





Critical Power Group  
Ashburn, VA 20147  
[www.criticalpowergroup.com](http://www.criticalpowergroup.com)  
703-443-1717

## ECO Offerings

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 703-443-1717

## THE MICROGRID NEVER STOPS THINKING AND NEVER MISSES A BEAT

### ENERGY INTELLIGENCE

*Think of a microgrid as active intelligence whose unblinking eye is fixed on optimizing your energy usage, ensuring your security and lowering your energy costs continuously throughout the day.*

#### MICROGRID POWER DYNAMIC

Real time generation and load management for energy savings and energy security

Purchase and Store Energy at Off-Peak Rates

Use Off-Peak Energy During Peak Periods

#### Savings

Best-in-class software and controls to ensure savings and optimization.

#### Efficiency

Increases savings by learning energy usage patterns, making use of resource and consumption forecast data along with dynamic optimization.

#### Security

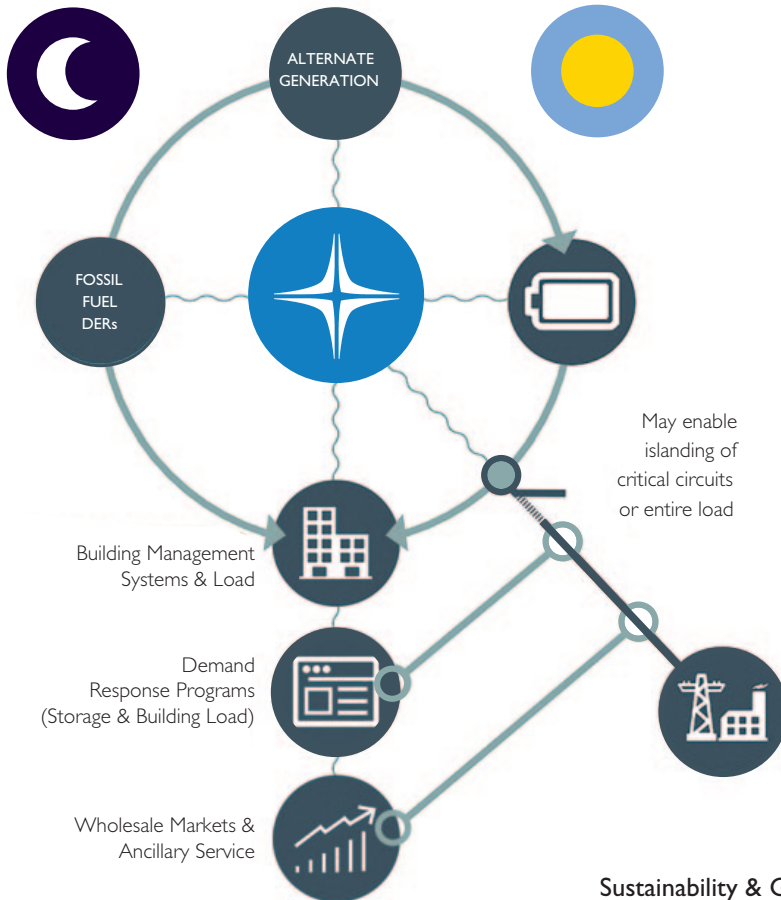
Combines onsite generation with energy storage, providing a physically secure and cyber-secure source of reliable, blinkless power.

#### Autonomy

Set-it-and-forget it. Configures your microgrid so that continuous user interaction is not required.

#### Sustainability

Reduces your carbon footprint with renewable self-generated power that frees you from price hikes, outages and carbon-fueled gridpower.



#### Sustainability & GHG Reduction

With rising utility costs ranging from 2-6% per year in most places and many jurisdictions offering tax based incentives, renewable energy is more cost effective than ever. We are no longer required to pay more for clean energy, but rather demand it at cheaper prices. mVSO will deliver the optimum mix of Solar PV and energy storage for your unique use case while quantifying the benefits.

