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Increasing Margins with packaged Low Voltage Digital Building Solutions

Fault Managed Power + POE

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Agenda

- Energy Efficiency Today
- New Technologies
- Advantages of a DC Microgrid
- Construction, EC's, and Low Voltage
- Packaged Building Infrastructure

Commercial
buildings
consume **18 to
20% of total
energy** and
generate **16% of
all carbon** in the
US



U.S. EIA (2022) Monthly Energy Review April 2022
National Renewable Energy Laboratory Nov 2021

Market Trends within the Electrical Industry

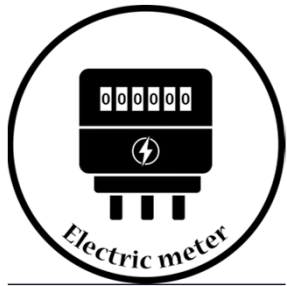
- Copper prices continue to rise & may even go to \$6 to \$7 / lb. doubling during 2023/2024
- Lead times are increasing bc the demand for electrification is high & supply cannot keep up
- Energy code is driving complexity and higher costs of building systems
- Labor costs are up while skilled labor is shrinking
- Clients require sustainable solutions (facilities with lower embodied carbon, use less energy, require less maintenance and last longer)

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Energy Efficiency Today

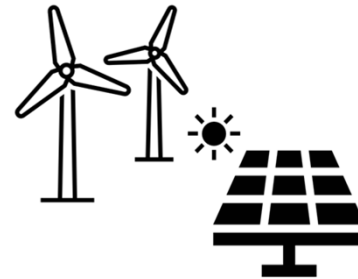


Contemporary Approaches



Metering/Sub-Metering

- Expose and Report



• Energy Generation



• Energy Reduction

- Energy Efficient Loads
- Load Management
- Systems Integrations

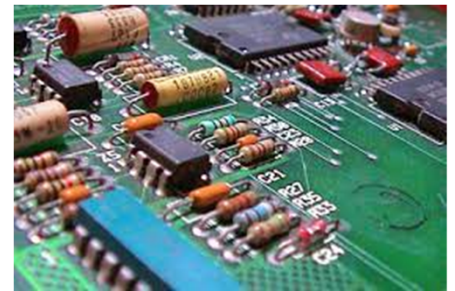


• Energy Storage

We Live in a DC World!

If AC is used in electronic circuits:

- It will create extra work for just handling the phase-shift between signals
- It will be harder to supply them by batteries
- You lose a part of the power when the voltage crosses 0
- If you have single phase, you have pulsating power
- You need to adapt the frequencies, if you expect them to work together
- And to design a good grounding would be a pure nightmare

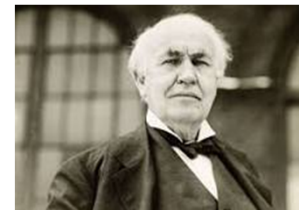


Nicola Tesla



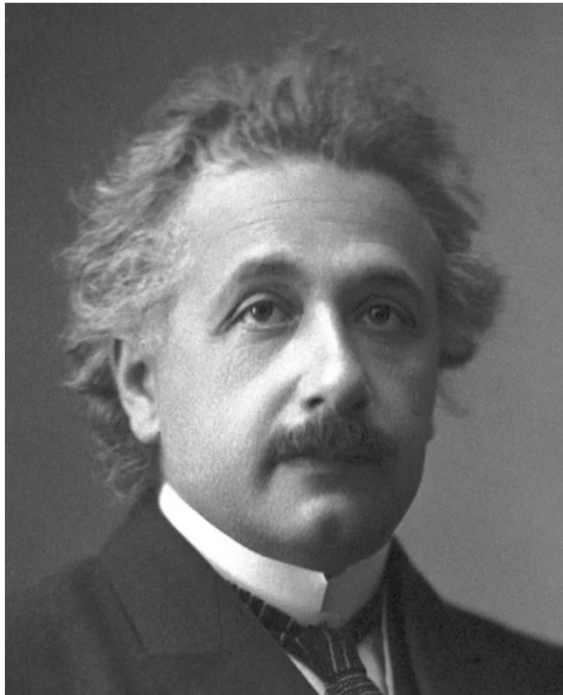
George Westinghouse

VS



Thomas Edison

We Can Do Better



"Insanity is doing the same thing over and over again and expecting different results"

➤ Albert Einstein



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New Technologies



Fault Managed Power



Article 726 Summary

- Provides **quick fault detection and handling**
- Class 4 systems provide **high voltage power safely** (up to 450V)
- Can be AC, DC, or hybrid, and must manage faults quickly enough to **prevent hazardous shock or fire**
- **Requires a transmitter(TX) and receiver(RX) working together**
- **No interoperability standards exist** so TX and RX are from the same manufacturer and must be designed to work together
- **Cabling requirements are similar to Class 2 and can share pathways**
- Compliance:
 - **Equipment must comply with UL 1400-1**
 - **Cabling must comply with UL 1400-2**



Fault Managed Power

EXAMPLE

AC or DC analog electricity from the grid, battery plant, or UPS.

The Transmitter converts Analog AC or DC to Digital Electricity.

