EMerge Alliance Standards for Hybrid AC/DC Power Distribution in Commercial Buildings

Brian Patterson
Chairman, EMerge Alliance
**PROBLEM:** MISMATCHED AC & DC POWER REQUIREMENTS

**ENERGY SOURCES – MIXED AC & DC**

- AC/DC Site Generation
- DC Campus Fuel Cells
- AC Line Power
- DC Wind Power
- DC Photovoltaic
- DC Fuel Cells

**ELECTRIC DEVICES – TYPICALLY DC**

- Electronic Lighting
- HVAC Actuators
- Sensor & Controls
- AV/IT Devices
- Security & Safety

**RESULT:** LOST OPPORTUNITY TO REDUCE ENERGY UP TO 30%

Source: Armstrong

Emerge Alliance Corp - ©2009
SOLUTION: A SIMPLIFIED AC/DC HYBRID COUPLED POWER NETWORK

ENERGY SOURCES

- AC/DC Site Generation
- DC Campus Fuel Cells
- DC Wind Power
- AC Line Power
- DC Photovoltaic

ELECTRO-ACTIVE DEVICES

- Electronic Lighting
- HVAC Actuators
- Security & Safety
- Wireless Controls

OPPORTUNITY: 30% LESS ENERGY, 15% LESS CAPITAL, 200% MORE RELIABLE

Source: EMerge Alliance Corp ©2009
The Building as part of a Power Network

Power Network Layers:

- Smart Grid
  - Regional Grid
  - Public Utilities
  - National Grid

- Smart Building
  - Electrical Devices
  - Room/Floor Level
  - Building level
  - Campus
  - Community

Typical Microgrid Node:

- Measure, Communicate, Compute, Actuate
- Local Control
- Local Microgrid
- Local Energy Storage
- Utility Feed
- Local Site Generation
- Upstream
- Downstream

KEY
- Comm
- Actuate
- Sense

ENERNET
MICROGRIDS
The Alliance Approach

It Takes an Industry to Build a Building

- Simple
- Safe
- Sustainable

Flexibility

Sustainability

Savings
Who is EMerge?

Over 60 (and growing) organizations participating in 6 member levels.

Advisory Council Members
- Los Angeles Community College District
- California Institute of Energy & Environment
- Turner Construction
- Naomi Miller Lighting Design
- Paladino and Company
- The PNC Financial Services Group, Inc.
- Darnell Group
- Southern California Edison

Members – Partial list, visit EMergeAlliance.org

**Founding Governing Members**
- Armstrong
- Johnson Controls
- NEXTEK
- OSRAM SYLVANIA
- WAVE

**Participating Members**
- AculyteBrands
- CONVIA
- CREATON
- CRESTRON
- ENERGY PEAK
- eneclear alliance
- FINALITE
- FINELINE
- HAGER
- HERALD
- Herman Miller
- KARELI INNOVATIONS
- kâne.ep.
- LIQID
- LUTRON
- MACH
- NORTHWIRE
- PHILIPS
- ROAL
- Tanaka
- Tyco Electronics
- Watt Stopper
- X-10
- ZUMTOBEL
- LUNERA
- LEVITON

**Liaison Members**
- BACnet International
- CABAA
- ENERGY PEAK
- eneclear alliance
- ZigBee
- Control your world

**General Members**
- CONFIGURA
- Electri-Cable Assemblies
- Universal Lighting Technologies
- Steelcase

**Supporting Members**
- ANL Light
- 3W Solutions
- APEX
- BRINJAC
- CTC
- Delta
- Energy
- Solutions
- Good Energies
- Integrated Design Solutions
- JB Design, Inc.
- Lighting Science
- LUCIFER Lighting Company
- PICA
- Paladino
- SENSOR Switch
- STANDARD SOLAR
- TESSCOR
What is EMerge about?
A DC power platform for commercial interiors.

- Promoting a new, open standard for room-level Direct Current (DC) power distribution in commercial buildings
- Safe, low voltage DC power at room level complements AC infrastructure of buildings
  - Creating a “hybrid power layer” at the load level
- Enabling plug-and-play device flexibility
- Increased energy savings from more efficient use of lighting, controls and other electrical devices
- Facilitating optional use of direct integration with renewable energy sources
Focused on Safety, Flexibility, Sustainability, Cost

» Reduce complexity
» Reduce installation time
» First-cost competitive
» Simple and flexible reconfiguration
» Plug & play capability
» NEC recognized Class 2 power levels – under 30 Volts
» Reduce system energy
» Create interoperable interconnect and device controls
» Simplify integration of solar panels, wind, fuel cell, and batteries
Scope of Work

Initial Focus on the Occupied Space
Content of the Work

Focused on Essential System Elements
1st Standard Completed

Room Level Power Distribution Platform
Typical Configurations

Working from the Top-Down
DEMONSTRATION OF THE STANDARD

AC power → LV DC Power → Infrastructure → Devices

(Converter) (Ceiling Grid & Cable Assemblies) (LED lights)

Room Level Power Distribution Standard
Benefit: Accelerating use of LEDs

LEDs are inherent users of DC power

- Eliminate 120V AC to 24V DC power conversion
  - No need for power supplies & enclosures
  - Higher reliability
- Achieve better design
  - Lighter weight, lower profile fixtures
  - Fewer finished components
- Higher efficacy (light output per watt)
  - Internal AC-DC conversion results in losses
  - LEDs driven by DC up to 10-15% more efficient
Benefit: Faster returns on renewables

Use less energy going DC direct, ie with Solar

- Improve power utilization
- Eliminate DC to AC conversion
- Maximize efficiency
- Back up with battery or tie back to AC grid

Typical Solar Power System:

~89% efficiency, solar panel to device.