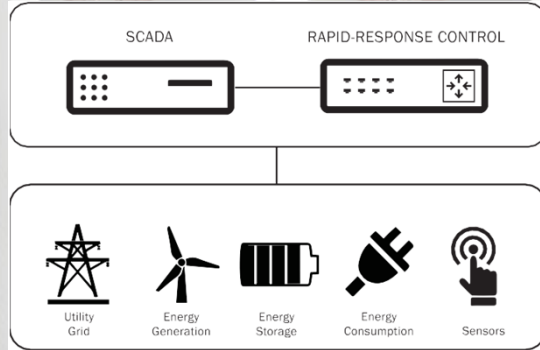
#### Energy Security & Resiliency

Our customers care about keeping the lights on. Often times, they don't realize that critical power support doesn't need to come at a premium price, but rather well designed and well controlled systems can offer approximately 20% of your load support in the event of a grid outage. Have more critical loads? Let mVSO prioritize system design to maintain those loads while also considering cost savings and sustainability.



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## mPulse™ DER Energy Manager



### Features

- ✓ Utility Interoperability
- ✓ Legacy Asset Integration
- ✓ Vendor-Agnostic
- ✓ Load Following
- ✓ Load Shifting
- ✓ Load Leveling
- ✓ Peak Shaving
- ✓ Energy Storage Integration
- ✓ Islanding Capability
- ✓ Real-Time Data Visualization



## Patented Forecasting Enables Critical Power Group to Manage Power Flow and Create the Outcomes Our Customers Care About:



### Economic Optimization: Cost Savings and Revenue Generation

Earn 12-18% Internal Rates of Return on your Power System. Whatever your location, utility, or rate structure, CleanSpark's mPulse™ software maximizes Return on Investment through using lowest cost power sources at all times while remaining flexible for future over the meter opportunities.



### Vendor Agnostic Integration

Power systems are expensive, reduce first costs by at least 20%. Vendor competition for high-value components such as Solar PV, Energy Storage, and Backup Generators can significantly reduce first cost and boost your project's economics.



### Reputable Ecosystem of Utility Proven Hardware

Utility proven substation field servers with a 10 year warranty drive CleanSpark's software and control suite at your site along with fleet scale data services ensure your system is accessible at all times.



### Flexible, Scalable, and Intelligent

mPulse™ is a massively scalable hybrid-cloud solution that puts site-specific business value into the microgrid to enable highly resilient, disconnected, intelligent site functionality while backing that functionality with cloud-honed insights drawn from not only your microgrid's own history but industry standard modeling and AI-driven forecasts.



### Cyber-Secure Energy Security

Designed from the ground up with NERC's Critical Infrastructure Protection (CIP) standards and the United States Department of Defense Risk Management Framework (RMF) in mind and built upon Microsoft's Azure's platform leveraging end-to-end encryption across all data-flows.



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## Natural Gas and Biogas CHP Solutions

**How Does CHP Solutions Energy Provide Value:** Critical Power Group offers CHP cogeneration specialist offering best-in-class cogeneration system for natural and biogas in the 50 to 2,000 kW power range. They offer the most efficient and reliable energy solutions with their unique standardized modular design and focus on making the highest quality product with outstanding service. With over 4500 2G systems installed worldwide, their customers confirm the quality and performance of 2G products and build the basis for our international success.

The first type is the heat that is recovered from the engine jacket water that is cooling the engine. Second heat from the exhaust gas is transferred via heat exchanger. This captured "waste heat" now can be used for heating, cooling, or generating steam. CHP system are typically installed onsite, supplying customers with heat and power directly at the point of use, therefore helping avoid the significant losses which occur in transmitting electricity from large centralized plants to the customer. CHP systems can be employed over a wide range of sizes, applications, fuels and technologies.



### Combined Heat & Power (CHP) System:

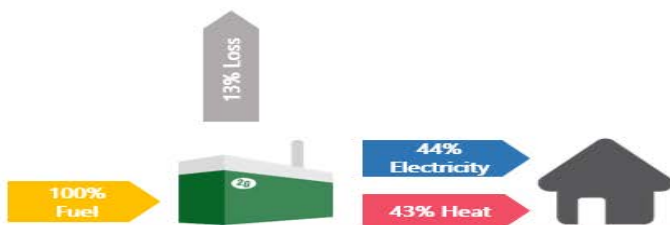
In the future, our power grid will not be made with a few large power plants, but with many small, decentralized Combined Heat & Power (CHP) systems.

CHP is an efficient and clean way of generating electric power and thermal energy from a single fuel source. The engine drives the generator, producing electricity, and the residual heat created during this process is recaptured and turned into useful heat.