The Digital Electricity packets are sent over low-cost structured cable.

Receivers convert the Digital Electricity back into Analog AC or DC.

The Analog AC or DC can power 1 or more remote load devices.



Conventional Electricity



DE Transmitter

Structured Cable



ENERGY PACKET



DE Receiver



Local Loads

ENERGY

SAFETY CHECK

Discrete "packets" of electricity, *every packet* is checked for safe transfer from transmitter to receiver.

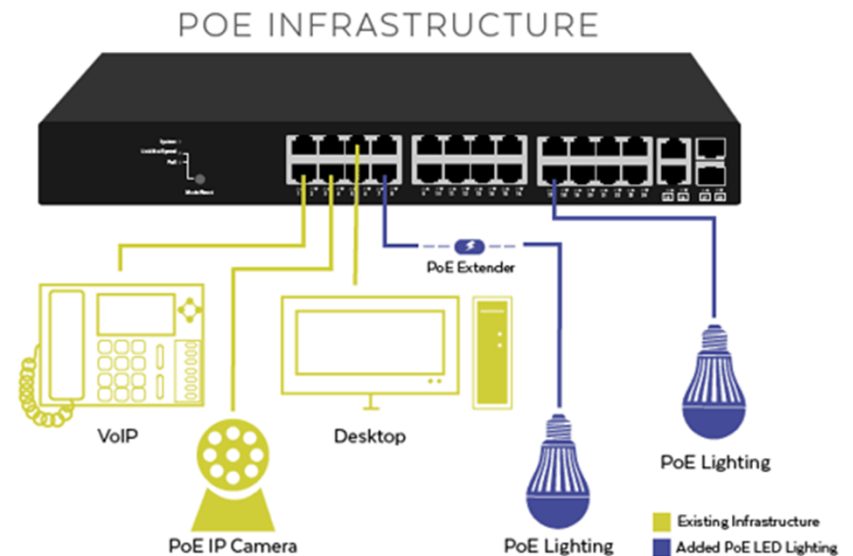
Each packet contains only a very small amount of energy,

Each packet is not harmful to people, animals, systems, or buildings.

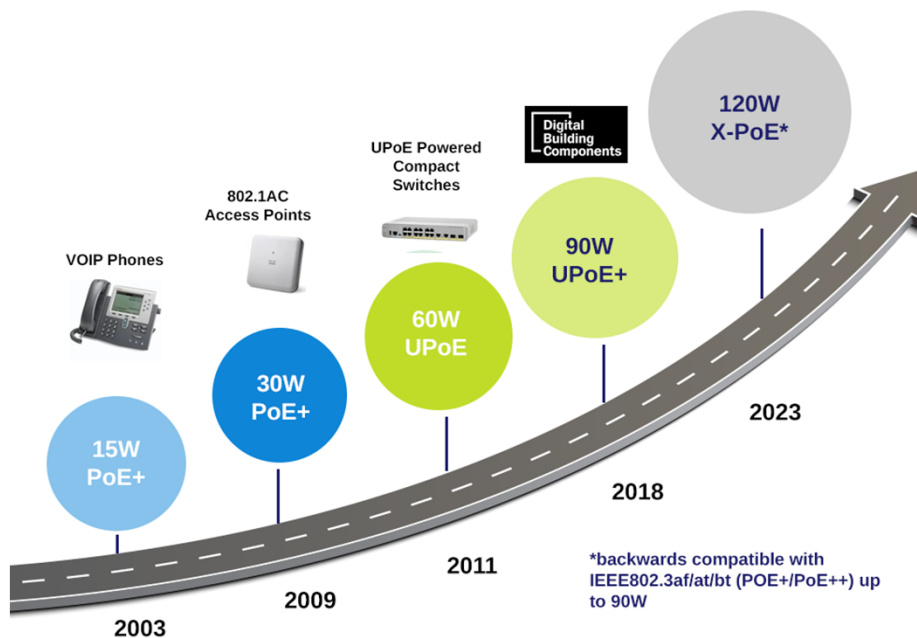
The VoltServer products are listed and certified to safety and EMC standards by a Nationally Recognized Test Laboratory.

Power over Ethernet

- PoE is the integration or delivery of direct current power & data over the same low voltage ethernet cable.
- PoE reduces the number of cables and power supplies required to install a network and power the devices connected to it.



Power over Ethernet Use Cases



- Early on in PoE, it was mainly lower power devices such as phones and wireless access points. This has evolved over time to deliver higher power over Ethernet cable.
- With the availability of higher power, lighting, air conditioning, televisions and more are now feasible. The move to PoE for DC objects will continue to grow.