Direct Coupling® System:

~99% efficiency, solar panel to device.

Sample topology shown ©Nextek Power Systems
Where are EMerge Demonstrations and Installations?
US Green Building Council Headquarters

- Continuous high light reflectivity acoustical ceilings
- DC multi-channel power servers – utility AC Primary
  - Solar supplemental planned for later
- Fluorescent light fixtures – with DC ballasts
- Wired controls, touch-panel interface
- Daylight, occupancy and dimming functions
- LEED Platinum for Commercial Interiors

Architect Rod Letonja of Envision Design:

“The infrastructure is in place for USGBC to add solar... Solar panels will be able power all the lights in the conference rooms with DC energy distributed through the ceiling grid.”
USGBC Headquarters

Plug & Play on a LVDC Bus Structure

- Fluorescent Lights (with DC ballasts)
- DC Ceiling Grid Mains
- DC Power Servers (hidden above ceiling)
- Daylight Sensors (mounted near windows)
- Motorized Window Shades
- AV Equipment (mounted on end walls)
- Wall Divider Sensor
- Separate AV controls in the room, controls to left of photo
- Lighting Controls (by back right entrance) – powered by the ceiling grid
ledgroup

» Interior architecture firm with sustainability focus
» Continuous high light reflectivity acoustical ceilings
» DC multi-channel power server – utility AC Primary
» Recessed LED light fixtures – driven by 24VDC
» Wired on/off wall controls and occupancy sensors

Brigette Preston, Managing Principal, lauckgroup:

“The lighting has been a huge hit with everyone... We’ve had all the building management people down to see it...Our design team loves it, too.”
PNC Financial Services

» Downtown Hi-rise commercial office building
» Non-seismic – union contractors installation
» Continuous – high light reflectivity acoustical ceiling
» DC multi-channel power servers – utility AC input
» Fluorescent & incandescent lighting fixtures – with DC ballasts
» Wireless (ZigBee) controls - touch panel interface – IP addressable
» Daylight, occupancy and dimming functions
» A/V DC powered speakers

“Smart Ceiling” in place – Case Study / Private Demo in Pittsburgh, PA
Nextek Power Systems

» One-story mixed use commercial office/lab/factory building
» Non-seismic – non-union contractors installation
» Continuous – High light reflectivity acoustical ceiling
» DC multi-channel power servers – utility AC with Solar (PV) planned
» Fluorescent lighting fixtures – with DC ballasts
» Wired bus/branch controls – traditional wall switch interface
» Daylight, occupancy and dimming function

“Smart Ceiling” in place – Case Study / Public Demo in Detroit, MI
UC San Diego – Sustainability Resource Center

» Mixed use facility on campus – home of UCSD’s Sustainability 2.0 initiative- pursuing LEED-CI Platinum certification
» Sophisticated direct DC Microgrid energy systems, generating 80 percent its electricity needs including 1 megawatt of solar
» Continuous – high light reflectivity acoustical ceiling
» DC multi-channel power servers – solar (PV) primary with AC alternate
» Fluorescent lighting fixtures – dimmable DC ballasts
» Wired controls – standard wall switch interfaces
» Daylight, occupancy and dimming functions
Southern California Edison

- Single story commercial office
- Promotes energy savings programs with commercial customers – studies lighting & control systems
- DC multi-channel power servers – utility AC primary
- Fluorescent lighting fixtures – with DC ballasts
- Daylight, occupancy and dimming functions
- Solar (PV) direct to DC loads planned in next phase

Targeted ‘Net Zero Energy Ceiling’ – Irwindale, CA
Armstrong World Industries

» Two-story mixed use commercial office/classroom/factory building
» Non-seismic – non-union contractors installation
» Continuous – high light reflectivity acoustical ceiling
» DC multi-channel power servers – solar (PV) primary power with utility AC back-up
» Fluorescent lighting fixtures – with DC ballasts
» Wired bus/branch controls – touch panel interface
» Daylight, occupancy and dimming function

“Smart Ceiling” in place – Case Study / Public Demo in Lancaster, Pa
Los Angeles Community College District

» Trade & Technology College – home of architectural, electrical & renewable energy depts.
» Re-purposed single story hi-bay multi-use building
» Clouds of high light reflectivity acoustical ceilings
» DC multi-channel power servers – utility AC primary, solar desired for future
» Fluorescent lighting fixtures – dimmable DC ballasts
» Wired controls – touch panel interface
» Daylight, occupancy and dimming functions
Learn More About Us
Visit Our Website @ www.emergealliance.org

Alliance FAQs
1. What is the EMerge Alliance?
2. What is the EMerge Alliance Standard?
3. Where is EMerge focused?
4. How can I obtain a copy of the EMerge Alliance Standard?
5. I have questions about the EMerge Alliance Standard, where can I learn more?
6. Who is part of the EMerge Alliance?
7. When can the market expect to see EMerge products and services?
8. Who should join the EMerge Alliance?
9. How can I get involved?
10. How can I stay in touch with EMerge news and information?