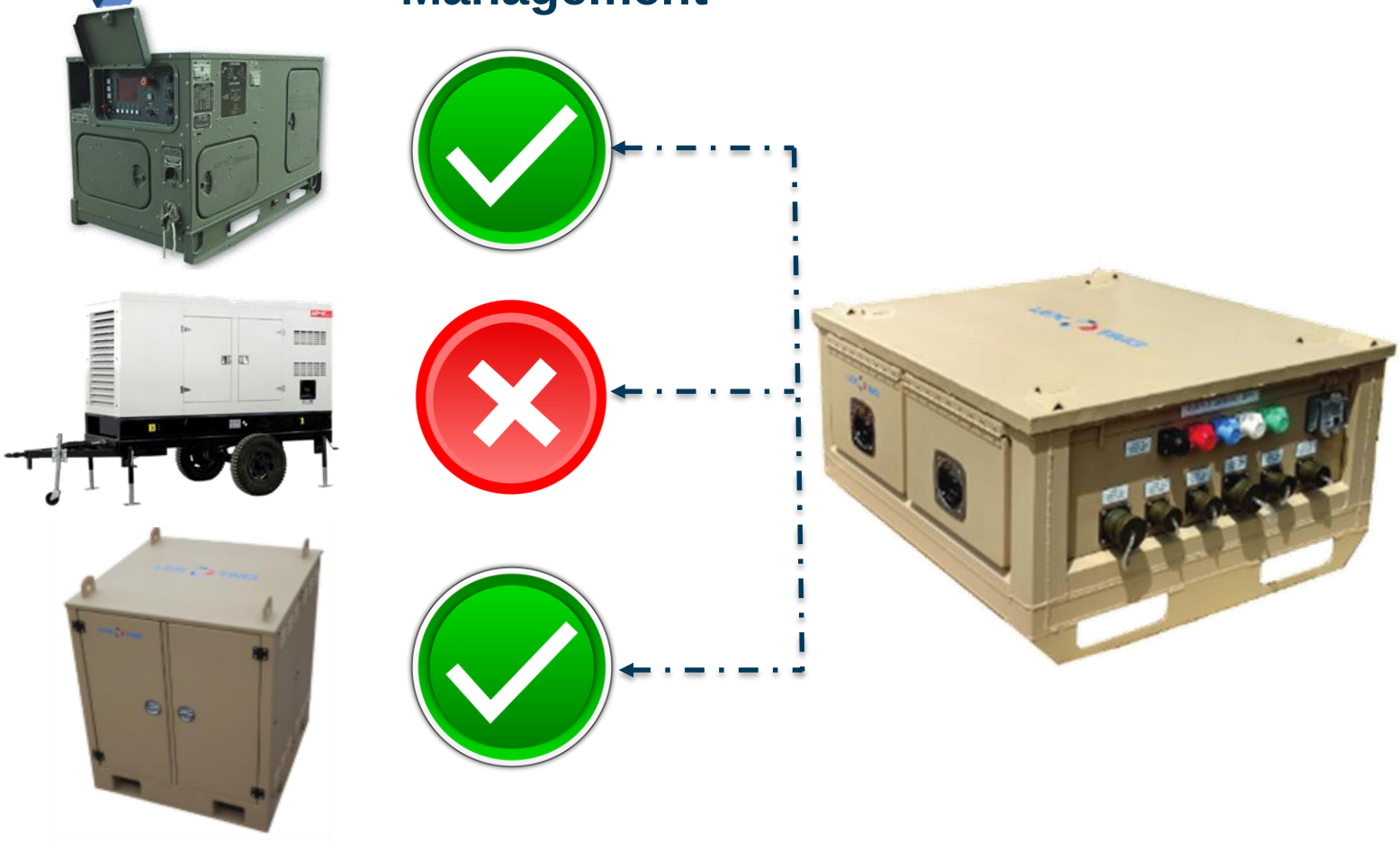
Status of loads (and sources) may be viewed locally or through a remote connected HMI or SCADA providing valuable information for both energy management and future planning

Intelligent Power Distribution – Local or Remote Control



Depending on the application or tactical power system configuration, the Power Management Module may act as the grid controller or be controlled by a master grid controller

Intelligent Power Distribution – Source Management



If desired, the PMM can provide source management for multiple types of generators (AMMPS, TQGs or Commercial) as well as energy storage modules