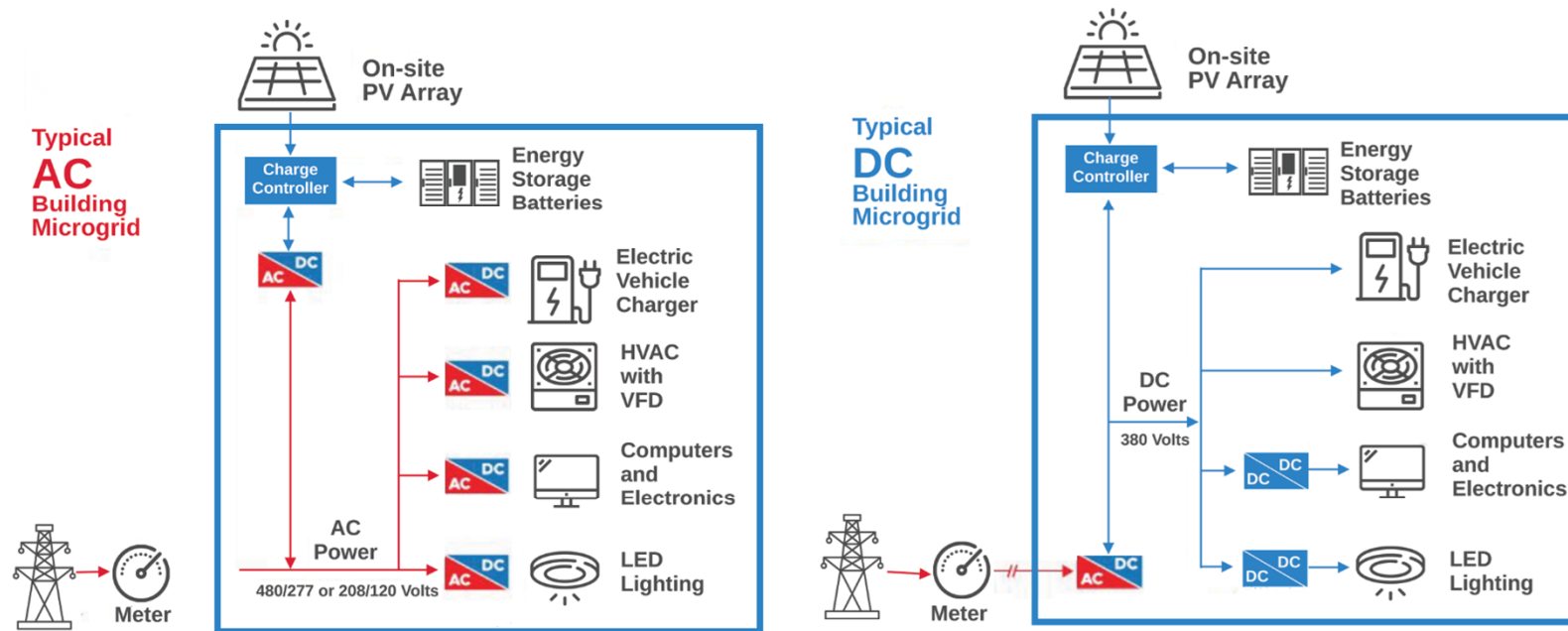
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Advantages of DC Microgrids



AC vs DC Building Infrastructure

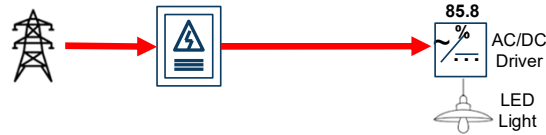
Eliminate Energy Loss By Reducing Conversions



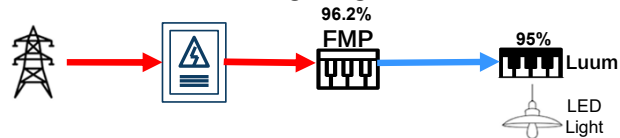
By eliminating expensive power conversions and directly connecting solar, batteries, EV charging, lighting and more via direct current power, the electrical system will be 10-18% more efficient than the industry standard and have up to a 30% lower total cost of ownership.

Electrical System Efficiency Comparison

Typical LED Lighting

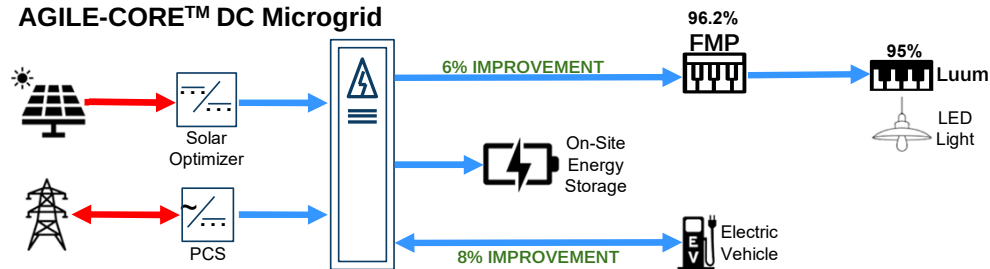


AGILE-CORE™ LED Lighting



FMP + PoE DC Lighting Systems are more efficient than traditional AC lighting systems

AGILE-CORE™ DC Microgrid



DC Microgrids are inherently more energy efficient than AC systems

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Construction, EC's and Low Voltage



Low voltage DC power is here and you are empowered to decide who implements it

- Class 2 low voltage wiring is typically performed by datacom technicians today
- Class 1 and Class 2 systems are converging
- High voltage AC and/or high voltage DC will always be present in commercial structures
- Electricians will drive the adoption of these technologies



