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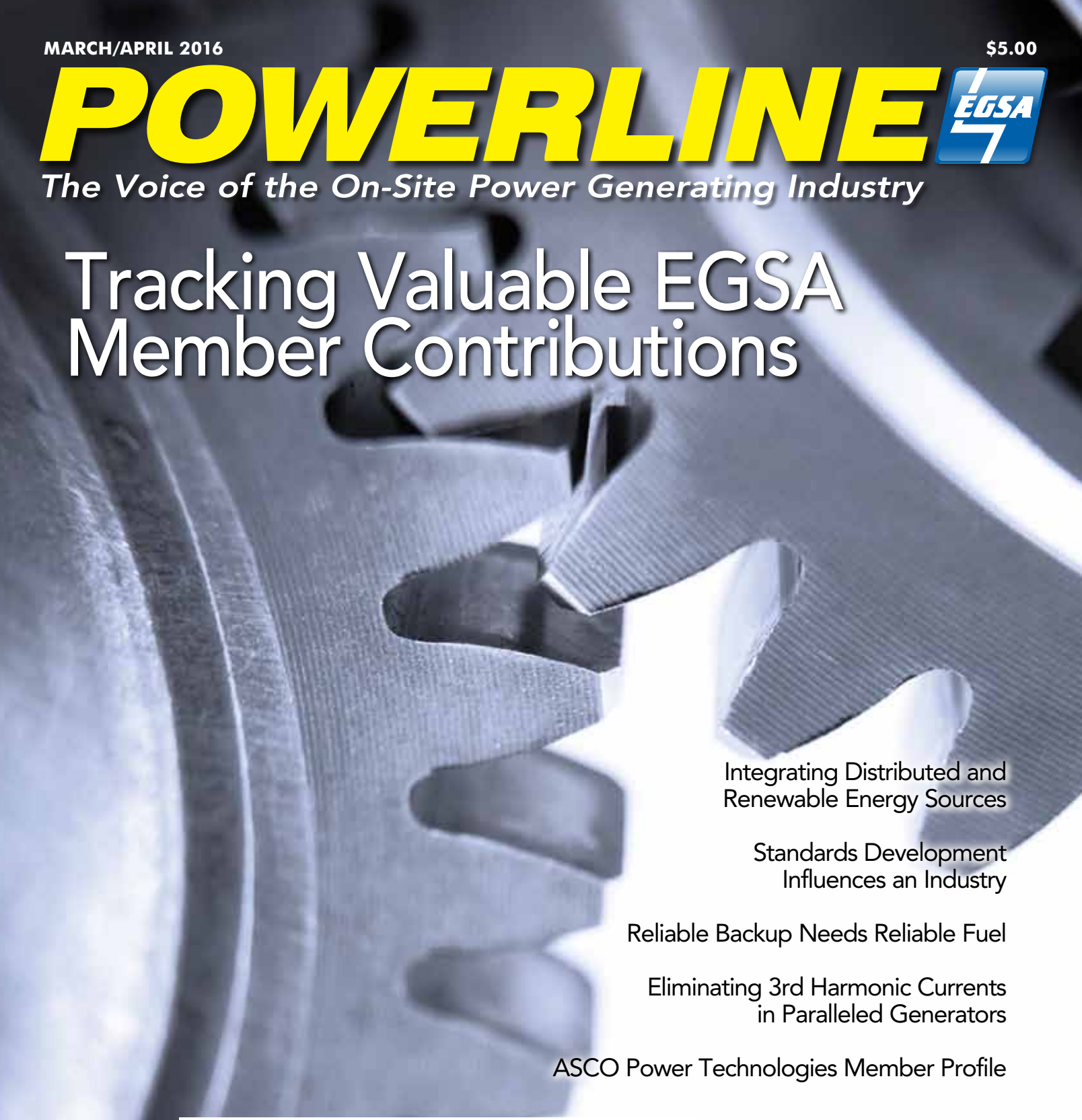

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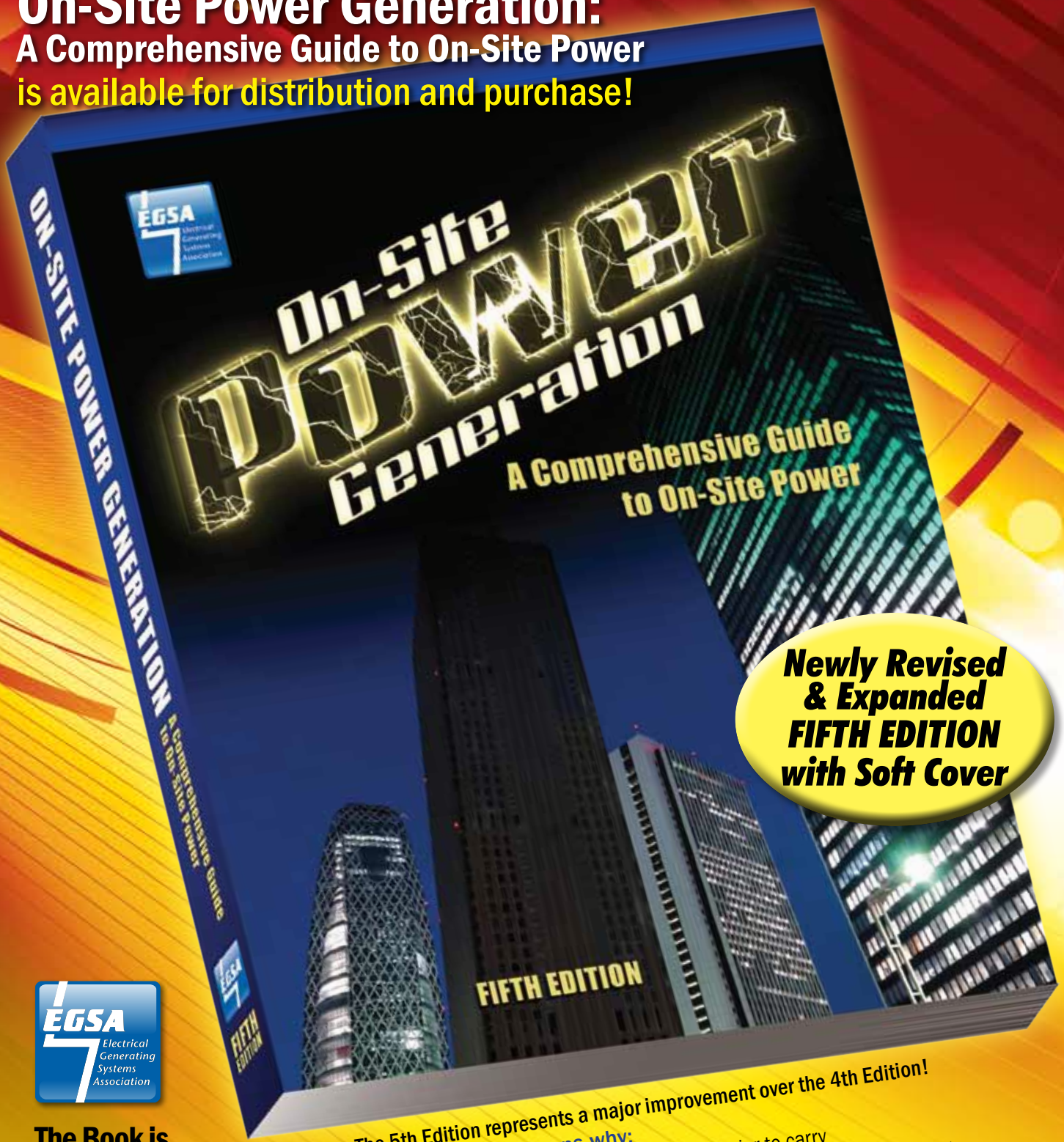

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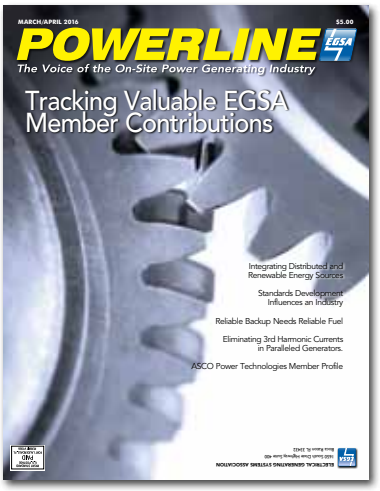

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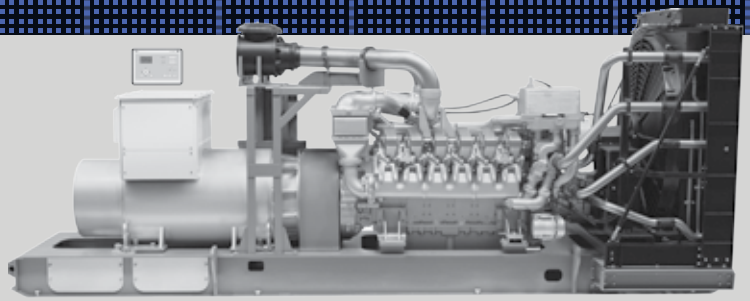

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EVENTS CALENDAR

Conferences

EGSA 2016 Spring Conference

March 20-22, 2016; San Antonio, TX

EGSA's Annual Spring Conference features educational sessions on a broad range of issues impacting the On-Site Power Industry. More information is available at *www.EGSA.org/spring* or by calling (561) 750-5575.

EGSA 2016 Fall Conference

September 11-13, 2016; Sacramento, CA

EGSA's Annual Fall Conference features educational sessions on a broad range of issues impacting the On-Site Power Industry. More information will be available at *www.EGSA.org* or by calling (561) 750-5575.

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June 7-9 ..... Charlotte, NC
August 16-18 ..... Sterling, VA
December 12-14 ..... Orlando, FL*

*To be held concurrently with POWER-GEN International 2016

Advanced Schools

April 4-7 ..... Austin, TX
July 11-14 ..... New Orleans, LA
October 17-20 ..... Nashville (Brentwood), TN

Industry Trade Shows

POWER-GEN International 2016

December 13-15, 2016; Orlando, FL

The world's largest show for power generation, featuring the EGSA On-Site Power Pavilion. For exhibit information, contact Liz Bustamante at (561) 750-5575, ext 206 or via e-mail *l.bustamante@EGSA.org.*

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Powerline is published six times per year on a bi-monthly basis. Articles and information submitted for publication should be forwarded to the attention of the Editor at the address above 30 days prior to publication. Technical articles and articles of general interest to the electrical generation industry are actively sought and encouraged. *Powerline* reserves the right to limit information appearing in its pages to that which, in its sole discretion, will reflect positively on EGSA and the industry which it serves.

Throughout every issue of *Powerline*, trademark names are used. Rather than place a trademark symbol at every single such occurrence, we aver here that we are using the names in an editorial fashion only. EGSA has no intention of infringing on these trademarks.

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EGSA...Work Us into Your Conversations!

Providing member value is at the forefront of everything that your Association does... from our Strategic Long Range Plan document, which is our roadmap for continued growth and success, to your Board of Directors, who strive for innovative ways to keep members engaged and keep the momentum of the organization moving in a positive direction collectively!

Speaking of positive, in case you need positive reinforcement, EGSA Members (and the On-Site Power community) serve a critical function in our society and with technology advancing at the speed of light and natural disasters seemingly becoming more frequent and severe, our importance doesn't seem to lessen, even during challenging economic times.

Consider EGSA's first 50 years. There are (literally) hundreds of people that have impacted our rich history. Last year, we showcased many of those people with our EGSA Time Capsule series in *Powerline* and via a collection of our members sharing their EGSA memories via our video time capsules. Review our *2016 EGSA Buying Guide* that came out in January or check out the article on Page 12 where we showcase our current member contributions annually. It isn't hard to find people making positive efforts on behalf of EGSA. We even track this list in realtime on our website if you are interested.

During our 51st year, we continue to look for ways to impact growth and reach our industry with the EGSA message. There are simple ways that you can help us do that. The singular most important way that our members can help EGSA to grow is through word-of-mouth.

Do you promote our brand outside of our conferences, to your colleagues, your customers and during travel? Maybe it is because I am President this year, but I have caught several members in the act of working EGSA into their conversations lately, and I find that refreshing! How hard is it really to find a way to position our brand during a professional conversation? There are so many tools that we provide to the industry, take your pick!

It is easy to understand that there may be many levels of association interest and membership activity, but when it really comes down to it, working EGSA into a conversation is not that much to ask. You also may be surprised at how much longer that conversation might go, assisting you in other areas of both your personal and professional life.

The more you realize the EGSA value proposition, the easier it becomes for our Association to continue to grow and shape our industry as a collective voice. Like your own business, we also strive for a membership filled with engaged employees/members.

So the next time you find yourself in a conversation with someone who is not a member of EGSA, but may derive benefit by checking us out, simply work us into the conversation. You might be glad you did!

We'll be over here holding up our end of the bargain. We sure hope you assist with this goal. Open communication is a two-way street. It is also key to member engagement, do you have an idea or a comment that might help us in this area? We'd like to hear from you. Send your comments to *e-mail@egsa.org* and thank you for your continued support of EGSA! ■

Michael Pope
EGSA Director
of Education
m.pope@EGSA.org

"T...e...n...SHUN!!"

The Raymond G. Russell Education Grant for Veterans

It is a well-known fact that there are not enough men and women entering the On-Site Power Generation industry to meet the needs of employers. Manufacturers need design engineers and sales engineers; distributors and dealers (DDs) need technicians and sales engineers; users of generator sets, such as data centers, universities and telecom companies, all need people to monitor, maintain and manage their on-site electrical power generating equipment.

THE WALL STREET JOURNAL. A4 | Wednesday, October 22, 2014

Bases Push to Keep Current

Military Turns to Independent Electric Grids to Ensure Uninterrupted Power Flow

By Rebecca Smith

TWENTYNINE PALMS, Calif.—Fear that utility companies remain vulnerable to hackers, terrorists and natural disasters has the Pentagon pushing construction of independent power grids at military bases across the U.S., including one nearing completion here at the Marine Corps combat center.

The base at Twentynine Palms, home to about 22,000 people and spread across 1,100 square miles of the Mojave Desert, still buys power from Southern California Edison.

Soon, however, it will be able to operate even if there is a blackout, using a system of small power plants, solar panels, batteries and diesel generators. It already is saving $10 million a year in energy costs.

Dozens of U.S. bases are marching in the same direction as they try to keep up with the growing power demands of a modern military.

"A lot of bases want what we've got," said Gary Mortimore, the energy manager at Twentynine Palms.

The U.S. military needs an uninterrupted flow of electricity to support operations at home and around the globe, officials said. Drones in Afghanistan, for example, have been piloted from Creech Air Force Base in Nevada.

Diesel-run generators that provide backup power can't do the job alone, given the electricity demands of the high-tech era.

