



P1 ALLIANCE NEWS:

Exhibiting at Solar Power International & Greenbuild, EMerge continued to provide opportunities for members to show-off their latest products & services. Check out the plans for next year's CES.



P2 UPDATES & EDITORIAL

It's the DC Microgrid's 100th Anniversary! Read WATT's UP and the Editorial by President Brian Patterson to learn more about the history of this little recognized occasion.



P3 DC PROJECT HIGHLIGHTS

Check out this issue's Project highlights columns including INTEL's Re-vamped DC Data Center and an update on the Alliance for a Sustainable Colorado's DC Project which is now underway.



P4 EMERGE CALENDAR

What's EMerge planning for next year? Consult our annual calendar of events starting with the CES Conference in January. Review reports from the two latest technical standards committees.

dCconnect

OFFICIAL NEWSLETTER OF THE EMERGE ALLIANCE

IS004

FALL/WINTER 2016 EDITION

Solar Power International – Greenbuild — CES TRADE SHOW SUCCESS — SETS PARTNERSHIP

The EMerge tradeshow demonstration strategy was in full swing over the past two months as the subject of hybrid AC/DC microgrids continues to gain marketplace attention. **EMerge** sponsored a live microgrid in its own Smart Energy Microgrid Pavilion at the **Solar Power International** show in Las Vegas which was a major success. Even before the end of the show, initially planned space for the microgrid feature space at next year's show was 75% sold out, sending show management back to the drawing boards to find additional space at SPI17, which will be in the Mandalay Bay Convention Center in Las Vegas in September 2017. As has now become tradition, the Pavilion was opened with a "Plug-Pulling" ceremony featuring Julia Hamm, President & CEO of the Smart Electric Power Alliance (SEPA),

Tom Kimbus, President of the Solar Energy Industry Association, and Paul Savage, Chairman of EMerge.



Following the great results at the Solar show, **Greenbuild**

2016, held in Los Angeles, doubled up on its

results from last year in Washington DC, featuring a ground mounted solar array outside the convention center, a glass enclosed hybrid microgrid on the show floor and over 35 solar microgrid powered booth spaces featuring **EMerge's** Net Zero Zone exhibitors.

The Net Zero Zone was also kicked off with a "**Greenbuild Unplugged**" ceremony. Presiding over the opening event was EMerge President Brian Patterson. Speakers from individual companies exhibiting in the "Zone" gave presentations on their products and services in the Zone's special presentation theater.

Success at both shows has propelled EMerge into a unique partnership with Solar Power International's show management (more about partnership—next page). Sign up now to join **EMerge's** presence at **CES 2017** in Las Vegas | Jan. 4-8, **Solar Power International** in the *Smart Energy Pavilion* at the Mandalay Bay Convention Center, Las Vegas, NV | Sep. 10-13 and/or the **Greenbuild 2017 Net Zero Zone** at the Boston Convention & Exhibition Center | Boston, MA | Nov. 8-10.

SOLARPOWER
INTERNATIONAL



EMerge Facilitates 1st Smart Microgrid Pavilion @ SPI 2016



EMerge Grows Net Zero Zone 3rd Straight Year with USGBC

GREENBUILD
INTERNATIONAL CONFERENCE AND EXPO

ALLIANCE NEWS

SETS PARTNERSHIP IS BORN

EMerge's involvement in major industry tradeshows has given rise to yet another key partnership. Due to our contribution and participation in this year's Solar Power International Conference, we have forged another important relationship with key industry players, the Solar Energy Industry Association and the Smart Electric Power Alliance via a partnership with its tradeshow joint venture corporation, Solar Energy Tradeshows Inc. (SETS).

In the most immediate future this relationship has yielded an invitation to facilitate a Smart Energy Marketplace pavilion at the CES Expo in January, the country's largest B2B technology tradeshow. The invitation came shortly after top

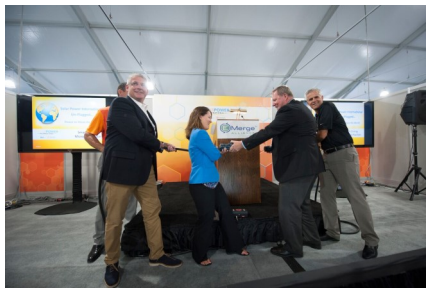


Consumer Technology Association (CTA) executives visited the Smart Energy Microgrid Pavilion at SPI in September this year. "The rapidly progressing convergence of IoT with clean renewable energy on the consumer's doorstep is a perfect example of where the Consumer Technology Association (CTA)™ can help advocate for entrepreneurs, technologists and innovators," said Brian Moon, vice president of international sales, CTA. "CES is a platform that allows technology leaders to connect and collaborate to propel consumer technology forward. To this end, we are excited to add the Smart Energy Marketplace to CES 2017, facilitated by SPI in association with the EMerge Alliance."