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Packaged Building Infrastructure



Agile-Core™ DC Lighting and IoT System

Agile-Core™ direct current system delivers greater efficiency, less maintenance, and access to data by eliminating AC wiring and AC to DC power conversion at the light fixture

- Uses cost-effective and safe class 2 wiring methodologies, reducing labor, copper, and materials compared to traditional lighting systems

Lower embodied carbon
(uses less rare earth materials)

10% more energy efficient
as compared to traditional systems

15% less maintenance
over the life of the system

Core Technologies for Safely and Cost Effectively Delivering DC Power and Control

Power Over Ethernet (PoE)

PoE is the integration or delivery of direct current power & data over the same low voltage ethernet cable. PoE reduces the number of cables and power supplies required to install a network and power the devices connected to it.

Fault Managed Power (FMP)

FMP allows for controlled power distribution that is safe, less expensive, faster to install, more energy efficient, and meets the needs for an increasingly digital world. It is a line powered system. Line powering is a means of energizing remote equipment, from a centralized location, over structured copper cable.

With the combination of FMP and PoE, power and data can now be provided at significant distances for large-scale facilities

Packaged Building Infrastructure Solutions using Agile-Core™ Technology



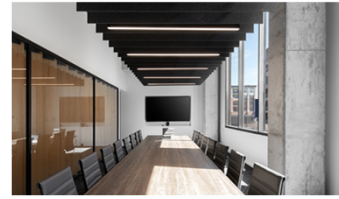
Warehouses and
Data Centers



K-12 Education



Hospitality



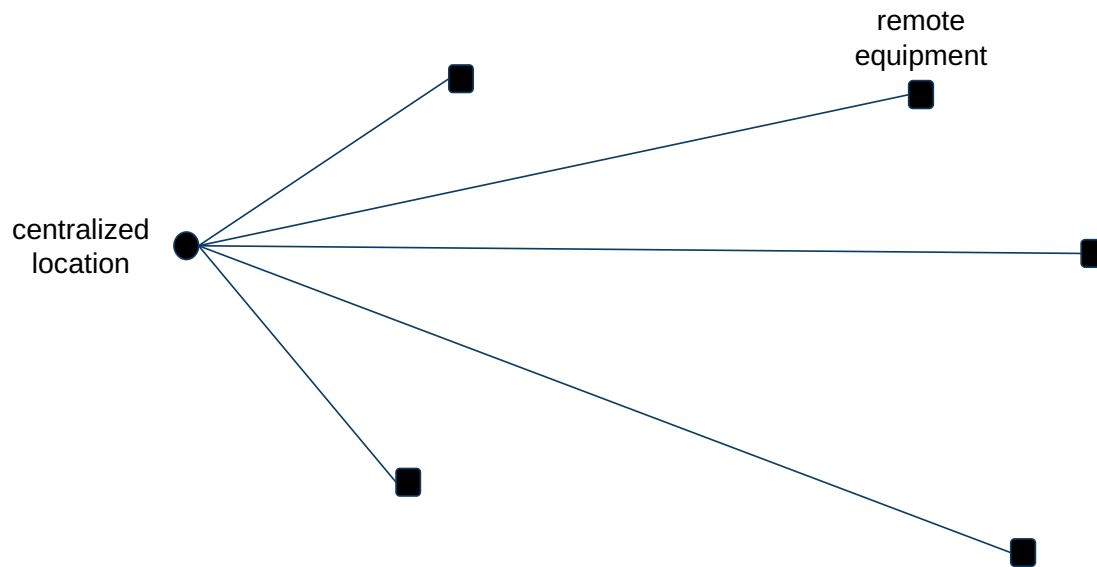
Offices



Campuses & Multi-
Site

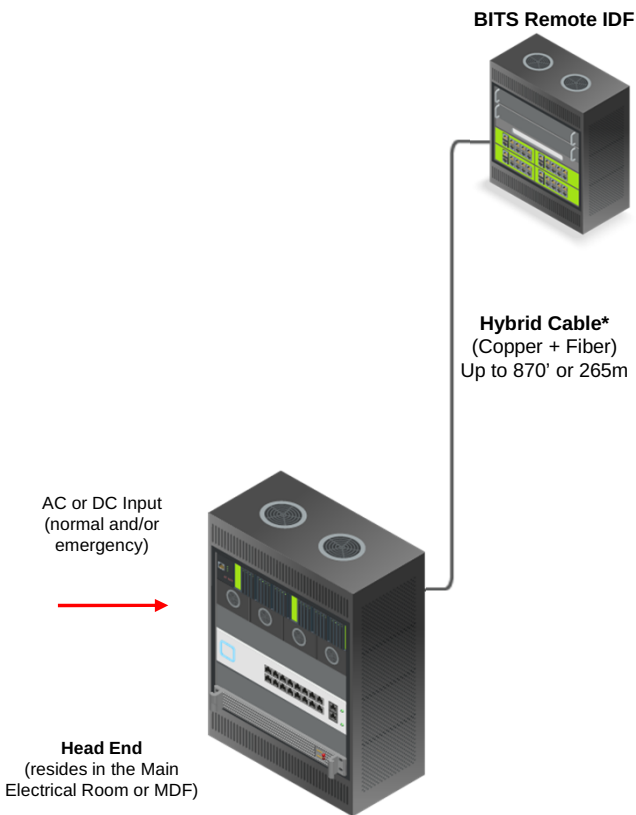
Packaged low voltage solutions are now available and can move power and data from the main electrical room to the intelligent lighting fixtures for spaces that are 25K, 500K, 1M, 5M + sq ft

Network Based Low Voltage DC System Topology



- The system uses a hub and spoke topology that is line powered.
- Line powering is a means of energizing remote equipment, from a centralized location, over structured copper cable.

