

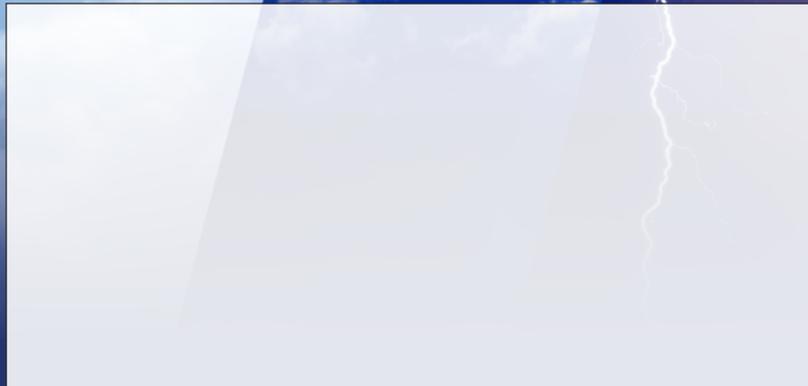
POWERLINE

The Voice of the On-Site Power Generating Industry

Q4 23

Brief Overview of Meteorological Data and Modeling for Power System Planning

How To Store and Handle Diesel Exhaust Fluid Effectively



Electrical Generating
Systems Association
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Washington, DC 20056



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EGSA George Rowley Schools of On-Site Power Generation

EGSA's Two-Tiered Power Schools



EGSA's Power Schools cover the theory and practice of all the components within a generator system. All course modules are led by volunteer industry experts in a non-brand specific, generic format. School registration includes a copy of the 5th edition of **On-Site Power Generation: A Comprehensive Guide to On-Site Power**, a 700-page reference book that covers all aspects of On-Site Power Generation.

Basic School

Perfect for staff new to the power generation industry or someone who needs an introduction to basic concepts and technologies, this school is appropriate for students seeking a foundation in generator technology. Whether you are in sales, marketing, management, application engineers, engine technicians, or administrative personnel, you will find great value in this course! The Basic School is a general, yet technical, overview of On-Site Power.

COURSE MODULES INCLUDE:

- Introduction to EGSA
- Basic Electricity
- Prime Movers
- Introduction to Generators/Alternators
- Starting Systems
- Introduction to Automatic Voltage Regulators
- Introduction to Governors/Speed & Load Controls
- Introduction to Transfer Switches
- Load Bank Fundamentals
- Generator Set Instrumentation
- Codes and Standards
- Generator Set Systems: Putting the Pieces Together
- Understanding Bid and Specification Documents

Advanced School

Our Advanced School is designed for those who have a good understanding of the basic mechanical and electrical systems found in an on-site generator site. A minimum of three years of experience in the industry is recommended. It will be particularly useful for those employed in engineering, project management, service positions, and business owners.

COURSE MODULES INCLUDE:

- Advanced Generators/Alternators
- Generator Set and Critical Power System Controls
- Generator and System Protection
- Advanced Automatic Voltage Regulators (AVRs)
- Advanced Governors/Speed and Load Controls
- Advanced Transfer Switches
- Multiple Generator Paralleling Switchgear
- Engine Emissions
- Noise Control
- Communications
- Advanced Generator Systems: Sizing to Service

Visit our website at EGSA.org for additional details on the EGSA George Rowley School of On-Site Power Generation.



2024 SCHEDULE

BASIC SCHOOL

January 22-24New Orleans, LA
March 18-20Virtual
September 29-October 3.....San Antonio, TX
December 9-11Virtual

ADVANCED SCHOOL

May 13-16 Charlotte, NC
July 15-18Virtual

POWERLINE

The Voice of the On-Site Power Generating Industry

Vol. 58 No.4 | Q4 23



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CALENDAR OF EVENTS

JANUARY 2024

EGSA at PowerGen

New Orleans, LA

- **Jan 22-24**
EGSA Basic School of On-Site Power
- **Jan 23**
EGSA Power Party

FEBRUARY

Feb 27-29

Load Bank Certification

Atlanta, GA

MARCH

Mar 18-20

EGSA Basic School of On-Site Power

(Virtual School)