"When I was a major in the first Gulf War, we went over there without computers or email," said Greg Bean, a retired Army colonel who works in director of public works at Fort Bragg in North Carolina, one of the Army's biggest bases. "Now, if you lose a server, your operations almost cease."

Concerns about electricity went up a notch last year when assailants disabled an electrical substation in California by shooting at 17 transformers that help power Silicon Valley.

The unsolved attack "made us think about our dependents, and how we position ourselves to endure that risk," said Capt. Alex Stites of the Office of the Deputy Assistant Secretary of the Navy for Energy.

Increasingly, the Pentagon wants power from its own sources. Solar panels, for example, have become almost as common on bases as flagpoles.

Photovoltaic panels provide nearly a quarter of the electricity at Nellis Air Force Base near Las Vegas. The panels already save the base about $1 million a year, said Jeffrey Mast, base energy manager, and a proposed expansion would double the output.

Fort Bragg is building a microgrid similar to the one at Twentynine Palms. On a typical day, Fort Bragg makes less than half the power it needs. It is narrowing the gap by trimming consumption.

For example, the base replaced electric dryers for parachutes with a "solar wall" that absorbs the sun's heat and funnels hot air up a tall silo to dry hanging parachutes.

"The endgame is to be able to survive if the grid goes down," said Paul Crissie, who recently retired as president of Honeywell Building Solutions, the company helping build Fort Bragg's microgrid.

For years, experts have recommended the U.S. military seek independence from commercial utilities.

"Our grid is old and it's reliant on technology that's outdated," said Michael Wu, energy program director for the Truman National Security Project & Center for National Policy, a Washington think tank.

A 2008 report from the Defense Science Board, a panel that advises the Pentagon, said faith in the electric grid was misplaced. The report, titled "Mission Flight—Lose Fuel," said it was unwise to assume that commercial power was reliable and that the backup systems on U.S. bases were adequate.

Of particular concern, the report said, was the U.S. electrical system's reliance on large transformers—usually housed at remote electrical substations—which send electricity across long distances.

"Largely unprotected," the report said, "they can be easily targeted and destroyed," leading to blackouts that could last months or years. Widely read, the report elevated the discussion of electricity to a matter of national security.

More recently, the Navy warned that it is concerned about the grid's vulnerabilities and said "we cannot rely primarily on an aging and increasingly stressed transmission grid to deliver mission-critical power."

At Twentynine Palms, base officials started worrying about power supplies during the California energy crisis that triggered rolling blackouts 14 years ago. Diesel generators provided the only emergency power at the time.

At first, the base added a small generating plant, followed by solar panels and batteries. This summer, it finished construction of a second generating plant that makes electricity and chills water, which cools buildings in desert temperatures that often top 100 degrees.

Technicians monitor equipment settings and temperatures in buildings with gear from Johnson Controls Inc., reducing complaints about hot rooms. Motion sensors and high-efficiency lighting cut electricity consumption.

Engineers estimate they soon will be able to generate about 80% of the electricity the base needs.

As the military gains more experience, and as retrofitting costs drop, the pace of development will pick up, said Dennis McGinn, assistant secretary of the Navy and a retired vice admiral.

More than money is at stake, he said. "Mission readiness is tied to energy security."

Energy Eater

U.S. government electricity consumption

Defense Dept. | Other government agencies

Billion kilowatt-hours

$20B

$15B

$10B

FY2000 '05 '10 '15

Source: Energy Information Administration

The Wall Street Journal

Meanwhile, military personnel leaving the service and recent veterans, all with generator set experience, are looking for employment in the civilian sector. Are they ready to immediately assume a similar role with commercial generator systems? Many DDs have found that there are some experience and knowledge deficiencies with military generator technicians. This is largely due to the differences between the power systems. For example, most military generator sets are required for portable, prime power applications while the majority of civilian generator sets are for emergency or standby duty and include transfer switches and other sub-systems in their installations.

The late Raymond G. Russell was a veteran and founder of Russelectric Inc., the well-known manufacturer of automatic transfer switches. The EGSA Raymond G. Russell Education Grant for Veterans directly addresses these issues. This generous grant provides the resources to fully fund an ex-military generator technician to attend a George Rowley School of On-Site Power Generation. All expenses, including transportation and registration fees are covered by the grant. Most importantly, an EGSA Rowley School will provide the veteran with the theory of operation and application of all the many components within the typical civilian generator system.

The knowledge gained at the school will make the veteran more employable by an EGSA DD or manufacturer. It will also help to prepare the individual for the EGSA Technician Certification exam. The coveted Journeyman Level certification is the ultimate technician qualification, but as I have previously mentioned on these pages, it is not easy to pass that test and serious study and extensive experience are needed.

AMPS at the CAMPS

The demand for generator technicians is also increasing within the military. The US military is making a concerted effort to reduce its reliance on the grid. It is widely recognized that the ageing grid is not sufficiently reliable and is vulnerable to attack.

The following are excerpts from an article by Rebecca Smith, which appeared in the *Wall Street Journal* on October 22, 2014.

Continued on page 24

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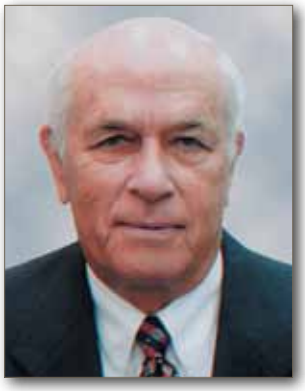
Codes & Standards Update



Herb Whittall
EGSA Technical Advisor
HWhittall@comcast.net

The National Electrical Contractors Association is writing another of its Recommended Practices. This one is entitled "*Recommended Practice for installing Stored Energy Systems*" and will be numbered NECA 416-201. I have signed up to be a member of the canvass committee for the Recommended Practice as a Producer. If you would also like to be a member, please contact Sofia Arias at *sofia.arias@necanet.org.*

The January/February issue of the *NFPA Journal* (on Page 20) has an article by Jeffrey Sargent subtitled "Highlights of the proposed 2017 NEC changes, including new articles of generation, distribution and utilization." There is a brief discussion of the new article, 710 and changes to Articles 425, 691, 705, 706 and 712. Jeffrey Sargent is a regional electrical code specialist for NFPA and can be reached for questions at the technical tab on NFPA 70 or the NEC at nfpa.org/70.

NFPA also announced their annual meeting (where all changes to the NFPA codes must be approved). This event will take place in Las Vegas from June 13 to 16, 2016.

One additional article of significance (Page 40) is an article on energy storage systems. The article includes information on lithium-ion batteries and points out the fact that these batteries have been known to reignite several hours after a fire. This is especially concerning, since they do not seem to know why the fire reignited since thermal imaging showed the whole battery was cool!

Another periodical I wanted to mention from a few months ago (November issue) is from *Diesel Progress* (Page 58). There was an article about load bank testing requirements. In the sixth paragraph, it says that the Joint Commission (which regulates hospitals etc.) requires the testing of generators every month to requirements more stringent than NFPA 110 requirements. They call for testing one of two ways: either testing the generator set under live load of at least 30% for 30 minutes while maintaining manufacturers minimum exhaust temperature, or testing for 2 hours with 25% load for 30 minutes, 50% load for 30 minutes and 75% load for an hour. The same paragraph says that transfer switches should be tested monthly.

IEEE Industry Applications Magazine (January/February issue) has an article (Page 51) concerning the sizing of medium voltage circuit breakers. Apparently, ANSI/IEEE have changed some of the criteria on how to select a circuit breaker for short circuit duty. As with many IEEE articles, it is very technical and unless you really need to know the details so you can select the proper circuit breaker, it is hard to read. However, there is an article by Mark Halpin (Page 76), the IEEE Standards Editor, and it is much easier to comprehend. It is titled "The Underlying Value in Engaging in Standards Development." It is easy to understand and shows what can be learned when engaging in the development and drafting of standards. Two sentences that are relevant are: "I strongly believe that you will benefit from participation in standards, based on your contributions to the process. Each person has different skill sets, abilities, and support and, therefore, can participate in different ways."

UL 1236 Ed. 8 Standard for Battery Chargers for Charging Engine – Starter Batteries has created a review proposal with two similar topics: 1). Modify Supplement SC to allow a communication interface to take the place of physical meters and alarms, and 2). Do the same to Supplement SE. Unfortunately, the voting for this review was only open until February 16, 2016.

UL 1012 Ed. 8 – Standard for Power Units, other than Class 2, is open for voting until March 21, but just to confirm, it is being reissued as an American National Standard.

The ISO Nations Committee has approved by votes of 8 for, 0 against and 2 abstentions both *ISO 8178- 4 Reciprocating Internal Combustion Engines – Exhaust Emission Measurement – Part 1 Test Bed Measurement of Gaseous* and *Particulate Exhaust Emissions* and *Part 4 Steady-State Test Cycles for Different Engine Applications.*

The IEEE Industrial and Commercial Power Systems Conference is scheduled for May 15th in Detroit. This is the conference that is committed to the replacement for the color books.

Finally, the next meeting of the NFPA 99 Committee is June 9 and 10, 2016. The location has not been announced. If you have some changes you want to be addressed, you need to submit them now, and also tell me about them in San Antonio if you join us at the EGSA Spring Conference. ■

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Tracking Valuable Member Contributions… Our EGSA Community is Gaining Traction

As most of our membership is aware, the EGSA Strategic Long Range Plan (SLRP) guides our plans of action in an overarching roadmap sort of way! In other words, the SLRP provides the goals and also the plans for getting there.

One of the most important goals that we, as an Association have is to continue to grow our membership and grow our member participation. As you are probably aware, the 'heavy lifting' of the organization gets done by the membership!

As we embark on our next 50 years as a formal Association, it is important to remember that EGSA was built on volunteer contributions. The commitments that each of you make and keep, on behalf of EGSA leads to the betterment of our Association, as well as the On-Site Power Industry.

The chart on these next two pages tracks our member achievements and milestones. In order to be considered for a leadership role in our organization, EGSA has established guidelines that provide a transparent route for milestones that must be achieved in order to be considered. This list is our formal way of tracking Members' achievements and valuable contributions made on behalf of EGSA and to provide a roadmap for interested Members who wish to be considered for leadership roles within the Association.

We began this chart in earnest in January of 2012. We rolled out a program where EGSA Staff tracks and recognizes our members who make these formal contributions to the Association and to our industry at large.

For obvious reasons, this list is not foolproof. We encourage members to speak up if our historical data is not correct! The chart is also housed real-time on our website *(www.egsa.org/AboutUs/Leadership.aspx)*.

The list includes our active participants, minus our retired members. Since 2012, anyone who has retired has been removed from the active list and placed on a retiree list.

We apologize if we have omitted anyone or left off a valuable member contribution. Please correct us if you find an error by contacting Kim Giles, EGSA Marketing Manager at *k.giles@egsa.org*.

Stay in tune with your Association. Get involved. We need your support!

Last Name	First Name	Executive Board	Director	Committee Chair	Committee Officer	Working Group (Chair Only)	Speaker - EGSA Conference	*Powerline* Magazine Author	Reference Book Author	Past Award Recipient				School Instructor
										William Timmler	Leroy H. Carpenter	James Wright Education	President's	
Ahmed	Mehmood								X					
Alley	Dave		2001 to '03	ED 2003 & Before					X	2001				1998 to '15
Anderson	Lowell										1972			
Anderson	Wayne								X					
Badr	Mazen				GR 2015 to current									
Barrios	Daniel													2012 to current
Basler	Matt		2005						X					
Basler	Mike								X					
Bauer	Warner	2005 to '09	1987 to '89 & 2002 to '04	CG 1993 DG 2003	CP 2004 & '05	Russell Grant 2014 & '15			X	1993	2011			
Beasley	Vaughn	2011 to '15	2008 to '10	DD 2009 to '11	DD 2006 to '08	Exploratory Task Force 2014 & '15								
Benke	James								X					
Berg	Brian		2011 to '13	MT 2009 to '11	MT 2007 & '08									
Birdsong	Bob													2004 to current
Blackman	Donald								X					
Brown	David	2015 to current	2009 to '11	BG 2010 to '11										
Carr	Raymond													2007 to '10
Casterline	Les			MT Co-Chair 2003 to '05 MT 2006 to '09										
Chelmecki	Chris								X					
Chen	Scott								X					
Chrysam	Walter													2007 to current
Clophus	Patrick								X					
Cutro	David						F11							2015 to current
Dauffenbach	Mike								X					2004 to current
Daugherty	Herb	1988 to '92	1985 to'88	Eng Section Chair 1987 to '91	Electrical Control Components 1983 to '86 Engineering Section Vice 1983 to '86				X	1989	1995	2000	2009	1983 to current
Denning	Jess													2012 to current
Detor	Nick				GN 2009 & '10									
Evans	Katie		2013 to '15	IT 2012 to current	IT 2011 &'12									
Evans	Steve		2012 to '14	GN 2011 to '12	GN 2009 & '10	Digital Paralleling 2013 & '14	F11		X					2010 to current
Feld	Paul		2016 to current		TC 2015 to current									
Fennell	Brad		2010 to '12	TS 2010					X					
Franks	Wyatt				GN 2013 & '14									

KEY TO COMMITTEE CODES

AHNM ..... Ad Hoc Nominating Procedures
BG ..... Buying Guide
CS ..... Codes & Standards
CG ..... Co-Gen/Environmental
CN ..... Convention
CP ..... Conference Planning
DG ..... Distributed Generation Subcommittee
DD ..... Distributor/Dealer
ED ..... Education
EM ..... Electronic Media
GS ..... General Subcommittee
GR ..... Government Relations
GN ..... Green
IT ..... International Trade
MT ..... Market Trends
MB ..... Membership
MM ..... Military Mobile Power
NM ..... Nominating
PG ..... Power Generation Subcommittee
RB ..... Reference Book
SC ..... Scholarship
SLRP ..... Strategic Long Range Planning
TS ..... Trade Show
TC ..... Tech Certification