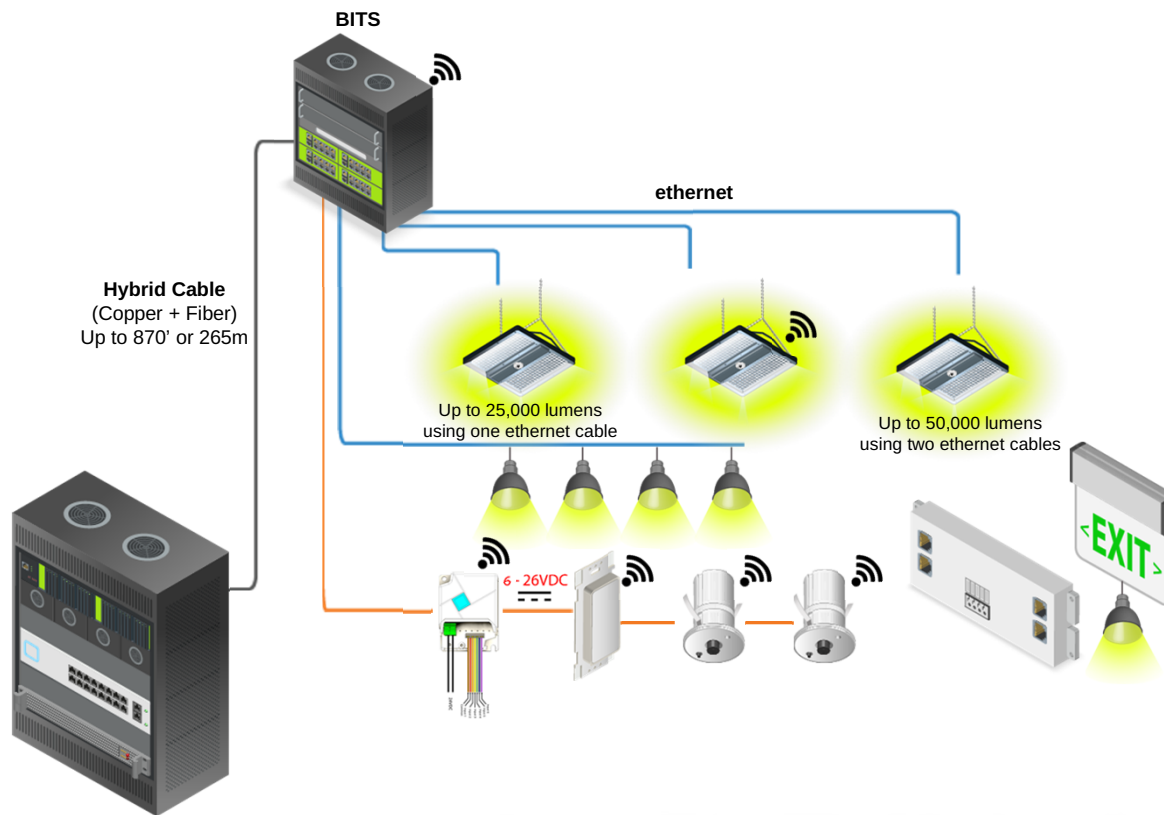
Agile-Core™ DC Lighting and IoT System



- The Head End is the hub of the system. 100 to 250VAC or DC power is fed into the head end and converted to Fault Managed Power (FMP). Power and Data may be combined and fed into a hybrid cable.
- Hybrid cable* is fed to a Building Infrastructure Transmission System (BITS) Remote IDF
- The BITS enclosure is intended to be suspended or wall mounted
- Each BITS accepts the hybrid power and data cabling and converts it to PoE
- Up to (X) BITS enclosures may each be home run back to a Head End rack

