The Grid of Grids

Presentation and Pre-show Sneak-Peek
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• “Grid of Grids” – EMerge Alliance
• Show Sneak-Preview #1 - CE+T Energy Solutions
• Show Sneak-Preview #2 - WES.net
• Show Sneak-Preview #3 - Nextek Power Systems
The GRID OF GRIDS
By Brian Patterson
Evolution or Revolution?
In the beginning...
Eventually, things settled down...
So we could...
But more recently...

**Electric Infrastructure Issue #1**

*Increasing Use of Electricity*

*Despite Conservation Efforts – Use Grows at Double-Digit Rates*

**Electric Infrastructure Issue #2**

*Over Dependency on Fossil-Fuel Sources*

*Coal & Oil issues are leading to Increased Reliance on NG & Nuclear*

**Electric Infrastructure Issue #3**

*Resistance to Expanding Centralized Infrastructure*

*There are real & perceived problems with using public domains*

**Electric Infrastructure Issue #4**

*Growing Problem of Resiliency*

*There are no easy answers for the existing grid*
we've been having some “issues.”
“we cannot solve our problems with the same thinking we used when we created them”
But, can we take two old ideas...
...add some ‘smarts’ & some new technology...
...connect the old

with the new...
...and end up with a more sustainable Grid of Grids?
The Grid of Grids evolution is well underway...
...as the Grid is getting “Smarter”...
...Microgrids are evolving to help!
Let’s see how...
Microgrids are comprised of 5 major functions...
LOCAL LOADS

ENERGY STORAGE

ENERGY MANAGEMENT

CIRCUIT UTILIZATION

LOCAL SOURCES

ENERGY MANAGEMENT
But before we go there...let’s go back to the beginning...
In the beginning...
**Local Sources**
- Solar PV
- Wind

**Energy Storage**
- Grid Tied Inverter

**Energy Management**
- UTILITY AC DISTRIBUTION GRID

**Circuit Utilization**
- AC Load Panel
- AC Critical Load Panel

**Local Loads**
- AC Loads
- AC Critical Loads
LOCAL SOURCES

ENERGY STORAGE

ENERGY MANAGEMENT

CIRCUIT UTILIZATION

LOCAL LOADS

Solar PV

Grid Tied Inverter

Wind

AC Load Panel

AC Critical Load Panel

AC Critical Loads

AC Loads

Solar panel

Wind turbine
LOCAL SOURCES
ENERGY STORAGE
ENERGY MANAGEMENT
CIRCUIT UTILIZATION
LOCAL LOADS

Solar PV
Wind

AC Convenience Load Panel
AC Critical Loads

UTILITY AC DISTRIBUTION GRID

CONVERTERS
AC-DC
DC-DC
DC-AC
INTERCONNECT

MONITOR
CONTROLLER
LOCAL SOURCES
- Solar PV
- Wind

ENERGY STORAGE
- Battery
- Flywheel

ENERGY MANAGEMENT
- MONITOR
- CONTROLLER
- CONVERTERS
  - AC-DC
  - DC-DC
  - DC-AC
- INTERCONNECT

CIRCUIT UTILIZATION
- AC Convenience Load Panel
- DC Convenience Load Panel
- DC Critical Load Panel

LOCAL LOADS
- AC Critical Loads
- AC Convenience Loads
- DC Convenience Loads
- DC Critical Loads
1 LITTLE MICROGRID
LOCAL SOURCES  ENERGY STORAGE  ENERGY MANAGEMENT  CIRCUIT UTILIZATION  LOCAL LOADS

MANY LITTLE MICROGRIDS

NEIGHBORHOOD DC MINI-GRID
Key Attributes of the Grid of Grids:

• Most new power capacity is generated at the fringe
• Most new generation, storage and loads are natively direct current.
• dc-coupling minimizes impact of distributed resource integration
• Self-healing mesh topology is resistant to linear dynamic failures
• Semi-autonomous distributed control via transactional management
• Local microgrids enables “energy as a service” differentiation
The Live Microgrid
An Onsite Demonstration of Advanced Microgrid Capability
Evolution and Functionality of the "Grid of Grids"
The MICRO-PEDIA™
An Electronic Self-directed Microgrid Encyclopedia

Explore the Microgrid World

How Microgrids Work
Microgrid Applications
Microgrid Technologies
Microgrid Anatomy

NORTH AMERICA SMART ENERGY WEEK

CONTENT BY

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“Plug ‘n Play”
DER Challenge Demonstration
American Made Challenge Solar Prize Demo Day Winner Announcement

Tuesday, September 24
5:00 PM - 6:00 PM

Location: Smart Energy and Microgrid Stage: Booth 5837

Winner announcement for the American-Made Solar Prize. Two winning teams will each receive $500,000 in cash prizes and $75,000 in vouchers. Refreshments will be served.
Pre-show Sneak-Peeks

CE+T Energy Solutions
WES.net
Nextek Power Systems
Mario Barbaresso P. Eng., President and CEO of CE+T Energy Solutions has been a part of the power industry for more than 30 years.

Barbaresso is an accomplished executive having held senior management positions for multi-national companies around the world. Prior to joining CE+T in 2018, Barbaresso managed a number of operations for Power Survey, Benning Power, Bombardier, Emerson Network Power, Nortel Networks and ABB Advanced Power Systems in Canada, Europe and the United States. Throughout his career, Barbaresso has established a history of organic and M&A growths by defining and executing creative strategies, streamlining operation processes, revitalizing product development efforts, establishing sales structure while boosting profits.