APRIL

Apr 7-9

EGSA Spring Conference

Miami, FL

MAY

May 13-16

EGSA Advanced School of On-Site Power

Charlotte, NC

JUNE

Load Bank Certification

Dallas, TX

JULY

Jul 15-18

EGSA Advanced School of On-Site Power

(Virtual School)

AUGUST

No events scheduled

SEPTEMBER/OCTOBER

Sep 15-17

EGSA Fall Conference

Bellevue, WA

Sep 29 – Oct 3

EGSA Basic School of On-Site Power

San Antonio, TX

NOVEMBER

Load Bank Certification

Location TBD

DECEMBER

Dec 9-11

EGSA Basic School of On-Site Power

(Virtual School)

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Nidec/Leroy-Somer/Kato Engineering

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Conferences & Events

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Powerline is published four times per year on a quarterly 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.

Message from EGSA's CEO

As we approach the end of another year, I would thank all the EGSA members and non-members that engaged with us in 2023. I would also like to thank the EGSA staff who work tirelessly on behalf of our members and our industry. Finally, I would like to thank the EGSA Board of Directors and Committee Officers for their leadership. We have accomplished a great deal, but we still have more we want to do. As such, I would like to take this opportunity to both look back and ahead to the new year.

The Value of Membership

Towards fulfilling our goal of continuous improvement, and to our knowledge for the first time ever, we surveyed our members on the value they get from their membership. When asked the following question, "How likely are you to recommend EGSA membership to another company? 1 being the lowest and 10 being the highest," the average score our members gave us was an eight (8) resulting in a net promoter score on the border between "good" and "great." Now that we have this benchmark and all the wonderful feedback shared by our members, the Board and I are committed to increasing the score, improving the membership experience, and implementing many of the recommendations as you will see reflected in our plans for next year.

One of the greatest pain points for our members has been managing their membership information including company information, employees' information, registering for EGSA schools and conferences, managing communication preferences, accessing online education through our learning management system, and making purchases on our store. Trade associations like EGSA use Association Management Software (AMS) to manage some or all aspects of these activities.

The AMS that EGSA was using was grossly inadequate for managing the activities of a sophisticated trade association, holding back EGSA's growth in many ways, and creating a poor membership experience. The EGSA Board and Staff recognized that a significant investment needed to be made. Consequently, the staff spent hundreds of hours this year researching, selecting, building out, and deploying a new AMS we're calling MyEGSA. By now many of you had a chance to interact with the new system and the initial feedback has been positive. It is our hope and expectation that MyEGSA will enable a much better experience for our members in all their interactions with the association.

EGSA Conferences

This year, we successfully convened our Spring and Fall conferences and continued growing our networking opportunities, educational offerings, and the number of exhibitors in the trade show. On average, over our last four conferences, 94% of attendees surveyed said the conference met or exceeded expectations, 89% said the exhibitors met or exceeded expectations, and 88% said the educational sessions met or exceeded expectations. In 2024, our Spring Conference will be held from April 7 – 9 in Miami, FL and our Fall Conference will be held from September 15 – 17, in Bellevue, WA. The Spring Conference registration and exhibitor sign-up will launch in early January 2024.

EGSA Education, Schools, and Certification

EGSA launched several education initiatives in 2023. We began offering our new Apprentice and Journeyman Certification tests leading to an increase in the number of tests taken for both compared to 2022. The updated Apprentice test has also resulted in



Mir M. Mustafa, JD
Chief Executive Officer
Electrical Generating
Systems Association

a higher pass rate and more technicians certified as Apprentices in 2023 than the previous year. Technicians have also begun taking advantage of our new recertification policy for the Journeyman Certification. Now, as opposed to having to retake the test every few years, continuing education in the form of manufacturer trainings, EGSA schools, EGSA conferences, and EGSA online learning can all be used to extend a technician's Journeyman Certification for an additional two years.