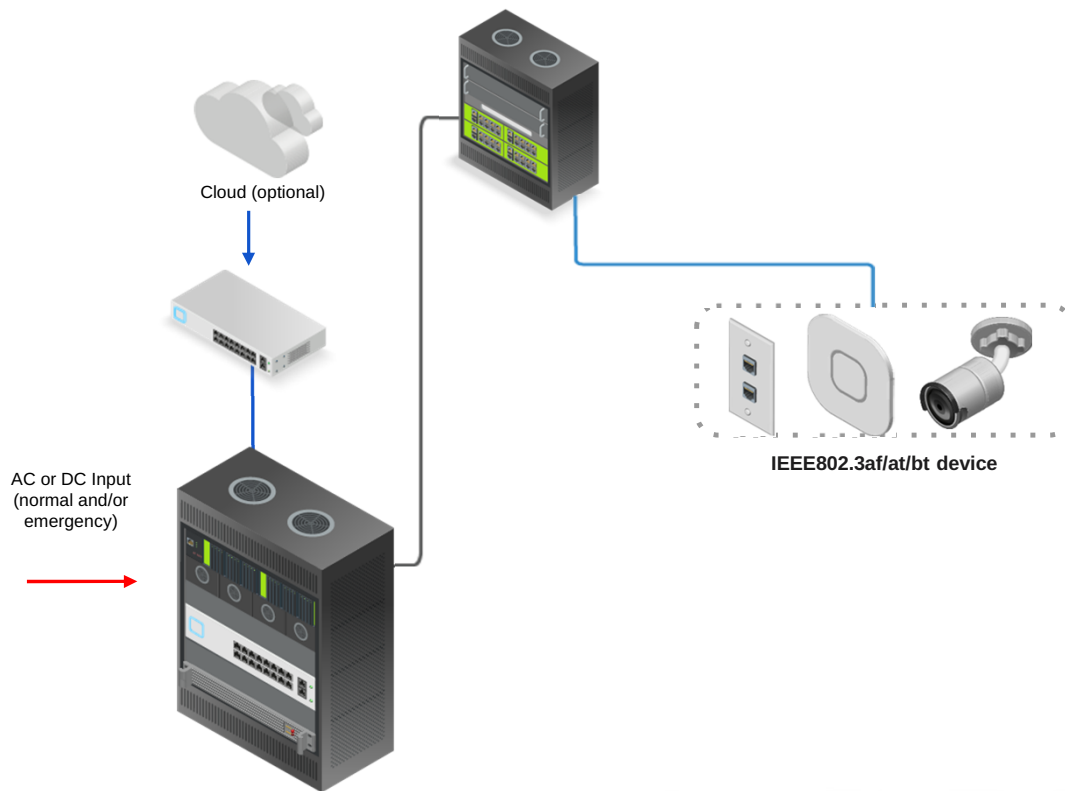
*multi-conductor copper cable may also be used when data backhaul is not required

Agile-Core™ DC Lighting and IoT System



- Each BITS can output up to 3,840 watts of power, includes (64) 60W channels of output across (32) ethernet ports. Or up to (120) watts per ethernet port and may be fed with normal and/or emergency power.
- Tunable white, static CCT lighting, high lumen fixtures, IAQ sensors, ON/OFF switches, scene stations, PoE lighting nodes and more may all be deployed using ethernet cabling.
- Distance from the BITS to the furthest object is 328' or 100m. Lights may be daisy chained together as long as the wattage per port is not exceeded.
- The Agile-Core™ system supports both wired and wireless communicating devices

Agile-Core™ DC Lighting and IoT System



- Each X-PoE port is backwards compatible to IEEE802.3af/at/bt (PoE+/PoE++) up to 90W
- Any X-PoE or PoE device may be powered and controlled from the BITS
- IT and OT systems may even converge maximizing savings potential and streamlining design of siloed systems

Infinite Lighting Options



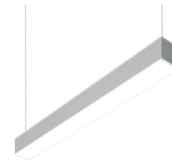
High Bays



Downlights



Troffers



Suspended



Exit / Emergency



Wall Packs



Linear



Wraps



Decorative



Site / Parking

All requiring less maintenance and 10% less energy to operate

Value: Data Driven Insights with FMP + PoE

Hourly Report

Temperature



Humidity

Finance: 30%
Conf Rm Center: 30%
CEO: 29%
Floater: 27%



kWh Consumption

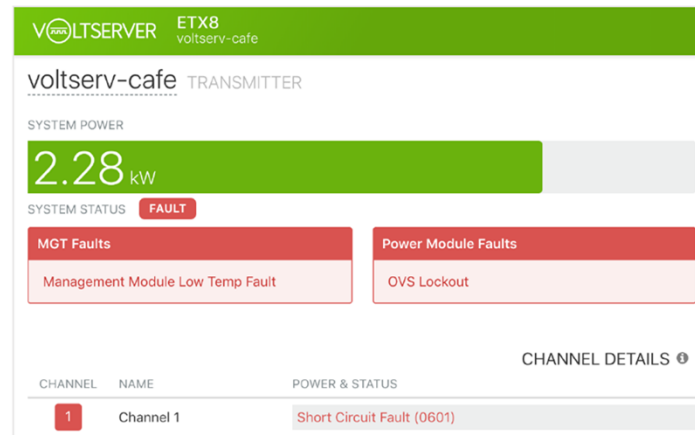
0Unassigned: 3%
Pantry: 8%
Lobby: 15%
Marketing: 11%
Finance: 6%
Floater: 5%
CEO: 11%
Conf Rm Center: 22%
Conf Rm Rear: 9%
Conf Rm Front: 9%
Kwh Saving: 1%