Over 175,000 businesspeople & 7500 press organizations are expected to attend CES 2017 where the Smart Energy Marketplace pavilion will be featured near the main entrance of the LVCC.

PHOTO HIGHLIGHTS

SOLARPOWER INTERNATIONAL



WATT'S UP

100th Anniversary of DC Microgrids in America

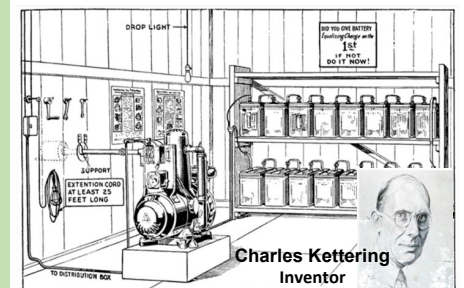


Fig. 299. Installation of a Delco-Light Plant, Showing Two-Tier Shelf Rack for Battery

Much is written about the battle of the currents that resulted in AC electricity being the format of choice over DC at the turn of the last century. The demand for electric conveniences were skyrocketing and electric utilities were experiencing tremendous expansion – to a point that is, that point being the city limits. Meanwhile, over 50% of the US population lived in rural America – on farms, in small towns and in rural and remote areas. These Americans had no possibility of enjoying the modern conveniences associated with electricity. From a pure commercial economic point, it was financially impractical to extend power lines beyond the more densely populated city limits.

Rural life at the time was simple, basic and, well – difficult. When the sun set, out came the candles and oil lamps for lighting. Fire hazards, smelly noxious wax and oil combustion by-products, soot on walls and clothes and carrying "light" with you – even to the outdoor outhouse were all inconveniences. Fresh water was pumped by hand and carried into the house and supplied to livestock by bucket.

But all that started to change significantly with Charles Kettering's invention of the electric start motor for the combustion engine. While a few small companies had started experimenting with small remote enterprise level power plants, the idea of an autonomous battery based system that could store electricity had yet to be invented. But Kettering's invention dramatically opened up new possibilities. Remote starting allowed the fuel efficient intermittent operation of a gas or kerosene engine dc generator to periodically charge the batteries or support the battery bus voltage under heavy loads. Enabled by his invention of the electric starter a few years earlier, the concept of a practical distributed electrical generation, storage and supply dc microgrid was born in 1916. There was no AC vs DC battle. With the use of battery storage, simple resistive loads and no long line transmission or distribution to worry about, DC was the obvious choice without the hint of a battle.

And yes, Charles was the same Kettering who, along with his business partner and co-founder of GM's Delco and fellow philanthropist Alfred Sloan, founded the Sloan-Kettering Institute – later to become the Memorial Sloan Kettering Cancer Center.

The year was 1916 – 100 Years Ago!

EDITORIAL

President Patterson's File: Learning from History



The Delco-Light farm electric plant story begins with its introduction in 1916. More than a mere product, Delco founder Charles Kettering designed and developed a complete family of electric power systems to provide electricity to farms, country homes, and virtually every rural or remote building. The generator set would automatically start when the batteries were discharged or over-loaded, and stop when they were again fully charged. The batteries would typically supply electricity for several days before needing charging.

Equipment to work with this "safe" 32 volt DC system included lights, well pumps, clothes washers, vacuum cleaners, coffee makers, toasters, waffle irons, irons, mixers, sewing machines and even a portable power hub to operate belt driven farm and household equipment, providing all the modern conveniences of a home in the city.

Despite a burgeoning microgrid industry of more than 150 companies who employed tens of thousands workers who had already deployed close to 2 million distributed power plants, the Rural Electrification Act of 1936 was passed by the Federal Government in the name of a "jobs program" in the middle of the Great Depression. This was only one year after Congress passed the Utility Holding Company Act of 1935 which started the ever increasing march to government granted monopolies. During the worst economic period in US history and worried about slowing growth and a complete government takeover, privately owned utilities, who produced and sold over 95% of all electricity sold in cities, willingly acquiesced to strict governmental regulation in exchange for territorial exclusivity. Government incentivized central utilities eventually delivered a knockout blow to the private microgrid industry—and with its demise—any hope of a commercial distributed power industry.