The Education Committee has also created two sub-committees which are focused on improving education and training for the industry and our members. The Rowley School sub-committee is currently focused on updating the Basic School of On-Site Power and is committed to offering the latest content while shortening the overall Basic School from 3.5 days to 3 days. The new Basic School will launch at PowerGen 2024 at the end of January after which the sub-committee will begin working on the Advanced School.

The second sub-committee is focused on creating a new Hand-On Technician Training (H.O.T.T) curriculum which EGSA Members can use to help acquire and train new techni-

FROM THE TOP

Message from EGSA's CEO (continued)

icians for their businesses. The curriculum will focus on overall generator set knowledge without being manufacturer specific. The curriculum will include, instructor led, lab based, and online training.

We have also been hard at work extending the value of EGSA membership by offering even greater opportunities for online learning so that people can access our education at home or in the office. We have placed all our Basic School modules online so that they can be accessed anytime on demand. We continue to offer the online EGSA Prep certification review courses for technicians preparing for the certification exams. We also launched our new sponsored webinars which so far have been hugely successful - these webinars are meant to add value by providing a marketing tool for our members to reach new audiences while also extending our educational offerings.

We added 13 new courses to our online learning library through our strategic partnership with UL with the potential for adding hundreds of hours of additional courses. We held two online on demand Basic Schools for the United States Navy this year as well as two online Basic Schools and one online Advanced school for our members. In addition to online, we also held two in-person Basic Schools, one in-person Advanced School, and three in-person Load Bank Certification Schools this year. Suffice it to say, in-person, online, and at our conferences, EGSA is investing heavily in industry education.

Next year, I'm happy to announce that the costs for all our schools will be reduced back to 2022 pricing or less. We will host two in-person

Basic Rowley Schools in New Orleans, LA, and San Antonio, TX, two online Basic Schools, one in-person Advanced School in Charlotte, NC, one online Advanced School, three in-person Load Bank School and Certification courses, and at least two On-Demand Schools. On-Demand Schools can be requested by any EGSA member or any end-user of on-site power, are highly customizable, and can be offered in both in-person and online formats.

The Future

At the start of next year, EGSA will launch three big new initiatives. First, we will begin offering discounts to our members on commonly used products and services like insurance, travel, hotels, rental cars, etc. These discounts will not only be available to our members, but our members will also be able to extend them to all their company employees at no additional cost beyond what they already pay for their membership dues. Second, we will pilot launch two local EGSA chapters to further extend the value of EGSA membership closer to your home and business. Third, we will empanel a new Government Affairs committee to launch our new advocacy program to influence federal government and regulatory policy. If you are interested in serving on this committee, please reach out to me.

In addition to these three initiatives, we will also update EGSA's Bylaws, launch a new newsletter, launch a new resource library where our members can access and share industry information, research, reports, white papers, and case studies, and launch a new online store for educational courses, EGSA Certification, publications, and merchandise. All these new activities, and more, will be ac-

complished in addition to all the other programs and services our members have come to love.

The Board, Staff, and I are committed to growing our association and our industry. We are grateful that a lot of former member companies have rejoined the association and a lot of new companies have joined for the first time over these past two years. Although that tells us that we are making great progress, we intend to continue accelerating the pace of change. As you can see, we have many exciting plans in the works for next year, but we cannot do it without your continued involvement and support!

Thank you to all the members and non-members that engaged with us this year. I wish you all a successful end to 2023, Happy Holidays, and Happy New Year! ●

Mir M. Mustafa, JD
Chief Executive Officer
EGSA



ARE YOU CONFIDENT YOUR TECHNICIANS HAVE THE KNOWLEDGE TO GET THROUGH THE NEXT ELECTRICAL EMERGENCY ?

MAKE SURE THEY ARE

EGSA CERTIFIED!

What is EGSA Technician Certification?

Generator technicians vary in skill level from employer to employer and market to market. Finding a way to identify a proficient and knowledgeable technician, or even identifying a technician's skill level can be challenging.

The EGSA Technician Certification Program has expanded to meet these challenges.