Last Name	First Name	Executive Board	Director	Committee Chair	Committee Officer	Working Group (Chair Only)	Speaker - EGSA Conference	*Powerline* Magazine Author	Reference Book Author	Past Award Recipient				School Instructor
										William Timmler	Leroy H. Carpenter	James Wright Education	President's	
Gaines	Terry								X			2008		1999 to current
Garcia	John			MB 2012 to '15										
Gibson	Curt						S15							
Haaland	Ole		2015 to current						X					1998 to current
Habic	Charlie	2014 to current	2007 to '09	MB 2006 & '07 CP 2015 to current AHNM 2009 & '10	MB 2004 & '05 CP 2011 to '13						2012		2013	
Hafich	Bob	2013 to current	2001 to '03 2011 to '13	NM 2004 MB 2008 to '11 TC 2009 to '11	MB 2004 to '07 Tc 2004 to '08					2012	2010		2012	
Hafich	Joe		2008 to '10	DD 2003 to '08 SLRP 2007 to '13						2010			2012 (Two Awards)	
Halbert	Mark						S15							
Hamilton	Randy								X					
Hartzel	Ron	2007 to '11	2003 to '06	CS 2003 to '07 EM 2006 to '10 SLRP 2007 to '13						2008			2012	
Hawkins	John			CS 2008 to '10	CS 2006 & 07									
Handlin	Harry													2008 to current
Hinde	Tim								X					1998 to current
Hodgkins	Rick				DD 2011									
Hoeft	John			MT 2015 to current	MT 2012 to '14									
Hurtado	David		2001 to '03											
Hunt	James								X					
Iskandar	David								X					
Jarrett	Harold													2015 to current
Johnson	Gerald (Jerry)								X					
Kaewert	William		2014 to current						X					2010 to current
Kelly, Jr.	John	2008 to '12	2005 to '07	DD 1997 to 2002 SLRP 2007 to '13		50th Anniversary 14' & 15'					2013		2012	
Knittel	Richard					TOYA 2012 to '14								
Lagree	James								X					
Lathrop	Todd	2016 to current	2012 to '14	CS 2011 to '13	CS 2007 to '10	Working Groups Chair 2015			X	2013				2005 to current

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PG ..... Power Generation Subcommittee
RB ..... Reference Book
SC ..... Scholarship
SLRP ..... Strategic Long Range Planning
TS ..... Trade Show
TC ..... Tech Certification

Last Name	First Name	Executive Board	Director	Committee Chair	Committee Officer	Working Group (Chair Only)	Speaker - EGSA Conference	*Powerline* Magazine Author	Reference Book Author	Past Award Recipient				School Instructor
										William Timmler	Leroy H. Carpenter	James Wright Education	President's	
Laurents	Debra	2010 to '14	2006 to '08	SLRP 2007 to '13	MB 2008 to '11 TC 2006 & '07					2015			2012	
Lawrence	Steve													2002 to '08 & 2011
Lechtanski	Joe								X					
Leslie	David								X					
Levere	Trish					OSHPD 2013 to current								
Lewis	Robert			GR 2012 to '15	GR 2009 to '11									
Lewit	Tanja				IT 2012 to current									
Linton	Greg	2006 to '10	2002 to '04	TC 2004 NM 2010 SLRP 2007 to '13							2014		2012	
Mcdonald	Bobby		2008 to '10		DD 2003 to '09									
Mcdonald	Jim			GN 2012 to '14	GN 2011 & '12				X					2008 to current
Mcmahon	Justin				GR 2015 to current									
Mueller	Robert								X					
Morrison	Rick		2013 to '15		DD 2011 to '13								2013	
Murphy	Ed	2012 to current	2003 to '05	MB 2003 CP 2011 to '14	CP 2007 to '10					2003			2013	
Neland	Richard				IT 2005 to '08									
Nagle	Chris						S14	X						
Olsen	Dick			IT 2004 to '08										
O'rourke	Jim						F12							
Osenga	Mike												2013	
Oshefsky	David				MB 2013 to current									
Padden	Mike			GR Co-Chair 2009 to '11										
Pafford	Bill		2004 to '06	CS 2001 & '02										
Patel	Bhavesh						S14	X						
Pearson	Dennis		2014 to current	ED 2011 to '14								2013		
Perez	Larry		2011 to '13						X					1995 to '98
Petro	Jack			TC 2015 to current										
Petty	Walter		2013 to '15	MB 2015 to current	GN 2011, MB 2013 to '15									
Philips	Dave				GN 2013 & 2014									
Pierson	Ben				ED 2011 to '13				X					
Piske	Bob		2016 to current	DD 2011 to '14	CS 2010 TC 2015 to current					2014				
Ponstein	Brian						S15	X						2015 to current
Pope	Michael	2009 to '13	2005 to '07	ED 2003 to '06 GN 2009 & '10		2013 ELS Working Group			X	2006	2009	2003	2013	2007 to current
Powers	Al					TOYA Working Group '15 to current								
Prevoznik	Mark								X					
Prosser	Al		2008 to '10		MB 2008 to '11									

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										William Timmler	Leroy H. Carpenter	James Wright Education	President's	
Redding	Wayne													2012 to current
Risser	Lyndon			DD 2015 to current	DD 2009 to '14									
Roundtree	Dennis		2007 to '09	ED 2007 & '08	ED 2004 to '06					2009		2006		1998 to current
Sappington	Steve		2016 to current											
Schaefer	Rich								X					
Schillings	Debbie				It 2015 to current									
Schroeder	Ron		2010 to '12						X					1994 to current
Scott	Richard								X					
Siebert	Marty								X					
Simmons	Robert					Silencer 2012 to 14			X					
Slater	Lanny		2013 to '15	IT 2010 to '12	IT 2009 to '12									
Steele	Mark		2010 to '12	GR Co-Chair 2009 to '11	GR 2005 to '08									
Stoyanac	Steve	2001 to '05	1998 to '00	MB 2001 to '03 NM 2005 & '08 RB 2006 to '12					X	2000	2006			2008 to current
Stringer	Dave		2015 to current	GR 2015 to current	GR 2012 to '14				X					
Struss	Darrell				IT 2009 & '10									
Summers	Kurt		2016 to current		DD 2015 to current		F15							
Svendsen	John				CS 2011 to current									
Sweeney	Rob				TC 2009 & '10									
Szalzus	Mark													2006 to '08
Van Maaren	Richard								X					
Venhorst	Brian				CP 2013 to current									
Vennie	David			IT 2015 to current	IT 2013 & '14									
Vild	Brent													2007 to '09
Visioli	Armand		2003 to '05	CP 2003 & '04						2005			2013	
Walls	Hal				CP 2014 to current									
Walters	Greg		2009 to '11		ED 2011 to current									
Weimer	Randy		1996 to '98											
Wein	Tom		2015 to current	ED 2014 to current	ED 2013 & '14									
Westhofen	Chuck				MT 2009 to '11									
Wilhelm	Paul				GR 2015 to current									
Winnie	Peter								X					

KEY TO COMMITTEE CODES

AHNM ..... Ad Hoc Nominating Procedures
BG ..... Buying Guide
CS ..... Codes & Standards
CG ..... Co-Gen/Environmental
CN ..... Convention
CP ..... Conference Planning
DG ..... Distributed Generation Subcommittee
DD ..... Distributor/Dealer
ED ..... Education
EM ..... Electronic Media
GS ..... General Subcommittee
GR ..... Government Relations
GN ..... Green
IT ..... International Trade
MT ..... Market Trends
MB ..... Membership
MM ..... Military Mobile Power
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										William Timmler	Leroy H. Carpenter	James Wright Education	President's	
Witkowski	Mike		2009 to '11	CS 2014 to current	CS 2008 to '13				X		2015			2008 to current
Whittall	Herb		1993 to '95								1996			
Wolf	Fred								X					
Wood	Ray			MM 2003 GR 1985 & 2004 to '08						1985				
Zirnhelt	Joe				MT 2011 to current			X						
Youkers	Chad				DD 2015 to current									
Zhou	Xin								X					

One final note, active service to an organization comes in all shapes and sizes. If you are interested in becoming more active in your Association, the singular best way to get involved is to act! Contact an EGSA Board Member or one of our knowledgeable staff members if you are interested! n

Green Energy: Threat or Opportunity?

This is the third and final article in a series leading up to the 2016 EGSA Spring Conference in San Antonio where we will have a panel discussing alternative energy. The first two articles looked at the evolving green energy technologies, the possible threat to the RICE-DG industry and costs of implementing alternative energies. This article looks at the challenges to distributed energy: regulatory/political, environmental and financial.

Integrating Distributed and Renewable Energy Sources

By: Steve Evans, Director of PCS Business Development, ASCO Power Technologies, a division of Emerson Electric. © 2016

The two main reasons for distributed generation are to either make money supporting the grid, or to provide back-up power to a local building/microgrid. When providing back-up power to a microgrid, intermittent power generation sources like solar or wind are not considered viable as long-term energy sources at this time. Energy storage may add a few minutes, or even few hours, of critical power but that still is not good enough for certain applications.

There are markets that might forgo the RICE genset in favor of energy storage like data centers that can transfer computations to a backup data center, a commercial building that only needs power long enough to evacuate, or a residence that can gamble that the power will be back on in a day or two.

These are the types of applications that, when combined with energy storage, present a small threat to the RICE DG industry. This article looks at the regulatory/political, environmental, and financial discussions regarding RICE DG.

Financial

In 2011, the Federal Energy Regulatory Commission passed a final rule that said:

"when a … [facility] participating in an organized wholesale energy market … has the capability to balance supply and demand as an alternative to a generation … and when [it is] cost-effective … , that demand response resource must be compensated for the service it provides to the energy market at the market price for energy… This approach for compensating demand response resources helps to ensure the competitiveness of organized wholesale energy markets and remove barriers to the participation of demand response resources, thus ensuring just and reasonable wholesale rates."

We have all heard our share of government lingo, but basically that allowed a generation company to pay customers to reduce consumption instead of generating that much electricity. Makes sense: reduce use instead of generating more. Saving a dollar is the same as not spending a dollar.

Well, some unknown "friends of the court" convinced the Court of Appeals that FERC overstepped their legal boundaries by saying they have no authority over rates regarding reducing consumption, thus suspending that FERC ruling above in 2013.

It reached the Supreme Court and on January 25, 2016 the Court of Appeals decision was overturned. This decision could end up being a real boom to the energy management business.

Electricity rates are a complex shell game with money and utility profits. Even before the original FERC ruling, demand response rates were available, in many instances to commercial customers only. Peak Shaving, Peak Lopping and IRC/ATS (Interruptible Rate Contracts utilizing an Automatic Transfer Switch [ATS] in "on-line test" mode to transfer all of the plant load to the generator) have been used for years to help consumers save money. The customer is granted a lower year-round rate if they promise to limit their demand below some level (Peak Shaving or Peak Lopping) or totally get off the grid when requested (IRC/ATS). The big reveal is the utility would save a lot more money with these programs that they would then pass on to the consumer.

On the other side of the equation, distribution companies – the one you pay to deliver power to your house or business – have to buy the electricity to meet the instantaneous demand. Power can be purchased many different ways: daily, 1 hour, 15 minute, and 5 minute intervals. As demand increases and intervals decrease, price jumps dramatically. From the Rocky Mountain Institute's website are examples of 3 cities from August 2015:

"In the Northeast, New York City recorded its third-hottest August (2015) on record.

In Texas, a lengthy heat wave with extended triple-digit temperatures saw ERCOT, the state's grid operator, set a new all-time record for hourly demand (ERCOT actually broke three demand records across two consecutive days in early August).

And in Southern California and Arizona the story was much the same… during the three August heat waves in question, the price spikes were especially severe.

Compared to "typical" wholesale electricity prices of $25–60 per megawatt-hour (MWh), in the New York ISO's western region, …wholesale prices hit $1,100 to $1,200 per MWh. …in Texas, the real-time price surpassed $600 per MWh, and a week later… $900 per MWh. [About the same time, the "next-day" rates jumped from $66 to $175… that is, the cost all day was $175 per MWhr, but short time peak rates were $900/MWhr.] And in the Southern California region of CAISO, where San Diegoans were sweltering, the real-time price broke through $1,200 [per MWhr]."

The Supreme Court decision has set the demand response (energy saving) to be valued at the same rates as the power purchased by the local grid operator. By either shutting down or

powering your facility from generators, one could theoretically save (1) the cost of the electricity not used and be paid the full demand rate at (2) daily or (3) short interval prices. Plus, one could (4) reduce peak demand, dropping the base rate. As much as we hate corny business sayings: a real "win-win" for the energy consumer.

There are a number of regulatory and technical "how to" issues to resolve, this concept might take a couple of years to implement on a wide scale. Or it might face other legal battles on different fronts. And this 'payment for saving' plan is for the local distribution companies, not directly for us consumers. With any new systems being installed today, though, I would recommend being ready to take advantage of this when it reaches the individual consumer by including a method of remote control and monitoring, like a Critical Power Management System.

Environmental

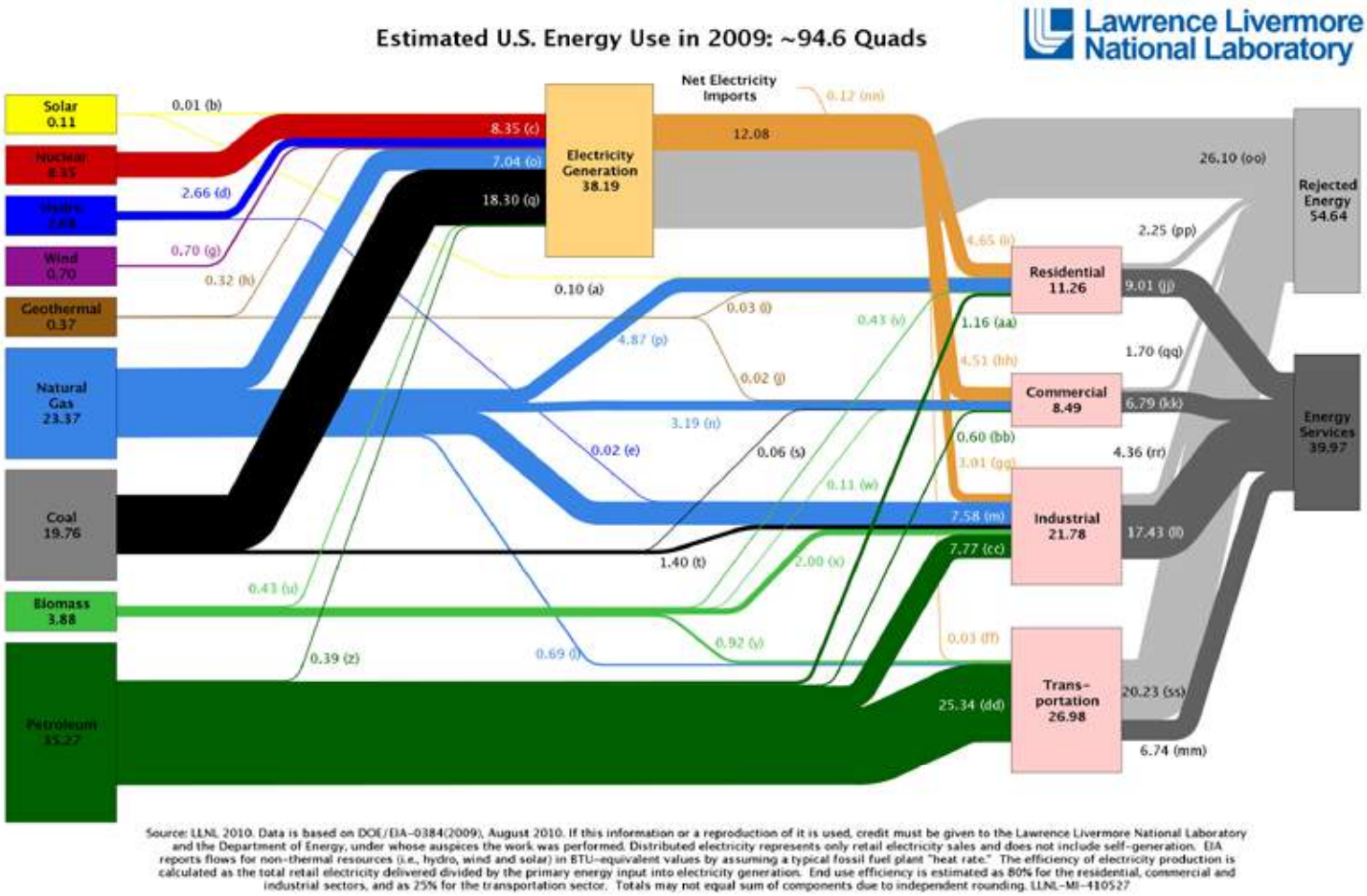
To make solar cells, they melt sand in what is essentially an electric arc furnace, consuming vast amounts of electricity. According to a *Popular Science* article from 2013, the solar industry should be electrically-neutral by 2020. That is, all the solar panels in the world should have made enough electricity by 2020 to offset the amount of electricity used to make and install all the solar panels in the world! National Renewable Energy Laboratory in Golden, CO agrees in principle stating that it should take a modern solar panel about 4 years of operation to offset the energy it took to make it. Oh, and don't forget solar panels degrade at between 0.4 and 1% per year with a life expectancy as low as 10 years.

