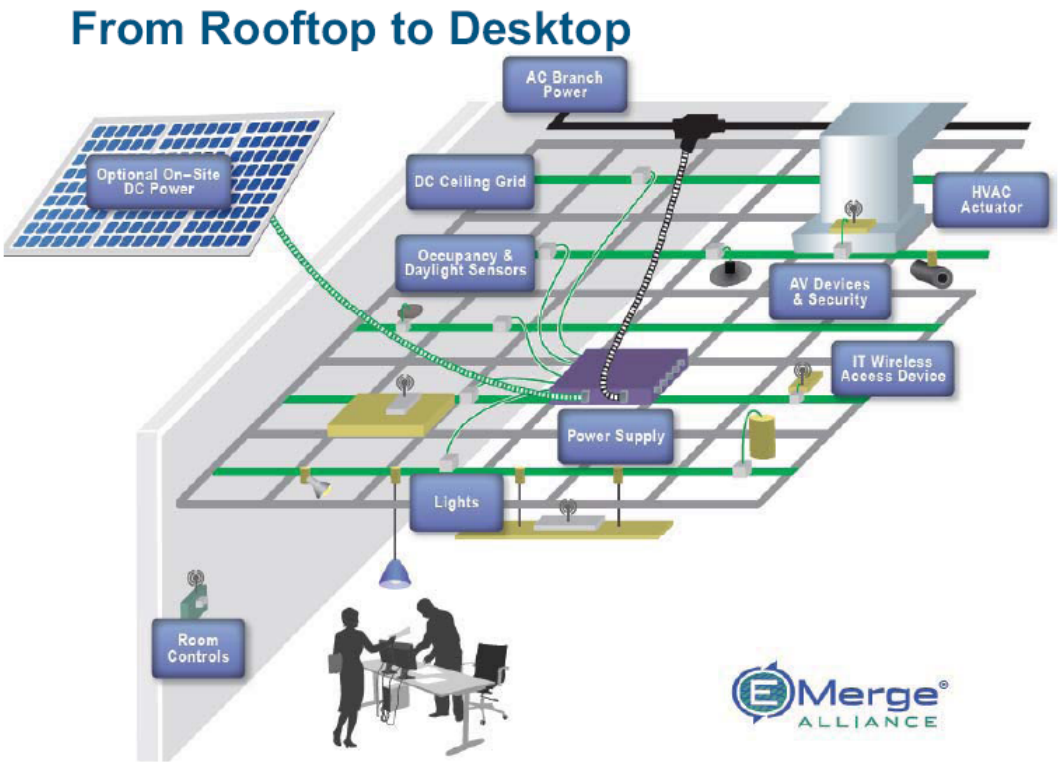
"Killer Apps" for a Ceiling DC Power Platform
Spring 2010, EDSGN 100 Design Project



Project Objective

Consider a commercial building space that has a low voltage DC power distribution system, what products would you design? What problems would be solved by your products? How would your product enhance the use of, or more efficient use of the facility by the owner, or provide a benefit to the occupants, such as personal comfort, productivity, or safety?

Project Background

Armstrong World Industries, Inc. (www.armstrong.com) is a global leader in the design and manufacture of floors, ceilings and cabinets. In 2008, Armstrong's consolidated net sales totaled approximately $3.4 billion. Based in Lancaster, PA, Armstrong operates 37 plants in nine countries and has approximately 11,000 employees worldwide.

Armstrong Building Products is a worldwide leader in manufacturing and marketing acoustical ceilings and suspension systems for commercial and residential applications. The business mix is nearly 90 percent commercial, with approximately two-thirds in improvement projects and the balance in new construction, which includes offices, healthcare, education, retail, transportation and other segments.

Armstrong recognizes the importance of protecting the environment and using resources responsibly. They are committed to good environmental stewardship in our dealings with customers, employees, the government and our community. Their policy on the environment is:

- To exercise care in the selection and use of energy and raw materials;
- To provide for environmental safety in our workplaces and communities;
- To be prepared for emergencies and to act promptly and responsibly to protect people and the environment;

- To ensure all products conform to safety, environmental and quality standards;
- To reduce waste and embrace recycling in all our operations, and to dispose of waste materials in an environmentally responsible manner.