We offer two levels of certification!

Program Updates

- We have made changes to both the Apprentice and Journeyman programs to ensure technicians are being tested on the most current advancements and technologies our industry.
- The Journeyman test has been split into four modules that will be taken separately. This allows technicians additional time to prepare for each portion of the test.
- The process for recertifying as a Journeyman technician has also been revised. Technicians may retake the test to recertify for an additional 5 years –OR– submit education/recertification credits to extend initial certification 1-2 additional years.

APPRENTICE LEVEL

(certification valid for 3 years)

The Apprentice level exam provides technical college students, recent graduates, military personnel and other 1st or 2nd-year technicians with proof that the basic skill set has been met.

JOURNEYMAN LEVEL

(Initial certification valid for 5 years. Option to extend up to 2 additional years with education/recertification credits)

Our Journeyman exam assures an employer that this technician meets or exceeds 3 years of practical field experience. It tests in 61 individual areas of expertise and has been upgraded to reflect current technologies.



Please visit EGSA.org/Certification for additional details on the program.

On-Demand Schools: Bringing EGSA Training Straight to You



Nathan Harris
*EGSA Director
of Education*
n.harris@EGSA.org

EGSA's Rowley Schools of On-Site Power have been providing important training to members and non-members across the country for over 15 years. Some companies even require the Basic school for all their new employees, from technicians to administrative hires. We love to see this, but we also recognize that as inflation has soared across our economy it is getting harder and harder to justify the costs of the school, travel, and all the internal expenses of losing multiple or even one member of your team for four days. On-Demand Schools are here to provide a solution for that very problem.

Savings

In the past few years, EGSA has traveled to member companies and completed On-Demand programs in their buildings. By doing the trainings on your "home court" companies save on flights, per diem, hotels, and other travel expenses. If you would like to send one person to an in-person school we highly encourage you to do so, but if your organization is one of the many that sends five or more people a year to these trainings this could be a much better option.

Tailored Training

Another advantage of On-Demand Schools is the ability to mix and match the courses from both our Basic and Advanced Schools. The Basic School of On-Site Power is designed to provide an overview of power generation while also introducing attendees to different components/gear they may see while working in the industry. The Advanced School on the other hand is more technical and goes in depth on components, system protection, communication, and other aspects of power generation that attendees with more experience may encounter. The beauty of the On-Demand schools is the ability to mix and match these courses to best fit the needs of your team. This year we were able to host schools for an organization that had an audience of all engineers, but they were new to the field of power generation. In this case we customized our entire school by introducing them to components and equipment they would be working on, while skipping some of the more basic principles that normally cover in the Basic School of On-Site Power. This turned out to be the perfect combination for that specific audience.

Customizable Scheduling

As I mentioned, losing a team member for up to four days can put a strain on anyone's business. The ability to adjust to your schedule is one of the largest advantages to the On-Demand Schools. In 2022, EGSA completed an Advanced On-Demand School for Hypower in Fort Lauderdale, FL. Hypower had technicians come in from all across South Florida for this training, but they would never have been able to support their day-to-day operations if we did four straight days. We were able to complete the school one Saturday a month over four months. By doing

this, they were able to completely support their day-to-day operations and did not miss a beat. We have also arranged schools to begin on a Friday and end on a Monday going straight through the weekend. This allows the school to be completed while lessening the impact of business operations.

Virtual Options

Since launching On-Demand Schools we have completed three completely virtual On-Demand Schools. One for the Air Force Facility team in California during the height of COVID restrictions. And just this year we completed two for Navy Facilities. In November EGSA provided a virtual school for Navy Facilities in Japan, Guam, and Mariana Islands. For reference, Japan is 14 hours ahead of the East Coast. From 6pm-10pm Eastern, Monday-Friday our instructors provided a customized school that focused on the unique needs and challenges of the Navy Facilities teams across the world. In early December, we hosted a second school for Navy Facilities in Hawaii and all of the West Coast again, using the same 4-hour a day for five days structure. As much as EGSA's dedicated instructors would have loved to travel to schools in Hawaii and the Mariana Islands, we understand that in this scenario virtual schools were the best option.