The Rural Electrification Act of 1936 brought urban power lines, strung from large centralized power plants, to farms at an initial price of \$1000, twice the price of a Delco-Light plant. In addition to paying for the energy he used, the farmer was expected to advance to the power company much of the costs of line construction. The balance of the cost was passed on to all rate payers as utilities were allowed to build into their pricing a profitable return on required new investments.

No one knows what would have happened with the microgrid industry had the Government not intervened. But that was that and this is now. With the success of clean, distributed renewable generation resources and viable electricity storage, a new stage is set for a re-emergence of the dc microgrid. With the ability to work in hybrid harmony and support of our increasingly challenged ac generation, transmission and distribution system, coupled with the new, more open and more competitive business models based on a convergence of new information technologies with new power electronics technologies, the government regulatory apparatus needs to meet the challenge of properly embracing the new dynamic and make-up of the electric energy industry and its millions of prosumers.

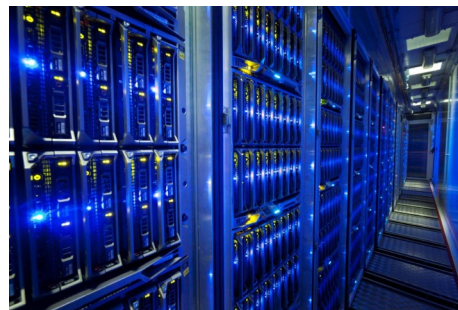
PRODUCTS & PROJECTS



Working with HP and Emerson Network Power, Intel reworked the 5MW electrical distribution network at its Portland Oregon data center this year to handle 380V of DC instead of the regular AC. The project followed the tenets of the EMerge Data Center Standard and followed its earlier work at the Lawrence Berkeley National Laboratory (LBNL) which found that a shift to DC could improve energy efficiency.

One of the reasons for the improvement was the elimination of the need to invert power provided through an uninterruptible power supply (UPS) system, many of which convert from AC to DC and back to AC. This reduces the time it takes to switch to battery power if the mains supply fails. Not having to invert to AC provided large savings.

Removing the rectifier and power-factor correction circuitry from the front-end AC power supply in the server can save several percent. Designers can take advantage of greater flexibility in the DC input, potentially with some loss of efficiency. The advantage is that the UPS does not have to provide fully regulated 380V DC. As it runs during an outage the weaker regulation will help to eke more out of the battery as it drains.



The Intel project found that the core improvement from a shift from the 415V AC used in the US to 380V DC was up to 8 percent. A study by Duke Energy suggested this could be pushed to 10 percent. Proponents of 380V DC claim there are further benefits for data-center owners. DC could help them pack more servers into the same space.

Intel found its DC data center's footprint was a third smaller than its AC predecessors. This could cut cable cost as the elimination of the skin effect meant the company could use thinner copper wiring than for AC distribution.

ABB has previously claimed a 1MW 380V DC network it built for Swiss IT company Green in 2012 had 15 percent lower capital costs than an equivalent AC system as well as being 10 percent more efficient.

THE ALLIANCE CENTER dcProject

Be a DC Project Insider—by Allison Reser, ASC

Our dc Project is an amazing thing. The conversion of an existing building to a direct current microgrid has never been done before! We want you to know about it. We want your ideas. We are making our process as transparent and collaborative as possible, and your participation is critical.

Why, you ask? The purpose of the dc Project is to serve as a powerful, innovative, replicable model. We will make mistakes and we will learn from them, so others like you can do it better.

What is the dc Project anyway? An introductory white paper available on our website, by Mark Reiner, shares insights, barriers, goals and motivations as to how commercial buildings can transform how energy is produced and consumed. The Alliance Center serves as a "living laboratory" for showcasing the successes and failures of the dc Project.

Interested in residential direct current? Demand DC: Accelerating the Adoption of DC in the Home, by Stephen Pantano, Peter May-Ostendorf and Katherine Dayem, outlines direct current options for you home and is also available on our website.

The Alliance for Sustainable Colorado 'dc Project' is underway in its six-story, 40,000 square-foot office building (The Alliance Center). The Alliance Center provides office space for more than 48 tenant organizations.