IEEE completes the solar panel environmental impact picture with a chemistry lesson. If you go to *spectrum.ieee.org* and search for "Solar Energy Isn't Always as Green as You Think" you can find the entire article. Solar wafer production uses valuable metals like silver, tellurium, or indium and produces many harmful byproducts including massive amounts of CO2 and sulfur dioxide emissions and chemicals like silicon tetrachloride, hydrochloric acid, and hydrofluoric acid to name a few. I'm no chemist, but the article explains these are some nasty chemicals. It goes on to explain recycling and properly disposing of these wastes are very expensive, so many of the US plants that properly disposed of or recycled these byproducts closed because they could not compete with China where the environmental regulations are often weak or non-existent. In one case a plant intentionally released chemicals killing "hundreds of fish and dozens of pigs." Looking at the entire life cycle environmental and financial impacts, maybe solar is not so "green" after all?

I did not include the environmental impacts of wind turbine production because (1) I could not find anything publically available and (2) I assumed shipping costs of large items like those used in wind turbines usually means they are manufactured in the US within our environmental guidelines.

About 22% of the electricity produced at the classic large power plant is lost in the form of heat just delivering electricity to our houses. This is just T&D losses; generation losses are even higher!

Looking at it another way, Lawrence Livermore National Laboratory estimates 2/3 of the energy consumed to make and



Source: LLNL 2010. Data is based on DOE/EIA-0384(2009), August 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 80% for the residential, commercial and industrial sectors, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

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deliver electricity is lost in the process. This is total BTUs: BTUs of fuel into the process, BTU's lost in generation, transmission, distribution, and BTU's lost in converting kW back to work energy – light, motion, heat, whatever electricity is used for. The graph shows 94.6 quadrillion British Thermal Units (or quads) of energy used in the USA for everything: fuel for our cars, heat for our homes, energy for our factories, fuel for transportation… all forms of energy. Electricity generation consumed 38.19 BTU quads, of which 12.08 BTU quads actually went to useful work and 26.10 BTU quads was lost in the form of heat. 12.08/38.19 = 31% overall efficiency. That may not seem logical but once we consider all the cumulative losses it makes sense. Most US power plants do not have a way to utilize all the heat, so they use cooling towers or large lakes to dump it.

The U.S. Energy Information Administration (EIA) reports generation data from commercial power plants just like the U.S EPA reports emissions data. Coal-fired power plants are required to release their emissions data to the EPA (ghgdata.epa.gov) and their electrical production data to the EIA (www.eia.gov). CO2 seems to be getting the most headlines, so let's combine these figures and create a measurement of CO2/MWhr.

Coffeen is a 1960's era coal plant in central IL. In 2014, according to the EIA, it produced 5.2 million MWhrs of electricity and emitted, according to the EPA, 5.3 metric tonnes of CO2. This would come out to 5,340,477/5,240,333 or 1.02 metric tonnes of CO2 per MWhr. Converting to lbs per megawatt-hour, that would be about 2247 lbs/MWhr.

One data point for comparison: A 2500kW CAT 3516C (they are good about publicly publishing their emissions data on the web) Tier 4 engine produces 3900 lbs/hour of CO2 at full load. Doing the unit conversions, 1,563 lbs/MWhr. Burning 173 gals/hour, the genset overall efficiency would be about 35%.

Comparing the overall efficiency of the electric power system at 31% and the genset by itself at 35%, it looks like we would be greener to use engines to directly drive rotational loads instead of using electricity. Consider adding a CHP or combined heat and power system to recover the heat, and www.energy.gov reports efficiencies as high as 75%.

Pollution is much more complicated than just C02, of course. And bi-fuel and gas engines are generally deemed "greener" then even Tier 4 diesels, except when you include methane and nitrous oxide, the equation changes. Looking at all the factors; losses in power generation, transmission and distribution systems, environmental impacts of silicon wafer production, how much cleaner today's Tier 4 engines are, CHP opportunities, and distributed generation just seems to make good economic and environmental sense.*

Regulatory/political

Of all the barriers, these are probably the most difficult! Today it is illegal for you to sell power to your neighbor via the smart grid or a local microgrid. Distribution utilities are usually for-profit monopolies, at least at some point. Some of the distribution companies are allowing customers to buy power from different sources, but most of us don't have a choice of our distribution companies. Power generation and transmission companies are also for-profit companies. You know what happens when you "margin-stack" when you bid a job; you buy something for a project and end up paying 2 or 3 markups on a component and suddenly your price is too high. Same thing is happening to your electric bill every month.

"The evidence is clear that generators are profiting excessively from RTO [Regional Transmission Operator] power markets, and that sellers' rates are not 'just and reasonable' as the law requires," says Elise Caplan with the American Public Power Association and Stephen Brobeck with the Consumer Federation of America, co-authors on a paper related to this topic.

The regulations can be confusing: NEC 700:2014, 12(A) requires 1.5 hours of back-up power for batteries, two hours for RICE. NFPA 110 requires back-up power systems to be driven by RICE with run times varying by building type. (NFPA110:2104, 5.2.4) The biggest challenges, though, can be getting the required environmental permits – like emissions, fuel storage, sound, etc. – to install RICE back-up power, especially in some urban areas. This might push some to use alternative energy source(s) plus energy storage systems (like compressed air or flow batteries) instead of RICE DG.

Net metering is not really fair to those that don't participate: selling power for the same amount as you are buying it for does not support the infrastructure costs. Politically it is a win for politicians, but only until the public filters the facts out of the fog. But the utility's response of buying power for the same as they can purchase it for on the market is not fair either: distributed generation from any source eliminates the transmission and distribution costs.

All these factors highlight a change in the utility model is necessary for the Smart Grid to work as politicians envision. As we shift to renewable energy plus energy storage and generation costs increase, as we tire of and then retire government subsidies, and if we continue to guarantee a profit for generation, transmission, and distribution companies as they margin-stack, electrical bills will soar. Those that can afford it will get off the grid – this is already happening in Hawaii. Eventually people will convince the government that they are tired of outrageous electricity costs and the utility business model will change. Hey, it happened to the phone company as technology shifted and it was not all bad!

How Can We Help?

Get involved! The greenhouse gasses discussions need to include the entire process of converting a carbon-based fuel to electricity and delivering it to the point of use. The EPA needs to allow those that are willing convert their older standby Tier 2 or Tier 3 engines to Tier 4 a way to recover that investment by selling power back to the grid, yet still be available to run with a fault in the Tier 4 retrofitted emissions system if there is an emergency. Educate customers on the benefits of CHP applications based on RICE-DG. Prepare existing or new microgrids to interface with the Smart Grid of the future. Be ready to answer customer's questions about integrating alternative energies into their power system. If you have a smart grid with good load control, fast-starting RICE-DG can be viewed as a spinning reserve.

GREEN ENERGY

When it comes to price, reliability, run time, and regulatory acceptance nothing comes close to RICE-DG. Today. But we cannot rest on our laurels too long. ■

Footnotes:

**The energy used to transport the coal was not included, the diesel used to start the coal boiler, or the energy to refine the diesel fuel.*

I would like to gratefully acknowledge the expertise and technical guidance of Brian Ponstein and Jim McDonald, true masters in the art and science of engine emissions.

About the author:

Steve Evans – Director of PCS Business Development, ASCO Power Technologies, a division of Emerson Electric.

Steve is a former Board Member of EGSA, an instructor with the George Rowley Schools of On Site Power Generation, and author of the chapter on Power Management and co-author of the chapter on Synchronous Generators in the 5th Edition of the *EGSA On-Site Power Generation – A Comprehensive Guide to On-Site Power.* He has authored several technical articles for *Powerline* and other magazines, domestic and international.

Steve has been involved with electrical power generation, transmission, distribution, conversion, and control for 35 years. He has contributed to standards development with IEEE 1547.

In his current role with ASCO, Steve is supporting various sales efforts and new product development.

Standards Development Influences an Industry

By: Jason Knedlhans, Business Development Manager – UL LLC

The grand light display of the Chicago World's Fair was a wonder when first seen in 1893. Tesla's vision to light the entire World's Fair with more than 100,000 incandescent light bulbs came true at a time when electrical power was in its infancy. The spectacle was nothing less than amazing to the people of the late 19th century. As the public walked the halls of the exposition, they imagined the electrified world to come with optimism and concern.

We find that same trend of innovation today in the energy production market, as innovation continues to push the boundaries of traditional power production. Electrical equipment has become smarter and more autonomous, and is expected to perform advanced functions as distributed energy and alternate energies grow in popularity.

Think back to the first time you used the Internet and realized the vast amount of information available through this connection. The possibilities were great, but once you found out about the ability to access all kinds of information online - were you also somewhat concerned? As we look into the future, we see our homes and lives connected to the internet more than ever before – and while these connections create opportunity, they also create risk for potential damage. In much the same way, risks are introduced to electrical power systems as they become more connected. Hence, safety and reliability remain the concern for these new areas of power generation. Considering these examples from different decades and industries, we can see that the concern for the safety of property and human life persist through time and application.

As William Henry Merrill walked the Chicago World's Fair in 1893, he contemplated the dangers of electricity and the need to ensure the safety of the public and their interests. He was aware of the hazards of electricity, as demonstrated by Edison and Tesla who battled over whether DC or AC power would dominate the power industry. Mr. Merrill was also aware of the rise in building fires, with many being attributed to the increase of electricity use. Having witnessed many deaths and injuries, he was determined to keep the public safe from the dangers of electricity. He began his work with the major cause for electrical fires: a breakdown of insulation, especially on Edison light bulbs. Soon after conducting his first official tests of insulating materials, Mr. Merrill founded Underwriters Electrical Bureau, which in 1901 became Underwriters Laboratories Inc. (UL).

In 1903, the first UL Standard - *The Standard for Tin Clad Fire Doors* - was released. This standard addressed the increasing need to keep workplaces safe during the increased use of electricity and fires in factories around the U.S. As the need for electrical and fire safety grew, UL along with organizations such as the National Fire Protection Association (NFPA), developed additional standards and codes.

UL continued the development of safety standards through innovative test method development and research. As a proactive step towards safe roofing systems, they conducted research into the travel of flame over roof covering systems. In 1916 many roof covering systems on residences & commercial buildings were made of wood. This was an obvious hazard, especially in a populous city like Chicago. UL found this was an issue and began by applying burning discs to the roof covering systems in order to determine their resistance to ignition from the flaming particles landing on the roof. It was soon found that this was not enough, as many fires began inside the building, and then traveled to the roof as the flames exited the windows. Out of this research, the Steiner Tunnel was developed in 1922, with the original Steiner Tunnel design still being used to this day. The invention of this test equipment has been credited with saving millions of lives today.

Continued from page 8

"For years, experts have recommended the US military seek independence from commercial utility power."

"When I was a major in the first Gulf war, we went over there without computers or email." said Greg Bean, a retired colonel who now works as director of public works at Fort Bragg in NC, one of the Army's largest bases. "Now, if you lose a server, your operations almost cease".

"Our grid is old and it's reliant on technology that's outdated" said Michael W, Energy Program Director for the Truman National Security Project & Center for National Policy, a Washington think tank.

"Fear that utility companies remain vulnerable to hackers, terrorists and natural disasters has the Pentagon pushing construction of independent power grids at military bases across the U.S., including one nearing completion at the Marine Corps combat center" (Twentynine Palms, CA.) "It will be able to operate even if there is a blackout, using a system of small power plants, solar panels, batteries and diesel generators. It is already saving $10 million a year in energy costs."

"Engineers estimate they soon will be able to generate about 80% of the electricity the base needs."

"Increasingly, the Pentagon wants power from its own sources. Solar panels, for example have become almost as commonplace at bases as flagpoles."

"As the military gains more experience, and as retrofitting costs drop, the pace of development will pick up, said Dennis McGinn, assistant secretary of the Navy and a retired Vice Admiral." "More than money is at stake," he said: "Mission readiness is tied to energy security."

It is reasonable to expect that as the U.S. military bases depend more on their on-site power (distributed generation), they will need to increase the number of personnel capable of installing, maintaining, trouble-shooting and repairing this equipment. This is good news for EGSA Members. At some point, these mobile power technicians will want to enter the civilian sector, and with help from the Russell Grant, Rowley Schools and other EGSA educational programs, we can expect these technicians to help meet the needs of many of our member companies.

"At Ease!"

The Television Standard of 1976 is another example of successful research in pursuit of the safety of life. In the early 1970s, fires from tube televisions plagued consumers, as the cathode ray tube element of the television would implode, causing a major shrapnel and fire hazard. UL worked closely with the Consumer Product Safety Commission (CPSC) to investigate 8,000 incidents in the U.S. The test method research conducted by UL resulted in the TV Standard UL 1410. UL continues to work closely with CPSC to this day, for example in collaborating to seek a practical solution for the certification of portable generators.

While many of the legacy methods and research often still hold true, the safety industry thrives on innovation and has been developing new methods and standards. With the increase in distributed energy and the need to support the grid, standards development organizations around the world are racing to keep up with a changing industry.

The world is seeing an increase in distributed power generation at the consumer and commercial levels. We've also seen how climate talks, large natural disasters and fluctuating prices of natural resources can greatly affect centralized power generation.

As power generation gets closer to the consumer, offshore oil exploration and drilling are requiring a higher level of safety, and changes at the utility level regarding new safety considerations must be examined. Globally this is happening in countries like Egypt, which is currently working with world leaders in safety to identify the standards that will govern its power installations. It's also important for stakeholders to participate and work with the Egyptian government in order to proactively mold the requirements. This is an exciting time as new regions of the world create demand and drive innovation forward.