Light

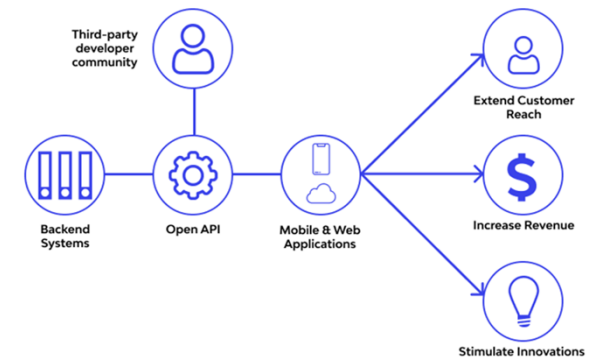
Finance: 61 Lux
Floater: 44 Lux
CEO: 59 Lux
Conf Rm Center: 106 Lux



Find, implement
and track energy
savings



Identify problems and
service equipment before
having to physically mobilize



Open API - third party
systems may pull data and /
or control objects within the
system

REAL WORLD PROJECT USING FMP + PoE



- 1st Net Zero Hotel in the United States
- 110,000 sq ft
- 165 guestrooms, gym, meeting spaces, gallery, restaurant
- FMP + PoE throughout
- 1,100 solar panels
- Battery Energy Storage System in place of a diesel generator
- Electrified kitchen

Grid Outage Example at the Hotel Marcel in New Haven



Event duration: 2h 36 minutes

Energy delivered by the
microgrid: 516 kWh

Solar production during the
outage: 292 kWh

Energy delivered by the BESS:
255 kWh

Carbon based fuel consumed: 0

Disruptions to the hotel: 0

REAL WORLD PROJECT USING FMP + PoE



39%

ENERGY SAVINGS

Compared to energy usage
pre-renovation

16%

CAPEX SAVINGS

Reduced CAPEX savings of
electrical budget



50%

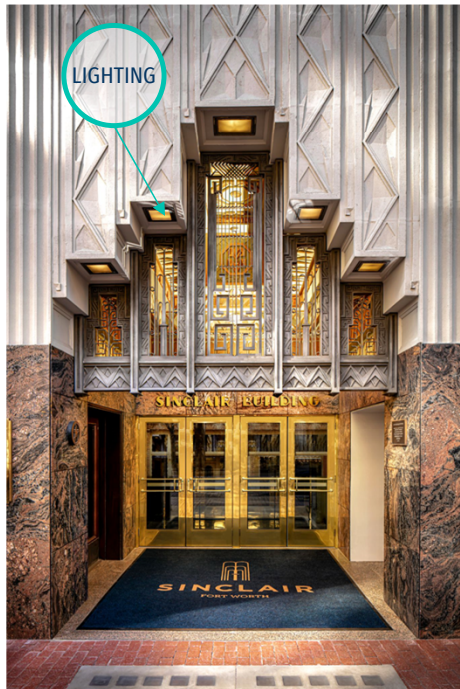
FEWER ELECTRICAL & IDF CLOSETS

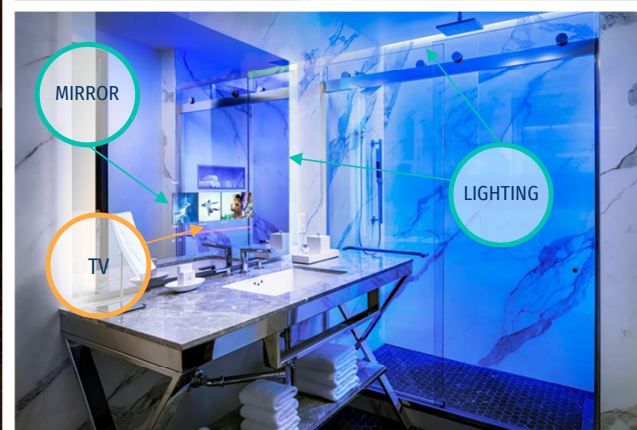
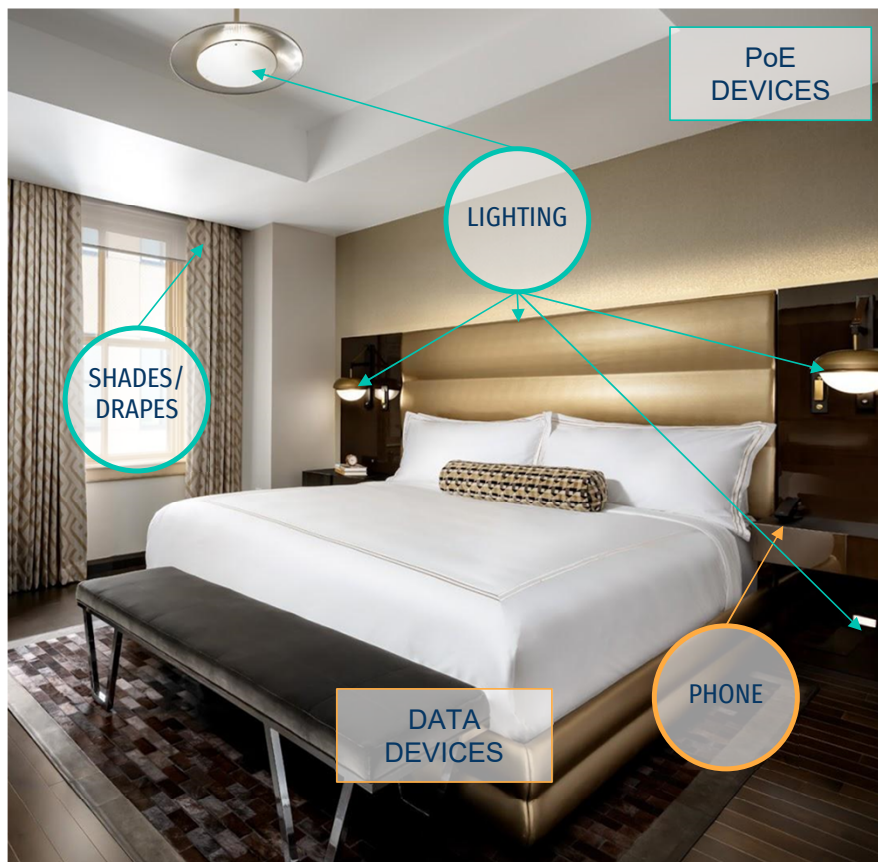
Created 1,092 SF (1%) of
additional usable space