Barbaresso is a certified member of the Canadian Engineer Board, and has graduated from Quebec’s Ecole de Technologie Superieure in 1986 with a Bachelor’s degree in Power design and Power Transmission. He is fluent in French, English and Italian, and has been trained in numerous project management, negotiation, and conflict management courses.
About CE+T Energy Solutions

CE+T Energy Solutions was formed to provide turn-key power solutions for datacenters, utilities and C&I customers adapting CE+T Power’s disruptive technologies for next-generation mission critical applications.

...with products that:

- Reduce energy cost and TCO
- Improve reliability and resilience
- Allow the seamless blending of power between various energy sources
- Offer harmonious integration of renewables, stored energy and the grid

CE+T Power Wins Google’s $1,000,000 Little Box Challenge
Next-generation Technology
Our Patented Multi-Directional Power Converter

- Allows energy to flow from source to load and vice versa
- Provides harmonious mix of multiple energy sources including stored energy and renewables
- Is modular and hot-pluggable
- Adapts to varied customer requirements with flexible, customizable configurations
- Ranges from a few watts to 3 MW
Worldwide Energy Projects

Over 200+ projects world-wide

200KW to 5 MW
Turnkey Solutions & Services Capabilities

**Site assessment**
Experienced Power System assessment, energy consumption, ROI study

**Solution Design**
Tailored engineering based upon standard building blocks

**Project Management**
Dedicated project management from start to finish

**Factory acceptance testing**
Tailored to your needs

**Installation and Commissioning**
Performed on-site by our specialists

**Technical Training**
Specific training or general sessions

**Continuous Monitoring**
Live or specific monitoring services

**Proactive Maintenance**
Resolve issues before it’s too late

**Modernization and After-Sales Services**
Update, upgrades, expansions, or repairs
CE+T joins efforts with Partners to deliver creative Energy solutions

- Demand response
- Peak Shaving
- Energy storage
- Microgrids
Presenting for WES.net – Joe Magno

Before joining the WES Team Joe’s career included executive positions in government, academia and the private sector focused on IT operations and energy resiliency.

Joe can be reached at joe.magno@wes.net
For over 40 years with over 5,000 engagements across the globe WES.net has successfully provided trusted support, services, and products that positively impact energy efficiency, resiliency, and continuity to owners and operators of mission critical facilities.

WES.net’s years of experience implementing asset utilization and management tools such as Eaton’s Foreseer WES has developed a set of non-proprietary (open) tools and techniques for mission critical energy management.

As a result, WES’s knowledge base and experience can provide real solutions to clients interested in integrating microgrid technology into their existing environments.
Knowledge is Power When Implementing a Microgrid Solution

The Standardization and Integration of Multiple Systems Is Critical

- Utilize CI Data Intelligence Asset
- Understand Advanced Operating Modes
- Model Future States
- Model Emergency Operating Modes
- Capacity Planning
- Mine Dataset for Advanced Functionality
- Predictive Maintenance

Avoiding “Cross Platform Dissonance” Is Critical
Resilient Adaptive Microgrids for Continuity of Operations

Command Management Systems

- Immediate and continuous real time situational awareness.
- Knowledge enables Resiliency, Resiliency = Saving Lives
- Enhanced protection modes for extended outages, EMP, or similar.

RAMS™ deploy geographically and operate independently but have full knowledge and interaction with peer systems.
Eaton’s Foreseeer connects an operation’s vast array of devices, regardless of the manufacturer or model to facilitate real-time power and environmental system monitoring at a single facility or multiple locations throughout the world, reducing power consumption and avoiding unplanned downtime due to system failure.

Building, factory, or facility data is aggregated from a variety of sources, protocols, and data streams to normalize across product types, equipment vendors and communications protocols. Data is presented to advanced processing for added intelligence, decision making, and visualization.

Please Join Us and our Partners in the Smart Energy Marketplace Microgrid Demonstration Theater and Learn More…

Demonstrations and Technical Experts will be there
High Impact; Low Cost Energy Technology

Started With Driverless Lighting & Controls As A Best-Practice For Smart Buildings
Better Fit
For Today’s Load

100% of the conventional AC circuits

Any Building

The New 100% for AC Circuits

25% reduction in circuits needed for dc lighting
25% reduction in circuits needed for dc outlets
Why The Mismatch?

40 watts of load

180 watts of capacity

Receptacle Doesn’t Appear 78% Underloaded
Class 2 Loads And Interfaces To Them

(Receptacle Not Actual Size)
Adopting DC Power Systems Yields Important Benefits:

- **Lower First Cost**, Either $1 psf, or up to 25%
- **Faster Installation**, up to 50% fewer hours
- **Lower Operating Costs**, > 10%
- **Longer Warranty of 10 years**
- **More Robust Hardware** & Fewer System Components
DC Power Systems Are Increasingly Specified in Buildings, Saving Time & Money For National Customers
Thank you and see you in Salt Lake!
Questions?
Explore the world of microgrids at one of these regional or national events

The Grid of Grids Virtual Microgrid Presentation & Pre-show Microgrid Marketplace Sneak-Peek