Other nations in the Middle East where national and international standards are being vetted for use include Saudi Arabia, United Arab of Emirates and Qatar. Select North American standards such as UL 2200 are accepted in the majority of these countries, with IEC 60034 and IEC 60204 also being accepted in the region. Even though there are a number of standards accepted in these countries, many manufacturers have been very successful in the region by leveraging their products' UL certification.

In Latin America there is an increase in UL Standards used in countries with 120 V, 60 Hz grids such as Colombia and Ecuador. Along with the increase in UL Standards use, some countries are requiring letters of compliance and inspection type. On the African continent, there is also a large demand for local inspections on power generation systems.

We've found that certification may reduce the need for inspection in some countries, but some still require onsite inspection. From the adoption of standards in areas of modernization to meeting the needs of a changing power generation landscape, standards must adapt to the trends and needs of the market.

In addition to the trends and changes in standards acceptance, there are situations where a gap exists in currently available standards. One example of this is generator assembly certification for units bound for Canada, which currently requires certification of the alternator and controller units in order for a unit to be considered acceptable for installation. The consideration of the alternator and controller only leaves a gap in certification, as no consideration is given to the prime mover, enclosure, fuel system and other critical components of the system. This gap causes an issue where the local inspectors in Canada may require additional inspections in the field by a third party. In some cases this applies to units that were previously inspected and moved a short distance. This not only adds costs but also jeopardizes a smooth commissioning of the site.

In response to the feedback from manufacturers, distributors, local inspectors and code participants in the industry, Underwriters Laboratories of Canada (ULC) determined that a harmonized standard with the current U.S. standard for generator assemblies, UL 2200, was the best path forward. Currently ULC is forming a group of industry experts to create a bi-national standard for generator assemblies for installation in Canada and the U.S., UL/ULC 2200. This is an opportunity for the standards development organizations to create greater opportunity for generator manufacturers and distributors in North America. The goal is to include all fuel train requirements from the Technical Standards & Safety Authority, TSSA, of Canada. The group is also looking to harmonize requirements for medium voltage applications, light towers and road going units. The vision of a single harmonized standard will streamline certification and field acceptance while reducing overall costs for manufacturers and distributors. Being a part of the development group is an advantage to all involved.

Another example of a gap in requirements is NFPA 37 fire testing for residential units closer than 5 feet from a dwelling. The five foot distance was put into place based on the known heat release and hazards of generators. The NFPA 37 document was revised to include a provision for placing generators closer to dwellings than the prescribed five feet. This is a step in the right direction. One concern is that the NFPA document does not describe the method for testing. This has caused confusion and acceptance issues in the field. Understanding the cost and time associated with the acceptance of the units, UL will be conducting research in 2016 in order to create such a test method and will publish it in UL 2200. The vision is to bring us one step closer to a harmonized and science-backed method.

Filling gaps in the certification standards is one way UL helps ensure that standards meet the needs of the global industry and of the public. We also look for areas where a standard does not meet the needs of changing technology. A good example of this is advancing functionality of generator controllers. This applies across the board, from residential units up to large power plant controllers. In addition, regulators are asking for more concise certifications for safety and functionality. In the industrial, com-

mercial and residential realms, controllers are gaining advanced functionality such as paralleling, grid interconnection, short-circuit protection and branch circuit protection. Some may argue that these functions have been a part of controllers for some time now, but we see a shift in the acceptance of these as distributed generation grows.

Additionally, the industry asked for a solution beyond the industrial control standard, UL 508, which did not fully address the functionality of a controller. In response, UL developed a draft standard UL Subject 6200. The group working on this standard is hoping to simplify requirements for controllers from residential controls to AVR controls for utility scale generator systems. In addition to simplifying requirements, the standard will bring all requirements for generator controls into a single standard. Another goal of the group is to create a tiered certification scheme to meet the needs of the application. For instance, it may be suitable for the functionality of simple controls to be evaluated in the end use application while large control systems may require functional safety evaluation for critical applications. We encourage you join the discussion or at least be a part of the discussion with the development group. There are many means of participating, which do not require a participant to be a formal part of the standards development panel. Additional information can be found on the ANSI website at www.ansi.org.

As the market evolves and new products and players enter, standards will continue to evolve. As long as people like Nikola

Tesla and Thomas Edison continue to innovate, UL will be here to help ensure the safety and functionality of these product innovations. As seen in the time of Tesla, the public is hesitant to adopt products without proven safety records. As the power generation market evolves and touches more consumers, standards can help provide the assurance that the products they use will not harm them, their families or their property.

With this, UL asks you to join the discussion and participate in standards development. Standards bring additional value to your product. In fact, one manufacturer touted that "Certification was the best thing to happen to my company." Being a part of the standards development can ensure that standards continue to raise the bar for safety and performance of products, creating advantages for companies, and industry in general. Participation in standards development not only takes products and markets to the next level but can also positively impact a business' brand. It's a great place to network and gather market information. UL looks forward to seeing you at a standards development event in the near future. To learn more about how to participate in the standards development process with UL, please visit www.ansi.org, csds.ul.com, or contact Jason Knedlhans at *Jason.Knedlhans@ul.com.* ■

About the author:

Jason Knedlhans is the Business Development Manager for Generator Equipment at UL LLC. He joined UL in 2006 as an engineer on the Energy team. His passion for responsible power generation led to Jason holding a number of increasingly responsible positions at UL, including management of the Energy and Power Technologies division engineering team at UL's headquarters in Northbrook, IL.

Jason obtained his Electrical Engineering degree from the University of Wisconsin – Milwaukee. He began his journey as an Electrical Engineer at Harley-Davidson Motor Company, designing and testing the charging systems, concept design, and EMC testing and analysis. After his work at Harley-Davidson he moved to Underwriters Laboratories, now known as UL LLC.

Jason is currently focused on service and customer relations development for generator products, including portable generator units, traditional generators, gas turbines and controls for hydro and nuclear applications. Jason has also been extensively involved in other power generation products such as photovoltaic products and accessories, inverters and battery systems. He has trained global engineering personnel and laboratory technicians on a number of topics, including generators and photovoltaic safety and performance testing.

Reliable Backup Needs Reliable Fuel

Service providers can find opportunity in supporting fuel integrity

By: Mark Stellmach, President of Fuel Management Services Inc.

Diesel fuel has many advantages as a generator fuel, and it is at its best when operators take preventive measures and preserve fuel integrity.

Effective fuel maintenance is a simple process that involves sound handling and storage procedures, additive usage and periodic testing. In the hands of an ambitious supplier or contractor, fuel maintenance concerns present a valuable business opportunity. Clients demand reliable backup power and fuel integrity is a vital piece of that puzzle.

The 2015 EGSA Fall Conference in Denver featured an excellent panel discussion on diesel fuel maintenance, where four EGSA Member Presenters outlined some of the important procedures for maintaining diesel fuel quality in storage. It is, after all, an important topic for everyone whose success is riding on successful delivery of diesel-fired backup power.

To grasp the issues involved in fuel quality maintenance, it helps to understand how the diesel fuel supply has evolved. This article will take a close look at today's essential fuels – ultra-low sulfur diesel (ULSD) and biodiesel – and explain their properties and characteristics. It will also examine how long-term storage affects these fuels and how preventive maintenance can preserve integrity.

Chemically Active Fuels

The current liquid fuels used today to fuel a backup generator include ULSD and in many cases include a blend of biodiesel whereby ULSD and any biodiesel blends contain a maximum of 15 parts per million sulfur. These two fuels are relatively new to the on-site power generation industry, and it is important to understand the differences between these fuels and the higher sulfur fuels of just a few years ago.

Both ULSD and biodiesel have different properties and characteristics than higher sulfur fuels. We could spend an hour and many pages of text discussing just the chemistry aspect of fuels before even getting to the impacts, housekeeping and preventive maintenance solutions. I will briefly review the fuel issues that have made preventive maintenance and tank housekeeping an imperative part of a generator service company's preventive maintenance contract.

There is a whole lot of organic chemistry going on at the refinery level that significantly affects the operability and performance of the end ULSD product. To optimize the production of diesel fuel from crude oil, refiners use increased amounts of heat and pressure. This process of catalytic cracking crude oil results in a fuel that is chemically active, unstable and dynamic. In addition, the process of removing sulfur by hydro-desulfurization exposes the fuel to even more intense heat and pressure, which stresses the fuel even further. These refining processes are the primary reasons why ULSD requires extra attention and monitoring.

ULSD fuel differs negatively from earlier diesel fuels in the following properties.

1. It has a greater affinity for moisture.
2. It has lower BTU value (negligible: 1 to 2 percent).
3. The lubricity is lower.
4. It is less conductive.
5. Resistance to microbial growth is reduced.
6. The fuel is more corrosive.

ULSD fuel differs positively in the following properties.

- It is cleaner burning.
- It produces fewer emissions.

The positive changes are welcome and were an intended consequence of sulfur removal. A few of the negative changes (2, 3 and 4) were expected to some degree and changes 3 and 4 are compensated for at the terminal by adding additives.

A Challenging Journey

Before ULSD leaves the refinery it must meet the ULSD ASTM D975 test specifications. Remember this point of reference to ASTM D975, as we will refer back to this shortly. Once diesel leaves the refinery the complex distribution chain provides many opportunities for the fuel to come into contact with different sources of potential contamination. Whether distributed through pipelines, ships, barges, tanker trucks and stored at potentially more than one terminal, the fuel comes into contact with contamination sources, which are ever-present. Typical contaminants include water, dirt, rust and microbes (bacteria and fungus).

Even if the fuel makes it from the terminal via truck to ultimately the generator storage tank without coming into contact with these usual contaminant suspects, the fuel will have to battle the same issues once placed in storage. Add to this the fact that most diesel – and biodiesel – has fuel stability problems, and it is clear to see that the deck is stacked against good reliable fuel storage and performance. Corrosion in fuel metering and dispensing components as a result of ULSD's affinity for moisture has been an ongoing problem since ULSD was introduced. This is the preeminent issue being experienced in other ULSD markets that were mandated to use ULSD years before the stationary engine market mandate took effect.

Don't be discouraged by all this "bad news," as we'll soon consider some simple steps and procedures that can minimize these problems. Before we get to those solutions, however, it's time to briefly get back to the ASTM D975 referenced earlier. Once in-spec fuel leaves the refinery, all bets are off as to what it will encounter along the way to its ultimate storage destination, and many of the parameters that define D975 quickly become irrelevant. Just because a fuel "meets spec" on delivery does not ensure that it will perform reliably after being placed in storage for some time. The On-Site Power Industry is uniquely challenged in this regard because turnover can be low in a fuel storage tank for a generator set. The average shelf life of today's diesel fuel is approximately six months before the natural dynamic nature of the fuel starts generating particulate and sediment. This particulate and sediment is normally made up of the fuel itself as hydrocarbons – the building blocks of any liquid fuel – begin sticking together to form longer chain molecules. This process is inevitable given the fuel's instability, and as the process continues, what once began microscopically will then produce macroscopic sediment. Not only is ULSD subject to fuel stability concerns, but according to the National Biodiesel Board (NBB), biodiesel being stored for longer than six months should be treated with a fuel stabilizer.

Promoting Fuel Integrity

Because today's liquid fuels are chemically active, ULSD and biodiesel are dynamic liquids and require monitoring to ensure fuel reliability. Fuel begins its life "in spec" with the ASTM requirements, but time, storage conditions and transportation are unkind to ULSD and biodiesel. Change happens, and it is all bad; nothing good comes about from the natural changes fuels undergo these days. The specifications tested before a fuel leaving the refinery are an important designation that the refinery has done its job to make a fuel that conforms to ASTM D975. After that it's the responsibility of the fuel handlers, fuel purchasers and end users to take care of that fuel to ensure its ultimate reliable operability.

This is where fuel maintenance practices come into play. The days of storing and ignoring diesel fuel are gone. Today, industry leaders universally recommend preventive maintenance practices for fuel in storage. The myriad threats to fuel integrity can be managed through routine fuel condition monitoring; testing of relevant fuel parameters; and treating stored fuel with appropriate additives. Annual or semi-annual fuel testing and additive treatment has been proven to take the risk out of storing fuel by providing a high level of reliability assurance.

And therein lies opportunity for generator service companies, because annual fuel testing and maintenance creates another source of service revenue that is easily integrated into their existing service contract. Treatment with a fuel additive further provides a level of assurance that the fuel will be ready when called upon. Proper additive application improves fuel storage stability, prevents corrosion, kills and prevents microbe growth, disperses sediment, and manages moisture accumulation.

Please watch for my future articles in Powerline, which will address specific fuel quality issues, testing parameters, treatment approaches, and the marketing of value-added services. ■

About the author:

Mark Stellmach is President and Owner of Fuel Management Services, which supports the On-Site Power Industry with fuel quality expertise. Mark has 24 years experience helping fuel providers and service companies improve the quality and reliability of their distillate fuels. He uses his expertise in the properties and characteristics of middle distillate fuel chemistry while relying on the company's world class fuels laboratory. With a deep and thorough understanding of fuel properties, Mark helps companies navigate the challenges to fuel quality in storage and provides them with treatments and test procedures that minimize fuel-related problems and optimize equipment performance. His company provides solutions, education and consulting for companies to manage fuel quality, ensure fuel stability and eliminate all potential fuel and tank contamination problems.

Mark has extensive experience managing ultra-low sulfur diesel (ULSD) fuel under all conditions. He is well versed in fuel refining, fuel contamination, fuel additive chemistry, and corrosion control for storage tanks and fuel distribution systems. He has provided support across several industries, including emergency power, utilities, diesel transportation, military, and heating oil delivery.

Eliminating 3rd Harmonic Currents in Paralleled Generators

By: Michael Z. Lowenstein, Ph.D., President MZL Enterprises, Consultant to Harmonics Limited by Jefferson Electric.

Distributed generation is becoming a more common design requirement for engineers and contractors, as facility managers seek to ensure continuing operations and gain more control over energy costs. Though backup systems have been around for years, maintaining optimal operations when multiple generators are involved remains a challenge.

Paralleling multiple generators on a common bus can lead to 3rd-harmonic currents circulating in the ground system. Triggered by differences in generator pitch, these currents cause increased heating of the generator windings and often result in ground-fault tripping of generator breakers. As a result, generators may need to be operated at less than full capacity to avoid breaker tripping.

Various approaches have been used to address this problem – but most of these raise issues of their own. However, applying a passive 3rd harmonic suppression system in the generator ground circuit can eliminate circulating ground currents without raising other side effects.

Drivers – and Challenges

Power continuity is becoming a major concern for critical-load facilities such as computer centers, hospitals, electronic manufacturers, financial institutions, and university systems. While short-term backup can be provided by UPS systems, long outages are supported by emergency generators. In many large facilities, multiple generators are paralleled to handle the emergency load.