Armstrong is a founding member of a non-profit industry group called The EMerge Alliance. The EMerge Alliance (www.emergealliance.org) was established to promote the rapid adoption of safe, low-voltage DC power distribution and use in commercial building interiors. EMerge has developed an open standard that integrates interior infrastructures, power, controls and peripheral devices, such as lighting, in a common platform. Other members of the EMerge Alliance include leading companies in diverse fields like Johnson Controls, Osram Sylvania, Philips, Steelcase, Lutron Electronics, Herman Miller, Tyco Electronics, Delta Power, Southern California Edison, WattStopper, and startup firms like Nextek Power Systems and Lighting Science Group.

EMerge will offer unprecedented design and space flexibility, enabling reduced energy usage, and improved sustainability in buildings. Its low voltage DC distribution standard promotes the use of a "hybrid" power layer within buildings. Customer applications of the standard will include products from member companies in four different, broad categories: Power, Infrastructure, Devices, and Controls.

The opportunity for direct DC power use to benefit commercial buildings and the environment is clear. Commercial buildings today use between 33–50% of all AC electricity produced and distributed by public utilities in the U.S. These same buildings also use a majority of digital electronic devices that are inherently DC powered. This means that more AC power must be converted to DC at the device level to power equipment like electronic lighting ballasts, solid state lighting (i.e., LEDs), lighting sensors and controls, HVAC controls and actuators, and assorted computer/IT equipment. The increasing amount of native DC power generated from renewable energy sources like solar or wind must also be converted to AC electricity to be compatible with existing AC distribution methods. These conversions, in both directions, result in significant losses of electricity and associated wasted energy. They also add to the complexity and reduced reliability of the overall electrical system.

Efforts to create a Smart Grid need "smarter buildings" that can minimize these conversion losses and reduce the overall load on our nation's energy resources.

Project Requirements

Your team should develop a design for a product that can be used as part of a commercial building space that has a low voltage DC power distribution system. What problems would be solved by your products? How would your product enhance the use of, or more efficient use of the facility by the owner, or provide a benefit to the occupants, such as personal comfort, productivity, or safety? Additional considerations include

- Safe—The product's intention and general design should be safe. While it is not expected that students are aware of all codes and standards involving safety in a commercial space, the product should not be obviously unsafe. (No open flames, etc.)
- Innovative—Think beyond the examples you have seen in the resource materials.
- Low Voltage—Product must be capable of using low voltage electrical power (for example, nearly all conventional overhead lighting can be converted to use low voltage power outputs). Power available per channel is 100 W at 24 Vdc.
- No Typical Lighting Products—Merely changing the power source of typical lights (from AC to DC) will not be accepted; however, this should not limit the possibility of innovation or new applications that may include typical lights or known lighting technologies.
- Commercial Value—Products cannot be only consumer orientated, they must provide value to the commercial environment; however, they can also provide personal value to people in the space.
- Known Technology—Must have a basis in known technology. No Star Trek transporters

- Time Horizon—Product must be reasonably thought possible in the near term (2 years) to midterm (5 years).
- Determine Possible Partners—Identify a model company or companies that could manufacture or bring your product to market.

Evaluation and Feedback

Armstrong will provide feedback on product concepts in the following criteria

- Development Time
- Chance of Success
- Intellectual Property
- Technical Complexity
- Business Complexity
- Level of Invention

Key Deliverables:

Note: Your instructor will clarify his or her expectations for these deliverables and their respective due dates.

- Technical report on Web
    - The format for the first page of your website will be given to you and all requested material must be provided
    - Project description
    - Trade studies
    - CAD drawings detailing the design solution(s) for the product concept
- Prototype/model of system
- Business case for your product
- Complete list of design concepts showing top 4–5 initial selections

Materials Provided:

- Sample ceiling DC powered systems and connectors
- Reference material and websites on relevant standards and technologies
- Website for design project: http://www.edp.psu.edu/design_projects/edsgn100/sp10
- Additional materials will be provided as the semester proceeds