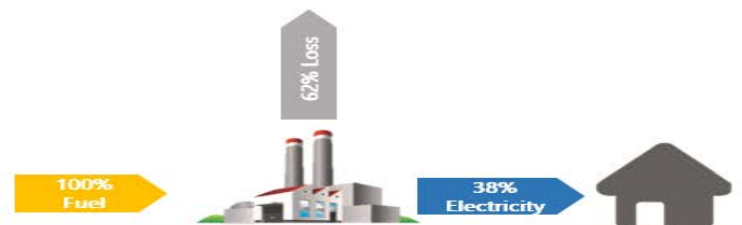
These two types of "waste heat" are produced by generating electricity.

### System Benefits:

- Substantial energy cost savings
- Fulfills highest environmental standards
- Sustainable energy investment
- Fast Return on Investment
- Independence from rising energy prices
- Compliance with governmental carbon emission
- Eases long term forecasts of energy budgets
- Full cost control
- Highest reliability and efficiency
- Stable operation in case of power outages within the utility grid



Power Generation with CHP



Power Generation in Utilities



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## Active Voltage Conditioning including black out ride through for all applications up to 15kV



### Key Features

- Up to 30 seconds of ride through
- 99.5% efficient
- No reduction of fault capacity
- Isolates line from DC Source
- Extensive diagnostics
- Voltage event log
- Separate Coupling transformer
- Universal DC interface accepts all types of storage systems
- MV Units also correct power factor

### Description:

The Active Voltage Conditioner (AVC) is an inverter based system that provides voltage sag and blackout protection.

The AVC is a flexible device that can be used in multiple applications

The AVC(RTS) can be configured with and without on-line voltage regulation capabilities to match the application requirements. It is available for low voltage equipment.

The ACC(RTS) will provide outage protection with customer choice of storage, while operation in an off-line mode. The outage protection time can be extended up to 15 minutes as an option. The voltage transfer threshold of the equipment is user programmable and can be adjusted to the sensitivity of the load.

When combined with the optional regulation module (AVC2) the AVC(RTS) can be used for continuous voltage regulation, voltage balancing, flicker reduction and sag mitigation or peak shaving, wind farm storage, pulses power and voltage sag protection

### Benefits AVC Topology

- Industrial design, rugged
- Small foot print
- Continuous smooth compensation
- Sub-cyclic response
- Fast & easily controlled current contribution

### Additional Product Capabilities:

- AVR (LV & MV & Nema 3R)
- UPS (LV & MV & Nema 3R)
- Digital Voltage Stabilizer (LV & MV & Nema 3R)
- Power Quality Meters ( Revenue Grade to Utility)



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**TOSHIBA**  
Leading Innovation >>>

## Why Toshiba UPS Systems

1. Highest Satisfaction Rating from End Users
2. Meets the Buy America Act
3. UPS Performance Guarantee
4. Best Warranty in the Industry - 3 Years
5. Most Advanced & Highest Performing UPS in the World
6. Most Dynamic & Energy Efficient UPS Unit Available in the Market
7. Marketing 5th Generation IGBT - Where as competition is 2nd and 3rd generation (10 years ahead of everyone)
8. Smallest (Over All) Dimensions and Least Amount of heat Due to Advanced IGBT and Silicone Carbide technology
9. Every Component within The Toshiba Unit is made by Toshiba Maximizing Performance, Efficiency and Reliability
10. Most Advanced Lithium Ion Battery Manufactured and Perfected by Toshiba
11. Over 25 Million Dollars of UPS inventory in Huston, TX for Quick Ship & Availability
12. 15 Year AC and DC Capacitor Warranty... Best in the Industry
13. Lowest Documented Failures in the Industry





## New Power Quality Metering



Critical Power Group's offering high efficiency and harmonic mitigation transformers, harmonic filters, and providing power system solutions to utility, industrial, governmental, institutional, commercial, and manufacturing clients. Their specialties are mitigating load-generated power system harmonics and improving system and load efficiency.

### Energy Efficiencies

- Reduced Power Consumption, Transformer Heating and A/C Loading
- Efficiencies Exceed Requirements of U.S. DOE 2016
- Useful Life Over 30 Years with Negligible Maintenance Costs
- Helps Earn LEED Certification Points
- Available in K-Rated 9,13 and 20

### How Do these Transformers provide Value?

Ultra-efficient and harmonic-mitigating transformers and filters. Over the last~ years, this manufacturer has been the first to develop and commercialize a number of leading-edge technologies and premium products within the low-voltage electrical distribution system. These products help companies improve efficiency as well as mitigate load-generated power system harmonics, resulting in significant energy savings and improved equipment reliability. Critical Power Group provides full engineering support for the application of its products, which are particularly well suited for energy efficient, LEED, and mission critical facilities.