In addition, some facilities are looking beyond backup scenarios, and incorporating distributed generation plans to both protect their own operations and generate excess power to sell back to their utility. To allow this, designers must successfully parallel multiple generator sets to a common bus and export the power to the utility. As windmill farms proliferate – to name one potential source of excess electricity generation – the need to parallel many smaller generators with the utility becomes more prevalent.

In any of these scenarios, the equipment involved can have differing generator characteristics, resulting in circulating 3rd-harmonic currents in the neutral. These circulating harmonic currents can create nuisance ground fault tripping decreasing system reliability and can damage generators. Extra current means extra fuel and reducing the circulating currents can result in significant cost savings.

Circulating 3rd harmonic currents in the neutral will exist when multiple generator sets share the same terminal or bus voltage, but produce slightly different internal voltage due to variances in their winding pitch. In the most elementary form of a paralleling arrangement, this current flows out of the line leads of one generator, through the paralleling bus and into the second generator. It does not flow into the loads. This current, called "circulating current", is in addition to the normal line current supplied to the connected loads, as illustrated in Figure 1.

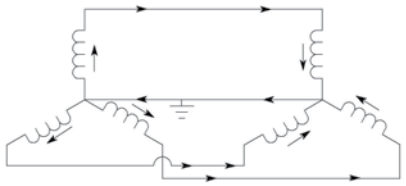

Figure 1: 3rd harmonic currents circulate between the two generators

Circulating 3rd-harmonic currents are more common than one might anticipate. For example, cost concerns could lead some end users to turn to used generators for standby applications that are needed infrequently. Used equipment, while operationally reliable, might incorporate different pitch windings, raising the potential for 3rd-harmonic problems.

Mismatching also may occur as a facility grows and develops, and generator-plant needs expand. The added equipment may be sourced from a different manufacturer and may have a different winding pitch.

Failure of existing equipment can force facility managers to purchase or rent generators on short notice, with little room for choice. Available options may have a different winding pitch from those systems that are still operating. And natural disasters may require immediate generator acquisition with limited choice available. Any of these all-too-common scenarios can put the end user and parallel power-generation system at risk of generating circulating 3rd-harmonic currents - an unreliable and potentially damaging situation.

This problem is thoroughly outlined in a data sheet from Caterpillar.[1]

Traditional Approaches

Circulating 3rd harmonic currents are not a new problem. Engineers and contractors have developed several strategies to help minimize potential damage when paralleling generators from different makers.

One approach is to match generator pitches. If multiple, paralleled generators are all of the same pitch, then they should all produce similar 3rd harmonic voltages, minimizing circulating currents. However, there is evidence that, even with the same pitch, generators from different manufacturers may have different enough 3rd-harmonic voltages to cause significant circulating harmonic currents.

Another method involves installing resistors, reactors, or switches to limit circulating currents.[2] Resistors and reactors reduce fundamental and harmonic current flow. However, if this equipment is large enough to be effective, it also may affect protective-relay operation. In addition, resistors and reactors produce heat, which is wasted energy.

A Newer Solution

A more recent solution is the harmonic suppression system (HSS), which impedes only the flow of 3rd harmonic current. The HSS circuit consists of an LCR (reactor, capacitor, resistor) parallel-resonant tank circuit, which is tuned to the 3rd har-

monic (180Hz for 60Hz distribution systems.). (Fig. 2a.) This type of circuit has a nearly infinite impedance at the tuning frequency and relatively low impedance at all other frequencies. (Fig.2b.) The HSS is totally passive in operation, with an impedance at the fundamental frequency usually below 0.05 ohms. As a result, little fundamental energy is dissipated as heat, yet high impedance at the 3rd harmonic limits flow of 3rd-harmonic currents to a very low value.

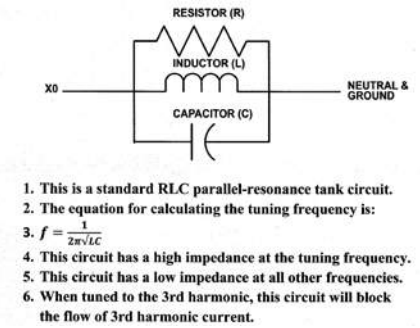

Figure 2a: HSS circuit

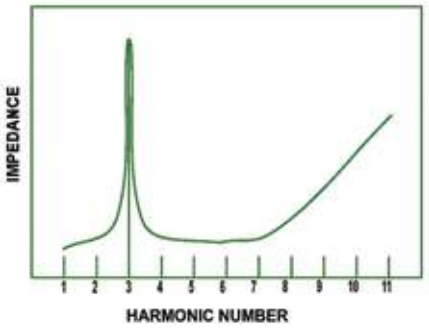

Figure 2b: HSS impedance curve

Figure 3a shows the usual wiring for a 4-wire generator feeding a delta-connected panel. The generator's common connection is landed at the ground bus within the switchboard, and this bus is connected to building steel or an earth ground. The common is also connected to the generator housing, providing safety and code compliance and ensuring that a common ground potential exists for the installation.

Figure 3b illustrates how an HSS could be installed connected between the common connection of a 4-wire generator and the grounding system. Instead of being directly connected to the switchboard ground bus, this generator common is connected through the harmonic suppression system. Since the harmonic suppression system prevents flow of 3rd harmonic currents, these currents are blocked from both the common and phase wires. The generator frame is connected to the ground bus with a separate safety-grounding wire, ensuring that the desired common ground potential exists.

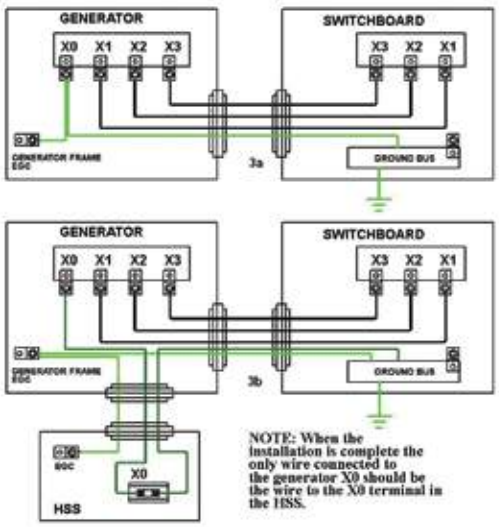

Figure 3a, b: Delta connected generator without and with HSS

Figure 4. shows the effect on 3rd harmonic current flow of inserting the HSS in the ground circuit of one of the paralleled generators.

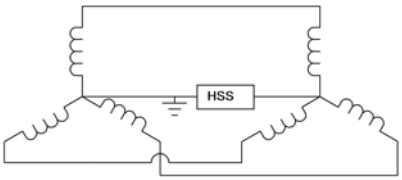

Figure 4: 3rd harmonic currents no longer circulate

Opportunities

Many opportunities exist for beneficial installation of the HSS.

1. **New Construction:** In multiple generator installations, even when all generators are manufactured by a single supplier, 3rd harmonic circulating currents have been observed. If generators are purchased from several suppliers, the likelihood that these currents will arise is increased. If problems are encountered, installation of an HSS on the offending generator or generators will solve it easily in the most cost-effective manner.
2. **Increasing Capacity:** As a facility grows in size the need to increase backup capacity will grow. It is possible that new generators available will not match the pitch of those already installed, particularly if the facility is older. If a problem is encountered, the HSS will solve the problem.
3. **Disaster Recovery:** A business renting emergency and backup generators must be certain that the rented units will be compatible with other equipment on the site. Installing an HSS on each rental unit as a matter of course will ensure that no pitch-matching problems will occur and that the generator can operate at full load immediately upon being connected.
4. **Refurbished Equipment:** A business refurbishing old or failed generators is not likely to be able to match the pitch of generators already owned by a facility. An HSS on each refurbished generator eliminates this requirement.

Conclusion

It is should be evident that the HSS is a simple and effective product for eliminating circulating 3rd-harmonic currents in paralleled generators. It is more cost-effective than traditional grounding resistors or reactors and dissipates no energy.

Reference[1], *Engine Data Sheet*, EDS70.4, Caterpillar, March, 1993.

Reference[2] Google grounding resistors.

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Appendix A: Case Studies

Stanford University

Stanford University located in Palo Alto, California, operates a backup power system to ensure that vital campus functions can keep operating, even if utility power is lost. A new 1.2 MW generator was installed recently to increase this backup power capacity. During load testing, managers discovered that operating the new generator at levels above 600 amps resulted in trip-

ping of the ground fault breaker. With the generator at 35% loading, the ground current was measured at 235 amps rms, with 232 amps of this current determined to be 3rd harmonic.

An HSS was sized for this generator based on ground-wire size requirements – in this case, a 400 amp rated unit was specified. After installation, following the wiring diagram shown in Figure 3b, 3rd-harmonic ground current was measured at less than 5 amps. With the ground current under control, the generator was easily brought to 100 percent load, with no breaker tripping problems. Figure 4. shows the generator ground current before and after the HSS was installed.

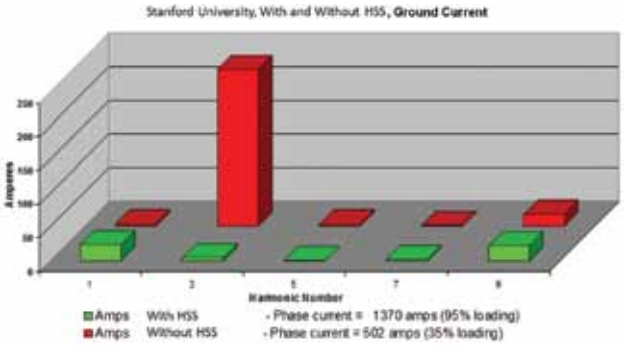

Figure 4: Stanford University HSS installation

Dane County Landfill

At the Dane County Sanitary Landfill Site No. 2, located just outside Madison, WI, methane gas is captured through a series of wells and piped to a central onsite generation facility. After drying and cleaning, the gas is used to generate electricity. The energy produced is sold under contract to the local utility, and revenues offset landfill operating costs.

The facility initially began operation with two paralleled Caterpillar G3516,820kW methane gas fueled generators, but because the landfill continued to expand and produce more methane gas, Dane County facility operators decided to add a third generator. This generator was of different pitch than the other two, but no problem was anticipated. When the third generator was powered up, high ground currents were encountered, and the ground-fault relay tripped when the load reached 80 percent of the generator's capacity. Measurements indicated a ground current of 450 amps, all of which appeared to be 3rd harmonic. To permit operation the relay was disabled, but neither the engineer nor the operators were comfortable with this mode of operation, and a permanent solution to the ground current problem was sought.

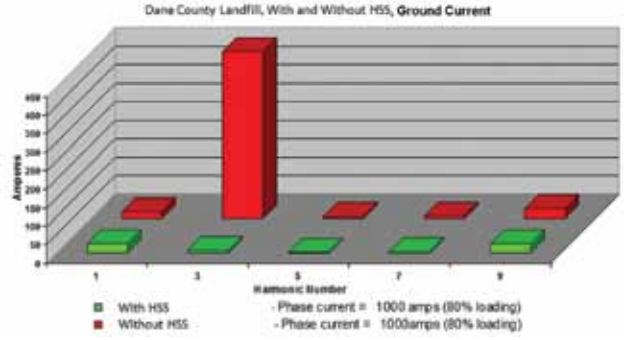

Figure 5: Dane County landfill HSS installation

To address the situation, operators installed a 400 amp HSS, and the generator was again tested at 80 percent load. Results before and after the HSS installation are shown in Figure 5. The ground current was reduced from 450 amps to under 10 amps. The ground-fault relay was re-connected and full operation with three generators on line was continued.

As the photo to the right illustrates, the HSS was attached to the top of the switchgear and wired directly to the ground bus inside. Installation took only a few hours and results were immediate.

Magee Hospital, Pittsburgh

At Magee the existing installation consisted of (2) CAT 3512 gensets rated at 1250kW each both with a 4/5 pitch. Being added was a CAT C32 1000kW with 2/3 pitch. When the 3 units were tested with a 1000kW on the on- site load bank over 900 amps of current was being carried by the C32's neutral.

The use of a grounding reactor was considered but the cost to rewire the existing installation along with the reactor's limitation of not really solving the 3rd harmonic problem made it an unviable choice. Another option was the use of a custom built sensing and switching system to change the load connection from wye to delta when the 2/3 pitch generator came on line. Not only was this approach expensive but, due to the requirement for a regular maintenance program, it created a possible failure mode. The solution selected by the design engineer was a harmonic suppression system which was installed on the roof of the hospital in the generator room. The HSS was the perfect solution to the hospital's 3rd harmonic current problem. It was the least expensive, and being completely passive, maintenance was not an issue. The HSS completely eliminated the 3rd harmonic current and was installed in less than 10 hours. The installation time included lifting the unit by crane to the roof of the hospital.

Table 1. shows the results of testing on the three-generator system after installation of the GenMax. The GenMax has reduced 3rd harmonic neutral currents of 900 Amps to a tiny current, less than 3 Amps. These results are typical of a HSS installation on generator systems where the generators have different pitches. ■

G3 = New Generator						
Applied Load	KW per gen	Load Distribution	% Load	Neutral Amps	%3rd Harmonic	3rd harmonic
500kw	234	G3 & G1	23	33	6%	2 Amps
500kw	232	G3 & G2	23	35	6%	2 Amps
500kw	243	33kw 1ph A G3, G2	24	35	6.40%	2 Amps
500kw	234	33kw 1ph B G3, G2	23	35	6.2	2 Amps
500kw	239	33kw 1ph C G3, G2	24	36	6%	2 Amps
1000kw	234	33kw 1ph A G1, G2, G3	47	35	9.90%	3 Amps
1000kw	230	33kw 1ph B G1, G2, G3	46	36	9.90%	3 Amps
1000kw	232	33kw 1ph C G1, G2, G3	46	37	9.70%	3 Amps
1000kw	450	G3 & G1	45	34	9.70%	3 Amps
1000kw	450	G3 & G2	45	35	9.70%	3 Amps
1000kw	291	G1, G2, G3	29	47	7.10%	3 Amps
		Circulating 3rd harmonic current before installation of HSS				900 Amps

Table 1: Testing data, Magee Hospital

Figure 7a: Magee rooftop installation
Figure 7b: Magee new generator
Figure 7c: Magee HHS
Figure 7d: Magee HHS wiring.
(Note the extra conduit, not needed because of wire-size reduction)

About the author:

Michael Z. Lowenstein, Ph.D. is the founder of Harmonics Limited, a company devoted to solving 3rd harmonic problems. He holds a number of patents for harmonic metering equipment and harmonic suppression systems. He retired in July 2008 to form a consulting company, MZL Enterprises.