I am very proud of the work we have done to make the schools available to everyone across the world. It takes a lot of work from staff, instructors, and the organizations to coordinate these events and in the end we have received overwhelmingly positive feedback on the training and expertise provided at these schools.

In 2024, we have potential On-Demand Schools lined up in Maryland,

EGSA Job Bank Guidelines

Alaska, and Massachusetts. This is on top of all our regularly scheduled in-person and virtual schools. If you have interest in EGSA providing a training for your team, please contact me at n.harris@egsa.org. 2024 is filling up and we are here to best serve our members for next year and beyond. ●

Nathan Harris
Director of Education

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 [EGSA.org/ Careers.aspx](https://EGSA.org/Careers.aspx).



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The Power of Membership



Shana Duthie
*Committee Chair,
Marketing and
Membership*

EGSA is an organization of members passionate about the onsite power industry. Founded in 1967, it quickly emerged as one of the industry's leading voices. While we are proud of the long-standing relationships with our existing members, as an organization we must relentlessly strive to attract new members and ensure that we are serving and engaging our current members. A bigger and stronger EGSA will benefit the entire industry and create a virtuous cycle of amplified benefits for all. With more members, we can significantly enhance the experience and value for existing members.

Here are some of the ways that increasing our membership will benefit us all:

- Increased organizational influence within relevant industries, government, and policy matters. Particularly within industry standards and the ability for our organization to be part of the standards. It is essential, with all the changes that are going on with energy, that as an industry, we have a voice. The more members we have, the more our ability to influence.
- Increased networking opportunities lead to potential collaboration, partnerships, and friendships.
- Increased and diverse expertise gives current members access to insights and resources we may not otherwise gain.
- Enhanced resources by improving our organizational revenue that may lead to improved services, events, educational opportunities, research, and other value assets. As technology continues to change rapidly, we need the education of our members to be

able to keep pace with these rapid changes and learn best practices.

- Increased diversity and inclusivity may lead to a greater mixture of backgrounds and ideas, allowing us to make a greater impact as an organization, including organizational influence and education.
- Improved reputation by obtaining more attention and respect within the field.

If each of us could commit to referring someone to attend the Spring conference in Miami, someone who may not have attended a conference in a while or may be entirely new to EGSA, it would assist in growing members.

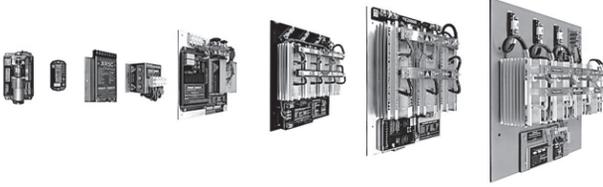
On a social media note, another way you can assist in the growth of our organization is by actively sharing LinkedIn posts with your network and increasing the visibility of EGSA across all the social media platforms.

EGSA brings together individuals who share a common pursuit of excellence. Our member organization's growth enhances individual experiences and contributes significantly to our industry's betterment. I eagerly look forward to meeting many new members at the next conference. ●

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SERVICE & MAINTENANCE



Frederic B. Sargent

President, Great Service ForumsSM

Since they first appeared in the mid-1800s, organization charts—more commonly called “org charts”—have evolved to reflect the progressively changing nature of business. Each new way of portraying companies has been meant to present the management philosophy governing them. Each new version has been intended to signal to everyone both inside and outside a company how to envision its organization.

The earliest example of an organization chart, created in 1855, portrayed the workforce, stations, and trackage of the New York and Erie Railroad. It is preserved today in the Library of Congress. Elegantly designed to look like a tree with many branches, from across the room it could be mistaken for a framed floral print on the wall in a gift shop.

In the early 20th century, the precursor for the company that became IBM pioneered an undecorated org chart more like one of today’s typical versions. It showed the company’s corporate structure based on departmental functions, which they labelled “manufacturing,” “systems,” “sales,” and so forth.