### Customer Services

- ROI Calculator available to quickly reach TCO/Payback
- Free of Charge to review drawings and specifications regarding any transformer projects
- TCO (Total Cost of Ownership) analysis for any owner demonstrating cost/savings
- M & V (measurement and Validation) of upcoming and current projects to ensure capabilities and requirements are met

### Harmonic Mitigation

- Reduced Power Costs
- Reduced Penalty Losses due to Harmonic Currents
- Reduced Transformer Heating and A/C Loading
- Reduced THDv less than 5% at Nonlinear Loads or Motor Drives
- Reduced Losses in Load, Reducing A/C Requirements
- Improved Switch-Mode Power Supply's "Ride-Through" Capability
- Balanced Primary Phase Currents
- Assured System Compatibility with Sensitive Electronic Loads

### The PQI Calculator™

TRANSFORMER LOAD

<b>Project</b>	Manhattan West - Brookfield		
<b>Description</b>	Compare the performance of a 75 kVA minimum efficiency transformer vs. a Type EY, 75 kVA Ultra-Efficient (Z3 Plus) Transformer		
<b>Date</b>	May 14, 2015		
<b>Rating &amp; Efficiency</b>			
Existing	kVA Rating	75.0	
Zero-Sequence Harmonic Flux Cancellation		No	
Linear Eff. at 35% of TX Rated kVA		98.00%	
EY Ultra-Efficient	kVA Rating	75.0	
Zero-Sequence Harmonic Flux Cancellation		No	
Linear Eff. at 35% of TX Rated kVA		98.82%	
<b>Capital Costs</b>			
Existing		\$2,903	
EY Ultra-Efficient		\$3,931	
Installation [ if replaced before end-of-life ]		\$0	
<b>Power Costs</b>			
Average kWh Rate (\$/kWh)		\$0.230	
Average Demand Rate (\$/kW/month)		\$0.00	
<b>Air Conditioning Requirement</b>			
Months/Year [ direct or indirect ]		8	
<b>Transformer Load</b>			
% of Nameplate kVA Rating for Existing	Daytime	Evening	Weekend
% of Nameplate kVA Rating for EY Ultra-Efficient	35%	15%	15%
Hours/Day for Segment	12	12	24
Days/Year for Segment	261	261	104
<b>Calculation of Energy Losses</b>			
Actual kW Losses for Existing	Daytime	Evening	Weekend
Actual kW Losses for EY Ultra-Efficient	0.558	0.318	0.318
Difference in kW	Existing	EY Ultra-Efficient	Average
	0.232	0.132	0.132
<b>Calculation of Annual Savings</b>			
Cost of Losses for Existing	Daytime	Evening	Weekend
Cost of Losses for EY Ultra-Efficient	\$402.19	\$229.32	\$182.75
Annual Savings, including A/C Costs	\$235.32	\$134.18	\$106.93
	\$205.80	\$117.35	\$93.52
<b>Calculation of Financial Benefits</b>			
Annual Savings, including A/C Costs, when using EY Ultra-Efficient	\$416.66 / year		
Payback on Incremental Cost [ substitution ]	2.5 years		
Return-on-Investment (ROI) on Incremental Cost [ substitution ]	40.5 %		
Payback on Installed Cost [ before end-of-life replacement ]	N/A years		
Return-on-Investment (ROI) on Installed Cost [ before end-of-life replacement ]	N/A %		
Annual Reduction in kWh	1,811 kWh saved		
Annual Energy Savings	1.2 %		





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**Socomec is an electrical equipment design and manufacturing company, specializing in low voltage energy performance in terms of safety, service continuity, quality and energy efficiency.**

- **Metering, Monitoring & Power Quality**
  - Power Metering & Monitoring
  - Current Sensors & Current Transformers ( All Amperages & Voltages)
  - Communication Gateways & Dataloggers



- **Energy Storage Solutions (Megawatts)**
  - Converters & Systems
  - Power Management on Smart Grids (EF & I)
  - Lithium & All Battery Options & Storage Options



- **Uninterruptible Power Supply**
  - Single Phase
  - Three Phase



- **Switching & Protection**
  - Non-Fusible Disconnect Switches & Holders
  - Transfer Switches
  - Enclosed Switches
  - Mounting & Cabling Accessories