Dr. Lowenstein received an A.B. in chemistry from Oberlin College, and an MS and Ph.D. in physical and analytical chemistry and physics from Arizona State University. He spent 13 years as a College Chemistry Professor and 8 years as a National Program Manager for the Solar Energy Research Institute. His experience with harmonics includes 20 years designing filters for 3-phase industrial drives. He has served as a lecturer at the University of Wisconsin, Milwaukee, teaching courses in Power Quality and Non-linear loads. He has presented invited lectures and seminars at national meetings for numerous organizations with concerns about power quality and harmonics. He now consults for Harmonics Limited by Jefferson Electric.

Dr. Lowenstein is a member of The IEEE Industrial Applications Society, The Power Engineering Society, and the Standards Society. He serves on a number of power quality committees.

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EGSA MEMBER CLASSIFICATION & DUES SCHEDULE (Choose appropriate membership below and enter amount in box #3 on reverse)

FULL MEMBERSHIP		Annual Dues	Initialtion Fee	TOTAL DUE
❑	MF **Manufacturer Membership** Any individual, sole proprietor, partnership or corporation seeking membership must apply for a Full Membership as a manufacturer if they meet one or more of the following criteria: 1. They manufacture prime movers for power generation. 2. They manufacture generators or other power conversion devices producing electricity. 3. They manufacture switchgear or electrical control devices. 4. They manufacture or assemble generator sets, UPS systems, solar power, hydropower, geothermal, or any other power production or conversion system including related components or accessories for national or regional distribution. 5. They are a wholly owned subsidiary of a firm that qualifies under rules one through four.	$870	$200	**$1,070**
❑	DD **Distributor/Dealer Membership** Any individual, sole proprietor, partnership or corporation actively engaged as a distributor or dealer for products listed under Manufacturer Membership may apply for Full Membership as a Distributor/Dealer. If an organization qualifies under Manufacturer Membership, it is not qualified under this section.	$310	$100	**$410**
❑	CI **Contractor/Integrator Membership** Any individual, sole proprietor, partnership or corporation actively engaged as a Contractor or Equipment Integrator of products listed under Manufacturer Membership, not bound by brand, geographic territory or contractually obligated as a Distributor/Dealer of a specific product. These firms typically purchase products from a Distributor/Dealer, Manufacturer or Retailer, adding value through installation, product knowledge, relationships, unique services, etc., and then re-sell the resulting product to an end-user.			
❑	MR **Manufacturer's Representative Membership** Any individual, sole proprietor, partnership or corporation actively engaged in the representation of products listed under Manufacturer Membership may apply for Full Membership as a Manufacturer's Representative. If an organization qualifies under Manufacturer Membership, it is not qualified under this section.			
❑	EM **Energy Management Company Membership** Any individual, sole proprietor, partnership or corporation engaged in energy management, including Energy Service Companies (ESCOs), Independent Power Producers (IPPs), Integrators, Aggregators, and other similar enterprises may apply for Full Membership as an Energy Management Company.	$210	$100	**$310**

ASSOCIATE MEMBERSHIP		Annual Dues	Initialtion Fee	TOTAL DUE
❑	**Associate Regular Membership** *(Select Appropriate Category Below)*	$210	$100	**$310**
❑	**Associate Full Membership** Any individual, sole proprietor, academic institution, student, partnership or corporation meeting the requirements of Associate Regular Membership may apply for Full Membership at their option to **enjoy the privileges of Full Membership, including the rights to vote and to serve on EGSA's Board of Directors.** Initiation fees and annual dues will be assessed at the existing non-manufacturer Full Member rates. *(Select Appropriate Category Below)*	$310	$100	**$410**

PLEASE SELECT ASSOCIATE MEMBERSHIP CATEGORY

Associate Membership Categories - Select One					
❑	AA	**Trade Publication Membership** Any trade publication dealing with the electrical generating systems industry or its suppliers may apply for Associate Membership–Trade Publications.			
❑	AB	**Trade Association Membership** Any trade association made up of individual or company members sharing a common interest in the electrical generating systems industry may apply for Associate Membership.			
❑	AC	**Engineer Membership** Any consulting or specifying engineer may apply for Associate Membership–Engineer. Membership may either be held in the employer's name or individual's name under this classification. Individuals whose employer qualify as a Full Member, as described in the Full Membership section, do not qualify for this category.			
❑	AD	**End-User Membership** Any individual employee of a company who owns or operates electrical generating equipment and/or related switchgear or components, whose responsibility to his employer includes planning, design, installation, supervision, or service of such equipment may apply for Associate Membership–User. Membership may either be held in the employer's name or individual's name under this classification. Individuals whose employer qualify as a Full Member, as described in the Full Membership section, do not qualify for this category.			
❑	AE	**Service Membership** Any individual, organization or academic institution that offers services such as research, testing or repair to the electrical generating systems industry may apply for Associate Membership–Services. Membership may either be held in the individual's name or the organization's name under this classification. Individual companies whose employer or parent organization qualifies as a Full Member, as described in the Full Membership section, do not qualify for this category.			
❑	AG	**Educational Institution Membership** Any postsecondary vocational-technical school or college offering on-site power generation-related instruction may apply for Associate Membership–Education Institution.			
❑	AM	**Military Membership** Any individual who is currently enlisted, or who has been discharged, or has retired from the US or Canadian Military may apply for membership within this category. Proof of military engagement is required by either current Military ID card or honorable discharge documents.	$50	N/A	**$50**
❑	AR	**Retiree Membership** Any individual who retires from a member company may apply for Associate Membership–Retired. This classification does not apply to any individual who is employed more than 20 hours per week.	*Complimentary*		**$0**
❑	AF	**Student Membership** Any individual currently enrolled at an academic institution may apply for Associate Membership–Student.	*Complimentary*		**$0**

1. Contact Information

Company _____

Address _____

City _____ State/Province _____

Zip/Postal Code _____ Country _____

Phone _____ FAX _____

Official Representative _____ Title _____

Representative's E-Mail _____ Company's Web Address _____

How did you hear about EGSA? ❑ Web site ❑ *Powerline* magazine ❑ Colleague ❑ POWER-GEN ❑ Other _____

Why are you joining EGSA? ❑ Certification Program ❑ CEU Program ❑ Power Schools ❑ Buying Guide Listing ❑ Other _____

2. Member Classification

Please use the worksheet on page one of this application to determine your membership type.

Full Memberships

- ❑ Manufacturer (MF)
- ❑ Distributor/Dealer (DD)
- ❑ Contractor/Integrator (CI)
- ❑ Manufacturer's Representative (MR)
- ❑ Energy Management Company (EM)

Associate Memberships

- ❑ Regular Associate Membership →
- ❑ Full Associate Membership →

(Select Appropriate Catagory)

- ❑ Trade Publication (AA)
- ❑ Trade Association (AB)
- ❑ Engineer (AC)
- ❑ End User (AD)
- ❑ Service (AE)
- ❑ Educational Institution (AG)
- ❑ Military (AM)
- ❑ Retiree (AR)
- ❑ Student (AF)

3. Membership Dues

(Please fill in the appropriate TOTAL amount from the dues schedule on page one.)

Membership Dues	$_____
Membership Plaque (optional)**	$ 55.00**
On-Site Power Reference Book (optional)**	$ 140.00 **
Florida Residents: Add 6% Sales Tax to ** items	$_____
*** Shipping and handling is included for Continental US Residents.*	
Non-Continental US Residents should call EGSA	$_____
*Headquarters for shipping charges for **items.* **TOTAL**	$_____

4. Payment Method

(Payable in US$ drawn on U.S. bank, U.S. Money Order, or American Express)

❑ Check #_____ Amount Due $ _____

❑ Mastercard ❑ Visa ❑ American Express

Card # _____ Exp. Date _____

Signature: _____

Print Name: _____

5. Products/Services

Please describe the nature of your business (50 words or less, NOT ALL CAPS). If you are a Manufacturer's Representative or Distributor/Dealer, please indicate which manufacturers you represent and/or distribute for; if you are a student, please provide the name and location of your school, your major and your anticipated graduation date:

_____

_____

_____

_____

Do you buy AND sell equipment? ❑ Yes ❑ No Do you manufacture packaged equipment? ❑ Yes ❑ No

Available Codes:

01 ---Batteries/Battery Chargers
02 ---Control/Annunciator Systems
29 ---Education
30 ---Emission Control Equipment
04 ---Enclosures, Generator Set
05 ---Engines, Diesel or Gas
06 ---Engines, Gas Turbine
07 ---Engine Starters/Starting Aids
08 ---Filters, Lube Oil, Fuel or Air
28 ---Fuel Cells
03 Fuel Tanks and Fuel Storage Systems
09 ---Generator Laminations
10 ---Generator Sets
11 ---Generators/Alternators
12 ---Governors
13 ---Heat Recovery Systems
14 Instruments and controls, including meters, gauges, relays, contactors, or switches
15 ---Load Banks
16 ---Motor Generator Sets
17 ---Radiator/Heat Exchangers
18 ---Relays, Protective or Synchronizing
19 Silencers/Exhaust Systems/Noise Abatement
20 ---Solenoids
21 ---Switchgear and Transfer Switches (Automatic or Manual), Bypass Isolation Switches, and/or Switchgear Panels
22 ---Trailers, Generator Set
23 ---Transformers
24 ---Uninterruptible Power Supplies
25 ---Vibration Isolators
26 ---Voltage Regulators
27 ---Wiring Devices or Receptacles

Enter codes here: (Limit 10 codes per category)

Products sold:	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
Products rented:	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
Products serviced:	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

6. Sponsor(s)

: A"Sponsor" is an EGSA Member who interested you in filling out this application. It is not mandatory that you have a sponsor for the Board to act favorably on this application; however, if a Member recommended that you consider membership, we request that individual's name and company name for our records.

Sponsor Name _____ Company Name _____

7. Official Representative's Authorization

Signature _____ Date _____

NEW EGSA MEMBERS

MF=Manufacturer DD=Distributor/Dealer CI=Contractor/Integrator MR=Manufacturers Rep
EM=Energy Management Co. AA=Trade Publication AB=Trade Association AC=Engineer
AD=End-User AE=Service AG=Educational Institution AM=Military AR=Retiree AF=Student

Accurate Power and Technology, Inc. . . . . DD
Mt. Dora, FL
Sonny Dukes, President
Accurate Power and Technology provides sales, service and warranty for GE, Kohler, Generac and Cummins.

Ayantra Inc. . . . . . AE
Fremont, CA
Ashok Teckchandani, CEO
Ayantra designs, builds, and supports a suite of wireless solutions for managing remote generators. The Ayantra solutions support all makes & models of generators. Product line includes FleetGen - for Transportable generators, FleetSentry - for Onsite Standby generators, myGENcare - for Residential generators. Ayantra products are and come with limited lifetime warranty

Bissette, Codi . . . . . .AF
Ontario, Canada

Bouwmeester, Arlen . . . . . .AF
Ontario, Canada

Cenflex . . . . . MF
Weston, WI
Carmen Sauer, Vice President
Manufacturer of flexible metal hose products and tubing for generators. Also a line of expansion joints, bent tube and bent tube assemblies, jacket water connectors, Tier 4 exhaust systems.

Coppelmans, Peter . . . . . .AF
Ontario, Canada

deWit, Brandon . . . . . .AF
Ontario, Canada

Dudley, Richard . . . . . .AF
Ontario, Canada

Foley Power Solutions . . . . . DD
Kansas City, MO
James Kerschinske, Sales Manager
Exclusive CAT dealer for Kansas and portions of Missouri. CAT diesel and natural gas gensets, automatic transfer switches, switchgear, rotary UPS and auxiliary equipment. 24 hour service with PM programs, rental fleet (up to 2000 kW), temperature control and distribution.

Gibbs, Aaron . . . . . .AM
College Station, TX

Gust, Colin . . . . . .AF
Ontario, Canada

Hayne, Alex . . . . . .AF
Ontario, Canada

Hoeft, Bennett . . . . . .AF
Franklin, WI

Hood, Joshua . . . . . .AF
Ontario, Canada

Hutten, Benjamin . . . . . .AF
Ontario, Canada

Johnson, Andre . . . . . .AM
Randallstown, MD

Kropa, Alexander . . . . . .AF
Ontario, Canada

Leniuk, William . . . . . .AF
Ontario, Canada

Little Sparkie Electric LLC . . . . . DD
Mt. Airy, MD
Catherine Nazarene, Managing Member
Commercial/industrial/residential electrical contractor. Full service Generac servicing dealer, factory-certified technicians on staff. Emergency service available, maintenance contracts available.

Loghrin, Dan . . . . . .AF
Ontario, Canada

Miller, Carl . . . . . .AM
Knoxville, TN

Power, Neil . . . . . .AF
Ontario, Canada

Reed, David . . . . . .AF
Ontario, Canada

Reniewicz, Michael . . . . . .AM
Luke AFB, AZ

Rx Monitoring Services, Inc. . . . . . AE
Bedford, NH
Katelyn Thomas, Business Developer
Rx Monitoring Services is a recognized leader in monitoring power quality (both AC and DC), temperature and humidity. Our service provides remote power quality analysis surveys followed up with comprehensive reports generated from the data collected.

Sage Oil Vac, Inc. . . . . . MF
Amarillo, TX
Aaron Sage, CEO
Sage Oil Vac manufactures an innovative oil change platform for clean efficient oil changes for mobile generators and standby generators.

Savage, Josh . . . . . .AF
Ontario, Canada

Vinnels-Bell, Richard . . . . . .AF
Ontario, Canada

Walker, Alexander . . . . . .AF
Ontario, Canada

Wheeler, Wayne . . . . . .AM
Colorado Springs, CO

Young, George . . . . . .AF
Ontario, Canada

ASCO POWER TECHNOLOGIES

Another in Our Series of EGSA Member Company Profiles

ASCO POWER TECHNOLOGIES

www.ascopower.com* & *www.ascoapu.com

ASCO Power Technologies manufactures power switching, controls and testing innovations for healthcare, data center, telecom, financial and residential applications. From its global headquarters and R&D center in Florham Park, NJ, it develops an unmatched product portfolio ranging from standard finished goods to custom-engineered solutions. Together, they satisfy any requirement for transferring, paralleling, monitoring and controlling, and testing on-site power. ASCO Technology, Support and Service mean power reliability for those who need it.

"Imagine a company that leads its industry in technology, support and service innovations for nearly a century. A company recognized by independent industry analysts for helping shape and guide the course of power switching and controls. A company with an unrivaled installed base of power transfer switches. That is ASCO" said Armand Visioli, President of ASCO Power Technologies.

ASCO engineers innovate. It goes to the company's core, running through new product design, manufacturing, technical support and service. It's both a business strategy and a way of life.

Why the emphasis on innovation? Because technology and business move at warp speed. Apple founder Steve Jobs once said, "You can't just ask customers what they want and then try to give that to them. By the time you get it built, they'll want something new."

That's the way it is in power switching, controls and testing. ASCO innovation engineered the planet's first power transfer switch in 1920. Innovation after innovation followed.