Later in the 20th century, as brand names of products like breakfast cereals became better known than their manufacturers, org charts were de-

The Picnic Shelter Organization Model: A New Way to Envision Your Company

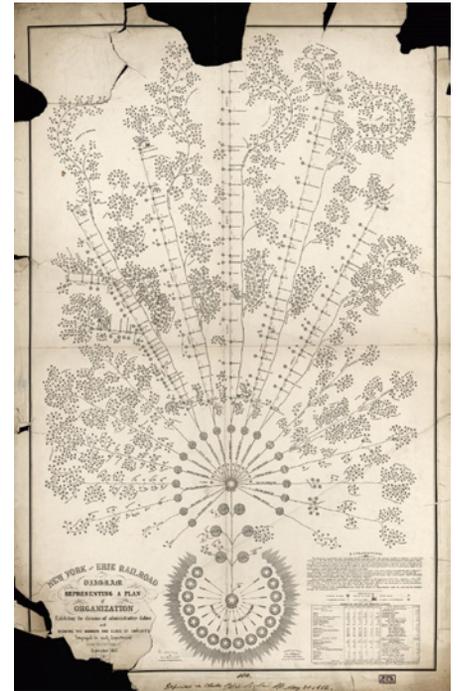
signed accordingly, showing the management and staff responsible for every aspect of producing, marketing, and distributing its main product lines.

Eventually, other types of org charts emerged to reflect a management theory du jour, such as the idea of “matrix management,” where a staff member might, in effect, have two specified managers. Later came the “holacracy” concept in which a staff member did not have even one specified manager, but instead a number of staff members that served as subject matter experts who they could consult, if necessary.

Inevitably, as things went along even further, org charts for some companies got completely away from boxes, lines, and right angles in exchange for bubbles—and sometimes that meant bubbles within other bubbles to convey the openness of their management philosophy.

In today’s environment in which “remote work” has become both the definition of a category of employment and a growing source of controversy, at Great Service ForumsSM it has sparked our idea for yet another design concept to serve the undying need for a visual representation of an organization. We call this new one, “The Picnic Shelter Organization Model.”

Despite all the current fuss about “remote work,” as though it had just recently sprung onto the scene, remote work has always been a regular part of overall employment. Today it is a much-debated issue, principally with respect to office workers, the largest single category in the workforce. Yet only one sixth of all employees have



Now preserved at the Library of Congress, this fanciful “plan of organization” for the New York and Erie Railroad, made in 1855, is the oldest known company org chart in the US.

traditionally sat in an office all day.

The Picnic Shelter Organization Model handily encompasses this kind and every other position in a company.

Although we can see and touch assets of a corporation, particularly those that convey its identity via its logo on buildings, vehicles, and other assets, in reality a corporation is an invisible and intangible entity. Its sales, marketing, and other promotional efforts may convey its corporate persona. But we need a way to visualize its operations in a manner not dissimilar to how the image of an automobile assembly line communicated the essence of the Ford Motor Company in its early days.

Here’s how The Picnic Shelter Orga-

nization Model can serve that purpose for most (but, admittedly, not all) companies.

First, the office staff members, as would be anticipated, are situated under the roof of the picnic shelter. Philosophically, there are no inside walls to separate them. Equally important, there are no outside walls to block the view of the rest of the company's operations, near or far.

Without walls around the picnic shelter, people either inside or outside will not quite so easily separate "the office" and "the field" in their mental image of the company. Whatever is going on in either geographical realm will be seamlessly connected.

Common expressions about "our end of the company" or "our side of the business" will not be engendered by the physical layout under the roof of the shelter or by an outer wall enclosing it.



And there will be no opportunity for organizational siloes to divide the staff into separate groups completely or partly unaware of each other's business activities.