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## Battery Storage for Grid Stabilization

ESS



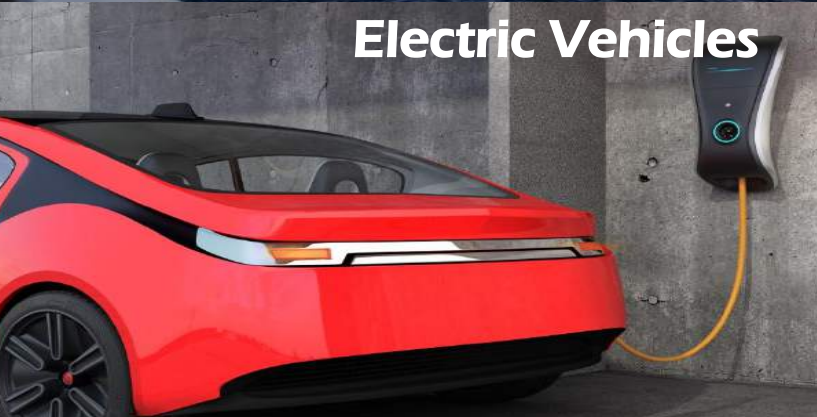
Aviation



Industry



Electric Vehicles



Marine





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## Energy Storage Solutions



## 15MW/2.4MWh Texas, Phoenix UPS Project



- Energy (15MW / 2.4MWh)
- Location: Texas, Arizona (Phoenix)
- Application: Data Center UPS



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# Power Quality Monitoring and Analyzing

With Janitza measurement technology you have everything from class A power monitoring system to full scale energy data management system.

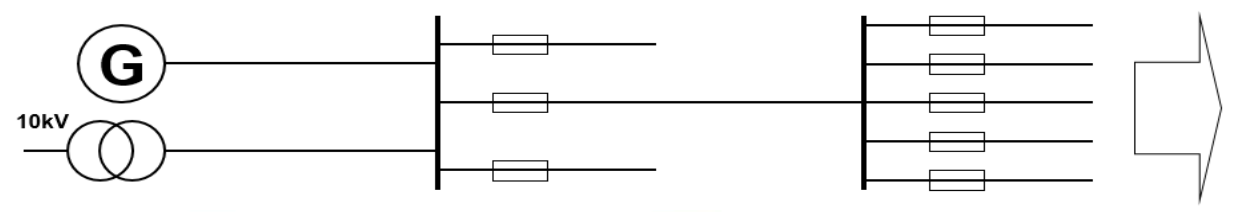
## Your benefits

- Flexible and scalable system architecture.
- Simple integration of non-communications capable meters via digital inputs.
- Acquisition of all media with electrical power, gas, water or steam consumption.
- Utilization of your existing infrastructure - or our simple expandable system architecture (thanks to the master-slave concept).



## Features

- Meter for PQ analysis EN50160
- Class A Measurements IEC61000-4-30
- Short interruptions and transient analysis
- Flicker and harmonic analysis up to 63rd
- Accuracy 0.1, and 0.2 U/I 0.2S, 0.5S for kWh
- Modbus / IP gateway function integrated
- Rack mounted and/or surface mounted
- Energy consumption and harmonics per phase
- Fast communication by close Modbus addressing
- Low power technology and low start value
- Data logging and alarming
- Remote I/O (Open/closed/tripped)
- Temperature monitoring
- Harmonic monitoring
- Programmable and compatible with PLC / SCADA system
- Up to 128 MB internal memory





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## Energy Monitoring Revolutionized

The Modular Circuit Monitoring System is redefining circuit monitoring with next generation technology that simplifies installation and connectivity while providing instant access to data in a user-friendly format. The versatile Core Module™ system is a single monitoring solution with peripherals optimized for branch circuit and multi-circuit monitoring applications designed to reduce the cost and complexity associated with legacy systems.