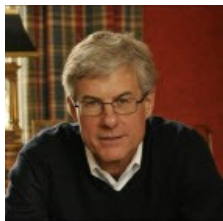
We are currently installing 64 meters on our existing AC circuits – the same circuits that will later make the transition to DC. These meters will tell us current energy usage in The Alliance Center, and will allow us to measure the AC/DC difference.

Second-use EV batteries are entering the market with roughly 50%-60% of initial capacity at one-fifth of the cost of new ones. Adopting these batteries effectively in buildings requires DC/DC (direct current) converters. In our presentation, we'll discuss how our DC/DC converter will create an opportunity in energy efficient commercial buildings through secondary EV battery use. As engineers, designers and builders look to DC to create more energy efficient buildings, our DC/DC converter will harness second-use battery power to fixed DC, meeting both the emerging DC and second-use battery markets.

Congratulations to the dc Project and project leader Sandy Vanderstoep, whose keynote presentation entitled, "Thomas Edison, Your Time is Now," is available at www.sustainablecolorado.org, or contact svanderstoep@sustainablecolorado.org, 719-330-8979.

TSC COMMITTEE NEWS

DC Metering TSC Formed



The **NEW DC METERING TSC** has been created and is chaired by David Lawrence, formerly of ABB and now Technology Development Manager

at Duke Energy Corporation. The charter of the committee is to create a standard for Direct Current Smart Meters. It will define requirements for revenue grade metering of medium and/or low voltage dc in various types of hybrid ac/dc and pure dc microgrids and other power systems for either grid tied or off-grid applications. The team volunteers number over 50 electrical system experts from around the world. The group will gather for monthly online meetings to conduct its work. The committee has formed four workgroups to begin its investigation:

1. Stakeholder & Use Case Identification
2. Existing Standards Identification
3. Existing Equipment Identification
4. Technical Specifications

The committee's goal is to issue a standard within 12-18 months. Those interested in actively contributing to the standard or its revisions should contact bmurphy@emergealliance.org or if already an Emerge member, sign up on the Emerge Member website.



EXHIBIT AT CES EXPO

EMerge's involvement in the 2017 CES Conference came at the eleventh hour with less than 2 months to go before the show opens on January 5th. But we jumped at the chance to get the attention of 7500 media outlets and 175,000 business and professional visitors expected to gather at the world's largest B2B event in Las Vegas.

It's not too late if you want to participate, as the CTA, SETS and Emerge teams have streamlined the process to become part of this inaugural event. Early commitment ends Dec. 9 and final commitment date is Dec 23. The Smart Energy Marketplace will feature a live microgrid that will power the first renewables powered pavilion at CES. To learn more about this or other upcoming events, contact:

bmurphy@emergealliance.org

UPCOMING EVENTS

November 28-30, 2016

Cleveland, OH

EnergyTech 2016

Wolstein Center, Cleveland State University

<https://energytech2016.com/>

December 13-15, 2016

Orlando, FL

Power-Gen International

Orange County Convention Center

<http://www.power-gen.com/index.html>

January 5-8, 2017

Las Vegas, NV

CES 2017

Las Vegas Convention Center

<http://www.ces.tech/>

January 19-20, 2017

Paris, FR

IEC SEG4

Centre d'affaires Espace Hamelin

http://www.iec.ch/dyn/www/f?p=103:194:0:::FSP_ORG_ID,FSP_LANG_ID:11901,25

March 26-30, 2017

Tampa, FL

APEC— IEEE Applied Power Electronics Conference and Expo

Tampa Convention Center

<http://www.apec-conf.org/>

April 5-7, 2017

Boston, MA

ACI's National Conference on Microgrids

<http://www.wplgroup.com/aci/event/6th-national-microgrids-conference/>

April 26-28, 2017

Santa Clara, CA

CABA Intelligent Buildings and Digital Home Forum

Intel Corporation Campus

www.caba.org/forum

May 9-11, 2017

Philadelphia, PA

Lightfair International

Pennsylvania Convention Center

www.lightfair.com/V40

September 10-13, 2017

Las Vegas, NV

Solar Power International 2017

Mandalay Bay Convention Center

Smart Energy Microgrid Pavilion

www.solarpowerinternational.com/

November 8-9, 2017

Boston, MA

Greenbuild 2017

Boston Convention Center

Net Zero Zone Pavilion

<https://greenbuildexpo.com/>

PHOTO HIGHLIGHTS