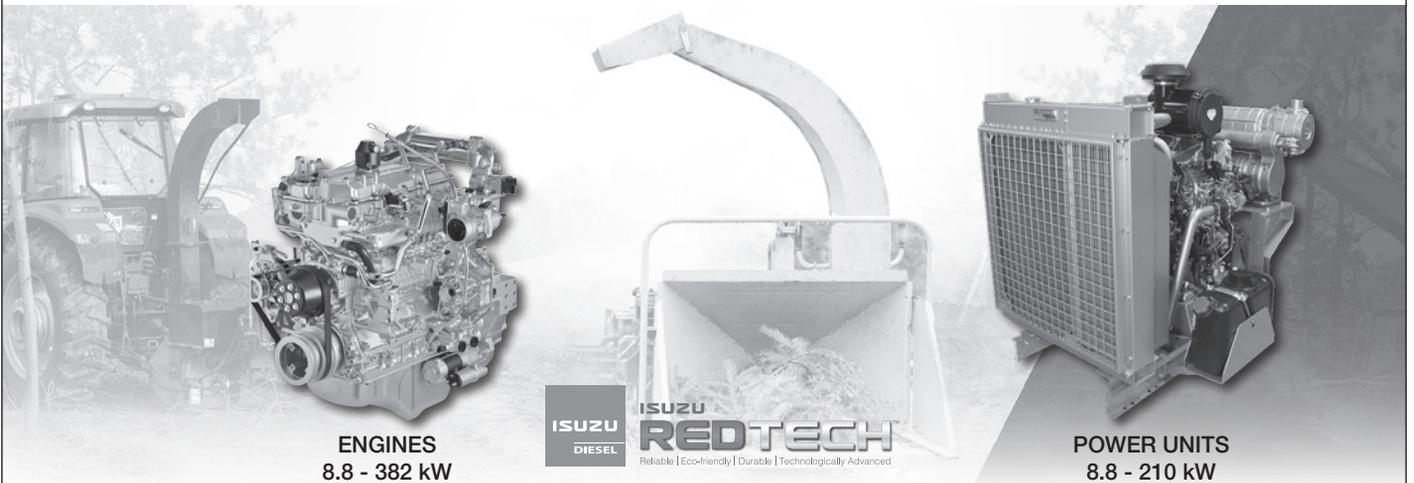
It is convenient with The Picnic Shelter Organization Model, of course, to portray the imaginary scene in a park area that is essentially flat. Then it is easier to visualize all of the various activities that are underway outside of the covered shelter.

The Picnic Shelter Organization Model is not a template for describing any company. Rather, it is a figment to convey the importance of seamlessness between all of the elements of a company, all situated on the wide expanse of a single platform. If it implants a mental image in the thinking of everyone in a company, no matter where they go to work each day, a company will be much better because of it. ●

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EGSA Certified Technicians

Advancing Professionalism in On-Site Power

As part of its commitment to advancing professionalism within the On-Site Power industry, EGSA has created the Electrical Generator Systems Technician Certification Program. Certification of personnel has become the hallmark of many industries in the United States today for one simple reason: It helps advance the profession by identifying consistent standards through which proficiency can be determined.

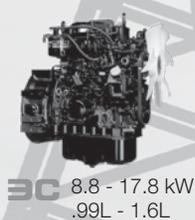
EGSA Technician Certification demonstrates a commitment to that ideal. Through rigorous testing, the program will identify those technicians who not only have a broad knowledge of electricity, mechanical and electrical components and the interaction between them, but are proficient in the installation, service, maintenance, and repair of On-Site Power generation systems.

Please visit egsa.org/Certification to learn more about EGSA Technician Certification. ●