### Features:

#### Rapid Installation

- Optimized for new & retrofit installations with no disruption to critical loads
- monitors up to 96 circuits
- Options for solid core, split core CTs, Rogowski coils and analog discrete and pluse inputs

#### Easily Access Data

- On-board web server provides immediate access to real-time and logged data
- Integrated data logging supports up to 64 GB storage, remotely accessible or manually exportable
- Available cloud monitoring service
- Customizable alarming features

#### Easy Connectivity

- Select from multiple connectivity options including: Modbus TCP/IP, RTU, BACnet, WiFi and cellular
- Open protocols allows connection with any third party monitoring system



#### Intelligent Features

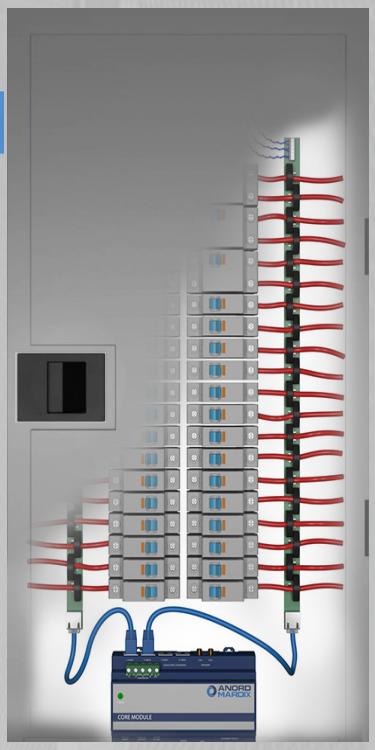
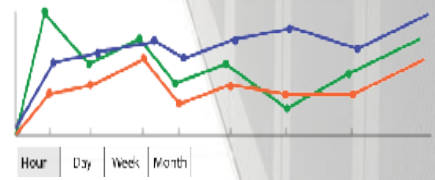
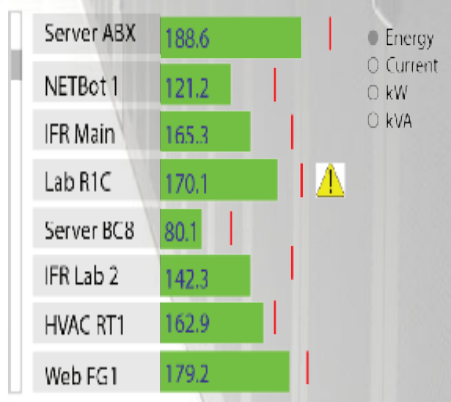
- Presences of voltage detection accurately indicates breaker status even under no load conditions
- Predictive Circuit Health Algorithm (patent pending) detects changes in circuit performance to predict potential failures
- Detailed power and energy monitoring per circuit including Waveform capture and THD

#### High Accuracy

- True 0.5% accuracy suitable for billing applications

Panel A01 ○ Circuit 23 - Load Health

#### Energy Use Per Circuit (kWh)





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## Critical Power Group Industrial/Utility Line Card

### Substation Transformers (Dry & Fluid Filled)

2.5 to 25 MVA, Voltages up to 69kV: Options Available

Switchgear & Switchboard  
with Arch Flash containment built in

Low Voltage: 00 - 6000 A Power Breakers; Up to 200  
KAIC; UL 1558 & 891; PLC Controls,  
Medium Voltage: 1200-4000 A Vacuum Breakers; Up to  
38kV; ANSIL/UL; PLC Controls  
Paralleling (Single or multiple generators)

Automatic Transfer Switches  
Breaker or Contactor Based

Low Voltage: 100 to 4000A; 3 or 4 Poles; UL 1008;  
Microprocessor Controls  
Medium Voltage: 600 to 2500A; Microprocessors

Manual Transfer Switch

Up to 1200A (3 & 4 Pole)

Fused and Non Fused Disconnect

Up to 1200A for AC & DC Applications

CHP - Modular and Engineers Solutions

50 - 8000kW @480-4160 VAC with Fuel Options

Modular Datacenter or SCIF\* (Leasable)

200-10,000 sq ft, 8-10 Weeks Engineered & Installed

EMI/ RFI Power Filters

10-2500 Amps (All Voltages & 50-60Hz) for SCIF & HEMP

CPS & QPS "No Break Rotary Power"\*

500 - 3600kVA @ 480-4160, 13,800 VAC (50 or 60 Hz)

AC/DC Flywheel; Ride- Thru Products\*

500-9000kVA @ 480V - 5kV (50 or 60Hz)

Energized Modular Building

Modular to Containerized Solutions

DC Energy Storage Solutions

30kW - MW, Mircogrid and Software Platform for  
management

Generator / Load Bank Docking Stations

208/120, 480/277, 4160V, Portable, Fixed, Single or Dual  
Source with ATS and/or Kirk Key Combination