Energy Storage – Critical to Grid Resilience

+

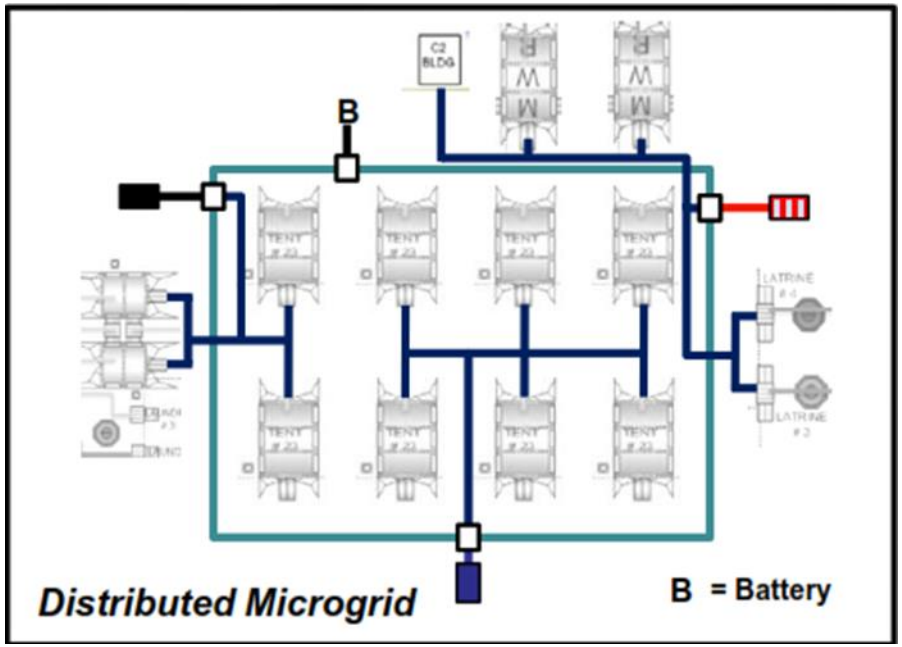
Generator Optimization and Ride Through

+

Maximize Usage of Renewable Sources

Energy storage adds **efficiency** and **resiliency** to the tactical microgrid. Backup power, Silent Watch, Peak Shaving & Generator Optimization are all capabilities that energy storage brings to the table to keep critical loads operational while also maximizing the use of renewable energy sources and overall system efficiency.

Bringing It All Together



Intelligent power distribution along with energy storage supports all tactical microgrid modes: Normal, Silent Watch, Critical Asset, Communications Failure Mode and Emergency

Questions?
Thank You!

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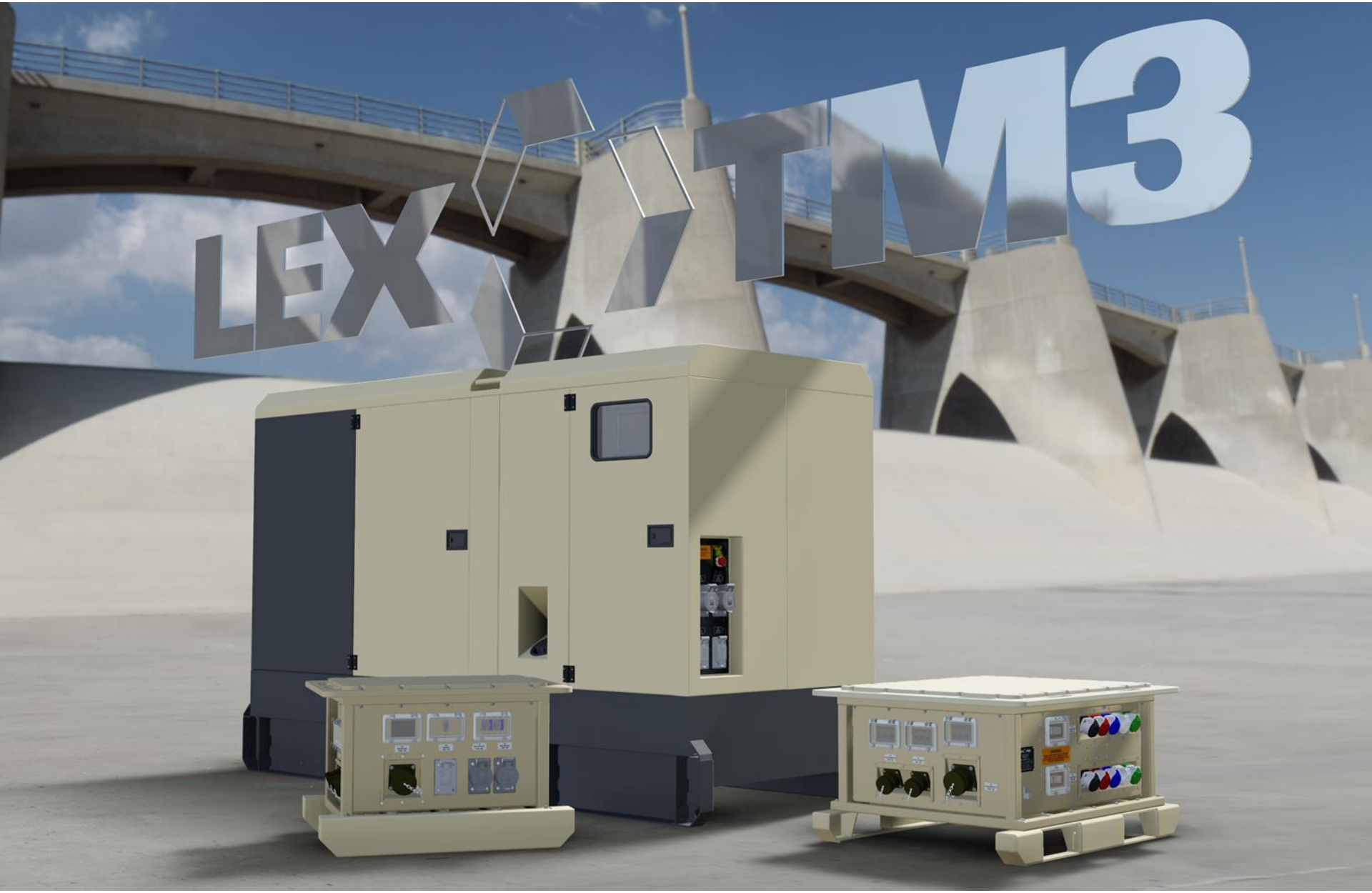
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