82%

Embodied Carbon Savings

As compared to AC wiring







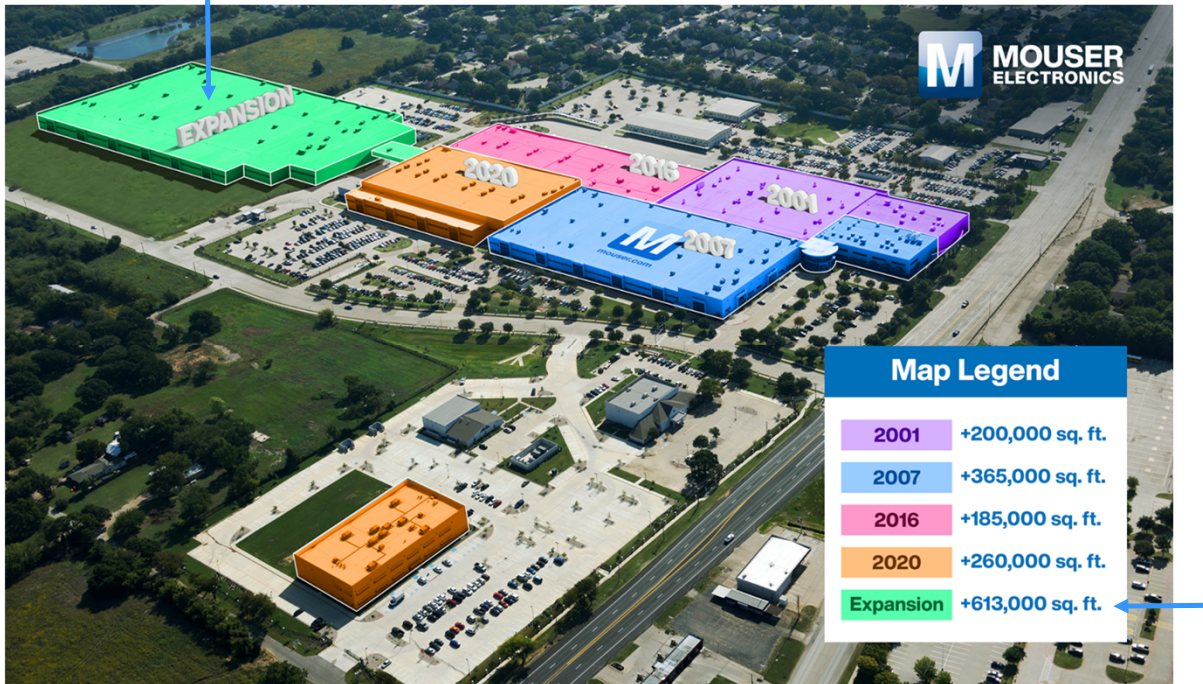
REAL WORLD PROJECT

23k Sq Ft Office at the Battery in Atlanta, GA



REAL WORLD PROJECT USING FMP + PoE

Automated Warehouse



- 600K + sq ft; 40' ceiling heights
- 1,700+ LED lights
- Integral daylight/motion sensors in luminaires
- Client selected the solution because of its granularity of control, flexibility, cost effectiveness, energy savings, and because it presents no risk to interfering with the wirelessly communicating automated mobile machinery

Pricing Example for Code Compliant 184K Sq Ft Warehouse

Traditional AC Line Voltage Lighting:

\$2.90 per sq ft

184K sq ft

(\$0) tax benefit

Total = \$580,000

Agile-Core:

\$3.00 to \$3.80 per sq ft

184K sq ft

\$699,200 to \$552,000 b4 tax benefit

(\$112 to 142K) tax benefit*

Total = \$556,589 to \$439,412

\$ Savings = \$140,587 to \$23,410

- + 10% Energy Savings Per Year OpEx SAVINGS
- + 15% reduction in maintenance

*When paired with on premise microgrid controller, PV and/or ESS, Agile-Core qualifies for the tax credit within the 2022 Inflation Reduction Act



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