VFD & Adjustable Speed Drives

0.5 to 1000 HP

Power Meter and Power Quality Monitoring

Class A Accuracy Monitoring

Surge Protection Device (SPD/TVSS)

40-300kA (All Modes, voltages and categories: A, B and C)  
Single and Three Phase Surge Suppression & Filtering

Load Bank

Resistive, Reactive, Portable, AC & DC up to 4000kW

Power Factory Products (Active & Passive)

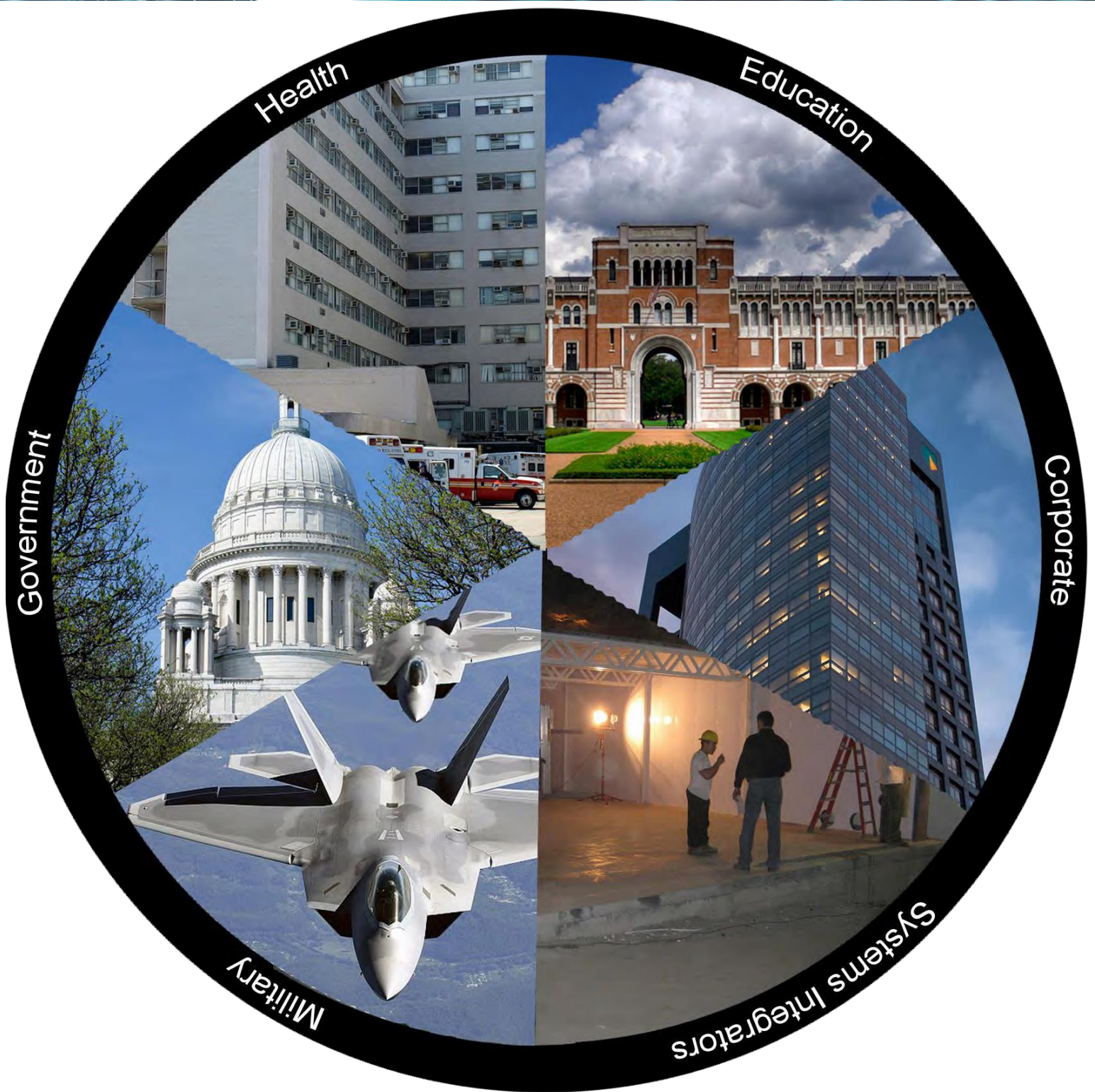
50-400 AMps (AC & DC), All Voltages

Dry Type Energy Efficient Transformers  
DOE 2016, Harmonic Mitigation

10-2000kVA; Uptto 5MVA and 34.5KV Voltages; VPI  
type; Available (Aluminum, Copper, K rated & 2016)