Above: Armand Visoli and Don Blackman discussing the new 7000 Series Touch Display Interface (TDI)

ASCO pioneered the first bypass-isolation power transfer switch, the first Ethernet/Web enabled connectivity for transfer switches, the first closed transition transfer switch and the first load shed optimization for power control systems. All represent industry benchmarks, widely recognized for their functionality and performance. One reason is that every component in every ASCO Power Transfer Switch has been designed exclusively for transfer switch duty.

Firsts in power testing include the first human machine interface for containerized load banks, the first UL listed permanent load bank, the first multi-voltage (AC/DC), multi-frequency (50, 60, 400 Hz) trailer-mounted load bank, and sector-leading microprocessor-based controls.

ASCO has developed every major innovation in power transfer switching, control and testing for more than a century. They help protect such mission-critical operations as data, telecommunications and financial centers, hospitals, and other facilities.

Bypass Switch Assembly in Welcome, NC

The renowned Fred Hutchinson Cancer Research Center in Seattle, for example, depends on ASCO systems to avert disruptions to critical operations and to protect irreplaceable research samples and stored data.

INFOTEC data center, the first Tier III-certified, public sector data center in Mexico that's helping stimulate an information- and knowledge-driven economy, relies on ASCO systems to help ensure power reliability.

A top 10 global investment banking firm chose the ASCO Critical Power Monitoring System to remotely operate a power chain at a trading and data center nearly 900 miles from the firm's facilities' control center in New Jersey. Eventually, power chains in other U.S. markets, Mexico and Brazil will be monitored and managed from a single site.

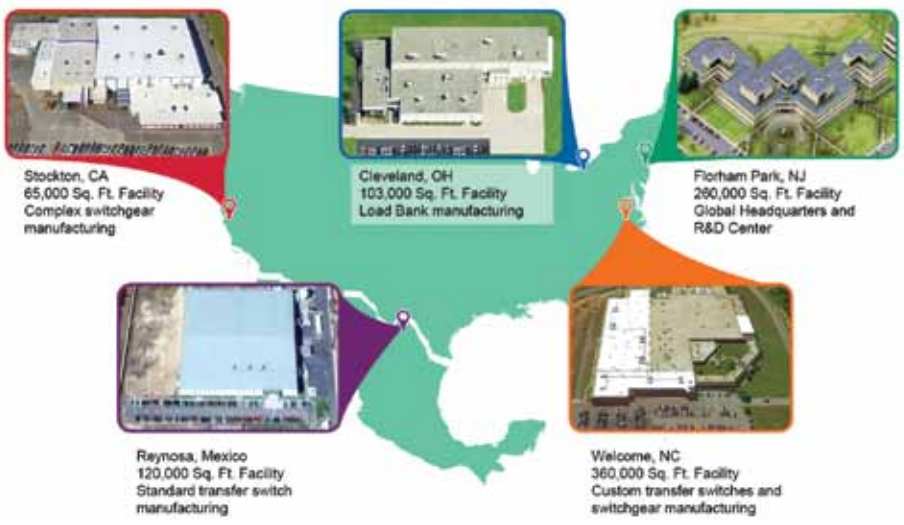
The White House mobile communications, U.S. Marine Corps, the Social Security Administration and NASDAQ (National Association of Securities Dealers Automated Quotations) chose ASCO's Avtron® and Froment® load banks and controls for power testing.

Executing innovation decade after decade requires a range of capabilities not often found in a single manufacturer. Foremost among them is a global corp of true, power-switching controls and testing engineers dedicated to solving today's evolving applications challenges and designing tomorrow's innovations. They represent unsurpassed intellectual capital on power switching, control and testing. Engineering staff represents the majority of more than 2,600 employees worldwide.

Their tools include three-dimensional, computer-aided modeling, finite element analysis and fused deposition modeling that design, overcome complex magnetic and mechanical stresses, and prototype components and entire systems. Engineers then test, verify and qualify designs to listing agency standards in a dedicated power lab.

More than 600,000 square feet of manufacturing capabilities located in North America bring innovative technologies to life. ASCO's Welcome, NC manufacturing facility, for example, produces some of the world's most complex and sophisticated power transfer switches.

Computer-aided manufacturing delivers the repetitive precision and accuracy that's absolutely necessary for meeting incredibly demanding tolerances. Highly-skilled technicians carefully hand wire, configure and test every product before it's shipped. Customers witness-test power control lineups at the factory that have been designed specifically for their facilities.



ASCO North America facilities

These capabilities make ASCO the 'go-to' source for a breadth and depth of on-site power-related products. The company has expanded that scope with strategic acquisitions. Firetrol® fire pump controllers, for example, joined the company as a natural extension of the business and as a customer of ASCO products.

Surge suppression products followed, becoming an integral part of ASCO Power Transfer Load Centers. Avtron and Froment load banks and controls provide important power testing capabilities for ASCO's broadening array of power-related products and services.

Standing with innovative ASCO Technology is ASCO Support and Service.

ASCO Support comprises global teams of project managers, applications engineers and sales engineers. They collaborate hand-in-glove with customers and their engineering consultants to build business-critical N+1 and 2N multi-megawatt and multi-campus systems.

Panaromic View of Welcome, NC factory

Teams also help customers configure standard power transfer, switching and testing systems for less-critical applications. Short lead times and quick delivery are major benefits for customers needing the security of on-site power 'now.'

Whether systems are sophisticated or simple, robust design and reliable operation are hallmarks of them all, from concept to completion and through their life cycles. Because if there's no performance, there's no power.

Regular servicing and timely repair keep systems operating at their peak throughout their lifecycles. ASCO Services, the largest power switching and controls service unit of its kind in the country, serves customers 24/7/365.

Highly trained and EGSA-Certified Technicians with fully stocked vans respond quickly to any customer need, whether it's to help commission a new project, perform annual maintenance, or solve a middle-of-the-night emergency on Saturday. Imagine that.

Today, ASCO continues imagining... envisioning...the future of power switching, controls and testing. Through its legacy of innovation, the company makes that vision a reality.

The EGSA Connection

As far back as the 70s, ASCO Power Technologies has been an active EGSA Member. As one of our most active employers, ASCO supports the EGSA community in numerous ways. As a matter of fact, ASCO has provided members of their team in almost every facet of our association, from EGSA Technician Certification (ASCO has 55 EGSA Certified Technicians on their staff at the present time) to the volunteer contributions on the 5th Edition of On-Site Power (providing both authors and purchasing books).

ASCO has also provided many leadership contributions during these 30 years and counting. From EGSA Presidents Lawrence Hogrebe (1982-83), Herb Daugherty (1992) and Gary Kidwell (2007) to several of our Board Members through the years, including Armand Visioli, ASCO President.

They have also committed resources to our EGSA Committees, whether it was speakers for Committee presentations or leadership roles within those 8 committees, ASCO has always been involved in the betterment of our organization.

There have also been numerous speakers and their presentations during our Conferences (Don Blackman and Bhavesh Patel to name a few). Thomas Black is also becoming more active in leadership roles, representing our manufacturing community by participating as a judge for our 2015 Technician of the Year Award (TOYA). "Tom could be a real contributor to EGSA, following in the path of many ASCO employees positively impacting EGSA," adds Charlie Habic, Gillette Generators, Inc.

The future of EGSA is much brighter with the ASCO contributions and our association has benefitted so much from their involvement. Thank You, ASCO Power Technologies! ■

EGSA JOB BANK

USA Northeast

Aftermarket Sales, Boston, MA

Kinsley Power Systems

Location: East Granby

Kinsley Power Systems is seeking an Aftermarket Sales Manager. The position is responsible for developing, growing and managing the Company's emergency power generator service sales business throughout a given geographic territory. He/she will serve as an ambassador to the Company's service department by selling service agreements, extended warranties and other service products to new customers while maintaining and expanding relationships with existing customers. The sales process includes, but is not limited to prospecting, cold calling, probing, qualifying, presentation & proposal generation and closing Accounts. The position is a hybrid of outside sales, technical sales, account management and customer service.

To apply: lbarnes@kinsley-group.com

Director of Industrial Sales– USA North East

Kinsley Power Systems

Location: Hartford, CT

The Director of Industrial Sales is a key contributor to the continued growth of Kinsley Power Systems. This position requires the successful candidate to create & implement a sales plan to exceed budgeted revenue goals, and manage some select key/strategic accounts directly, and actively manage a staff of outside sales engineers to maximize revenue/earnings while embracing the Company's core values and driving sales force effectiveness along with utilizing a solid analytic competency and CRM expertise.

To apply: Lbarnes@kinsley-group.com

Field Service Technicians (Diesel & Gas)– USA North East

Kinsley Power Systems

Location: CT, NY, MA, NH, VT, ME, NJ, PA, RI

Kinsley Power Systems is seeking experienced generator technicians throughout the Northeast. This position is responsible for completing preventive maintenance, repairs and service on standby power generation equipment. Due to the nature of the service business Field Service Technicians must reside within 25 miles of the available territory and have a clean driving record.

To apply: Lbarnes@kinsley-group.com

EGSA Job Bank Guidelines

EGSA will advertise (free of charge) EGSA Member company job openings in the Job Bank. Free use of the Job Bank is strictly limited to companies advertising for positions available within their own firms. Companies who are not members of EGSA and third-party employment service firms who service our industry may utilize the Job Bank for a $300 fee. Blind box ads using the EGSA Job Bank address are available upon request; company logos may be included for an additional fee. EGSA reserves the right to refuse any advertisement it deems inappropriate to the publication. To post an EGSA Job Bank ad (limited to approximately 50 words) please visit *www.EGSA.org/ Careers.aspx.*

Aftermarket Sales, Boston, MA – USA North East

Kinsley Power Systems

Location: East Granby

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Director of Industrial Sales– USA North East

Kinsley Power Systems

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To apply: lbarnes@Kinsley-group.com

USA Southwest

Generator Technician

Precision Mechanical Services

Location: Bossier City , LA & East Texas- North America

Looking for a reliable, experienced, and team minded employee in the power generation field . Tech needs experience with trouble shooting gensets, transfer switches, alarms, and time management. Load bank, annual service, fuel testing, installations experience is needed. Training in any brand is a plus.

To apply: Send email to Precision24.net or call 318-746-8147

Application Deadline: 2016-04-01

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Light Towers

- 7.5 KW Standard
- 4000 Watts of Light
- CSA Certified
- Digital Controller for Auto/Programmable Starting
- Sound Attenuated Enclosure
- Kubota Engine
- Mecc Alte Alternator

Generator Sets

- **Tier 3 Flex** & Tier 4 Final Engines Available
- Voltage Selector Switch
- Multiple Power Output Configurations
- Heavy Duty DOT Trailers
- Kubota/Perkins/John Deere Engines

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ComAp Names Peter Sandin Chief Executive Officer

ComAp today announced that its Board of Directors has appointed Peter Sandin as Chief Executive Officer effective March 1st, 2016. Peter Sandin will also be joining the Board of Directors from March 1st, 2016. Libor Mertl will remain at ComAp as a non-executive Board member.

Libor Mertl said "This is a great time for Peter Sandin to join ComAp as it is poised to grow aggressively in the next five years. Peter's wealth of experience in the technology industry will allow ComAp to achieve our growth and financial targets. Our industry is becoming more focused towards communication, mobile and user experience and Peter's expertise in automation software and mobile telecommunications will bring ComAp the edge it needs to succeed in the future."

Peter said of ComAp: "It is an exciting time to be joining ComAp, this being ComAp's 25th anniversary year. I am looking forward to helping the ComAp team advance into the future and continue to develop innovative technologies, whilst always focusing on the things that make ComAp great – family, values and our customers. I am excited about the potential that ComAp and its team has and I am pleased to be able to lead them into the next 25 years."

Peter comes to ComAp from ReadSoft in Sweden where he held the position as COO specialising in business process automation. Peter also brings 14 years of experience at Sony Ericsson and Ericsson Mobile Communications, where he held senior positions in Product Management, Quality and Customer Services.

For any additional information please contact Michael Reiner (Marketing Communication Manager) at michael.reiner@comap.cz

For more information please visit *www.comapllc.com.* ■

Volvo Penta Earns 13th Consecutive NMMA Customer Satisfaction Index Award

Only Marine Sterndrive Manufacturer to Receive CSI Award for 2015

The National Marine Manufacturers Association (NMMA) has presented the 13th consecutive annual Customer Satisfaction Index (CSI) award to Volvo Penta for its gasoline sterndrive engines.

The CSI awards, presented at the Miami International Boat Show Feb. 11, recognize boat and engine manufacturers for excellence in customer satisfaction. Volvo Penta was the only company to win a CSI award in the sterndrive category this year.

The marine industry CSI award signifies that Volvo Penta achieved and maintained a standard of 90 percent or higher in customer satisfaction, based on surveys of over 67,000 customers who purchased a new boat or engine during the period from April 1 to Dec. 31, 2015.

"At Volvo Penta, we take customer satisfaction very seriously. That's why we're the only gasoline sterndrive manufacturer to have won this award every single year since the program's inception," said Ron Huibers, President of Volvo Penta of the Americas. "Our new high-tech gasoline engines, which we introduced during the past year, formed a large percentage of the engines reviewed in the CSI survey for 2015. These new engines, based on technology advances never before available in a marine gas engine, give customers a unique combination of high performance, fuel efficiency, quality and reliability, and they're backed by our industry-leading warranty programs and after-sales support. Special credit goes to our network of servicing dealers, who are largely responsible for our continued success in giving customers a boating experience that's second to none."

For more information please visit *www.volvopenta.com* ■

The union of ASCO, Avtron and Froment.

The global leader in load banks.

We've put all the pieces together.

The proven, market-leading load bank technologies of Avtron and Froment are a perfect fit with ASCO Power Technologies. Combining world-class innovation and more than 200 years total experience, ASCO is your one-stop partner that offers complete solutions that you can rely on to solve any power testing requirement.

Sigma brings cost effective solutions to today's power testing requirements which can require high level instrumentation, data capture and verification with the ability to link multiple load banks of differing capacities or combination and controlled from one hand-held terminal or PC.

Broadest Portfolio

No company in the world can match the depth and breadth of our portfolio. From simple 10 kW portable load banks to multiple MVA, we can provide a solution for virtually any application. We revolve around your needs, with the expertise and technical knowhow to assemble custom solutions that provide leading power test solutions.

Technology

Innovation is at our core, complemented by our commitment to build load banks to the highest standards – ISO9001, UL/CUL, CSA, CE, IEC, NFPA. Technical leadership includes Sigma control which is sector leading in simplicity, ease of use, and accuracy.

Experience

Ninety years combined experience in load banks is only matched by the 125 years ASCO has been providing power solutions. Our team of experts has provided countless standard and custom load banks to the industry over the years.

ASCO®

www.emersonnetworkpower.com/loadbank • (800) 800-ASCO
ascoapu.com • customercare@asco.com

EMERSON
Network Power