<b>Flexible Busway for AC or DC Distribution</b>	<b>40-1200 Amp, PQ Meters, Flexible plug &amp; play distribution</b>
<b>Power Conditioner &amp; Active Voltage Regulator*</b>	<b>10-6000kVA 50-60 or 400Hz</b>
<b>Static UPS*</b>	<b>1kVA-22kVA Single Phase (Commercial to Hospital Grade) 15-2000kVA Scalable and Redundant Three Phase</b>
<b>All Batteries (EF &amp; I)</b>	<b>Lithium, Prue Lead, AGM, VRLA, Wet Cell, NiCad</b>
<b>Battery Monitoring ( New &amp; Retrofit)</b>	<b>VRLA and Wets Cells Hardwired and Wireless, for UPS, DC Power and Generator Applications, Multi voltage, Jar &amp; Cell level</b>
<b>Battery Charger</b>	<b>Single Phase, Three Phase 12,24,28,130,260 VDC 6-1000 ADC</b>
<b>Rectifiers (AC to DC)</b>	<b>SCR &amp; IGBT, Modular: Single Phase: 6-100Amps Three Phase: 50-500Amps, 50-60Hz</b>
<b>Inverters (AC to DC)</b>	<b>10-200 kVA; All Voltages, 50-60Hz</b>
<b>Power Distribution Units (PDU/PDM)*</b>	<b>50-1000kVA @ 480 VAC input &amp; 120/208, or 415/230VAC output, 50-60Hz</b>
<b>Lighting Inverter UL 924</b>	<b>Single Phase, Three Phase, 10-400KW</b>
<b>Frequency Converter</b>	<b>10-500kVA (Static &amp; Rotary, 50, 60 or 400Hz</b>
<b>Static Transfer Switch (STS)</b>	<b>Dual Source, Up to 4000 Amp, Digital IGBT</b>
<b>Isolated Power Panel</b>	<b>Modular, Singular, Double Feed, Ground Fault Monitoring</b>
<b>Cable Tray &amp; Ladder Rack</b>	<b>Flexible (Bendable) 3"-21" W Under Raised Floor or Over Head installation options Dense Cale Tray 2"-24"W Aluminum Cable Tray</b>
<b>Raised Floor</b>	<b>Slotted Panel, Aluminum Panel, Hybrid or Solid Panel</b>
<b>Server Rack &amp; Containment Solutions</b>	<b>42U, 55U and custom, Hot Isle and/or Cold Isle</b>
<b>Server Room Cooling</b>	<b>CRAC Unit, Air Cooled, Water Cooled, Wall Mount &amp; In Row</b>
<b>Facility Monitoring / DCIM / Smart PDUs</b>	<b>Stand-alone, Web enabled, Wireless, Open Protocol</b>
<b>Multi Branch Circuit Monitoring (New or Retro Fit)</b>	<b>Versatile and compact, High Accuracy, Split/Solid Core CT</b>
<b>Silent SCR Treatment &amp; Emission Control for Engines</b>	<b>New and Retrofit applications, Diesel or Natural Gas, NOx, CO, PM VOC's for emissions</b>
<b>AVC &amp; AVR</b>	<b>Automatic Voltage Controller or Regulator (LV &amp; MV) Indoor &amp; Outdoor 50-2000kW &amp; Parallelable</b>
<b>Field Service Offerings</b>	<b>PM &amp; Emergency Service (7x24x365) on Infrastructure Load Bank, UPS Rental Equipment &amp; Sale Portable Spot Coolers Rental &amp; Sale I/R Scanning &amp; Staffing Facility SCR Installation &amp; PM Services Industrial, Military Grade &amp; Ruggedized Equipment Monitoring &amp; Remote Notification</b>

\*Available as an efficient Green solution, Indoor or Outdoor \*Any Voltage and any Frequency



**Critical Power Group**  
21760 Beaumeade Circle  
Suite 190  
Ashburn, VA 20147



[www.criticalpowergroup.com](http://www.criticalpowergroup.com)  
[sales@criticalpowergroup.com](mailto:sales@criticalpowergroup.com)  
703-443-1717