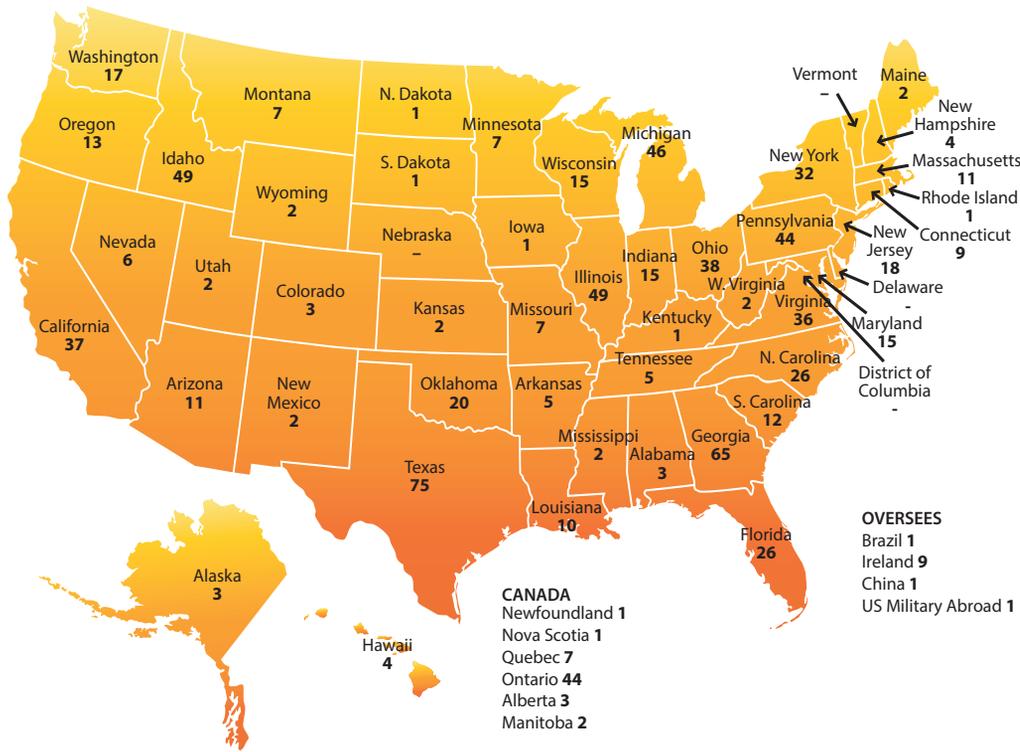
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EGSA Certification Levels

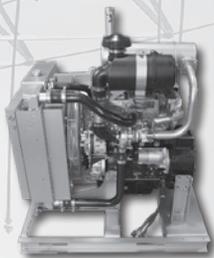
Apprentice

The Apprentice level exam provides technical college students, recent graduates, military personnel and other 1st or 2nd-year technicians with proof that the basic skill set has been met (certification valid for 3 years).

Journeyman

A passing grade on our Journeyman exam assures an employer that this technician meets or exceeds 3 years of practical field experience. This exam tests in 61 individual areas of expertise (certification valid for 5 years).

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Advanced



Brief Overview of Meteorological Data and Modeling for Power System Planning

When available, direct observations are the most accurate way to characterize atmospheric variables. However, the necessary observing network does not exist and would be impractical to build; therefore, models are used to fill in the temporal and spatial gaps. Models that synthesize weather data for use in power system analysis should ideally capture the physical and dynamical relationships between weather variables and produce weather states that are physically plausible, evolve realistically in time and space, and produce distributions of conditions like those that are observed in reality.

Currently, the models range from simple models, often developed by power systems engineers with little meteorological training, to highly sophisticated physics-based weather models. Some of the latest artificial intelligence methods are also starting to be deployed in conjunction with physics-based models, to reduce the enormous computational requirements of running the physical models at high spatial resolution.¹

Simple Models

Simple models are easy to understand, but because of the complex nature of the atmosphere, they are often inaccurate. Simple statistical models develop relationships between two or more variables at a site or, in some cases, across several locations. A category of methods often used in integrated resource plans and similar planning studies is to use

actual historical generation data or loads for a region, and develop empirical relationships between these data and a longer time series of weather observations from one or more nearby sites. These methods are easy to understand, are simple to implement, and use standard meteorological observations, which are relatively easy to acquire for long time periods. It is possible to create useful relationships between variables like temperature observed within a load center and the concurrent load. Similar relationships are used to link wind speed at an off-site location to wind speed at a generating site in order to predict a longer time series of monthly and annual output expectations during renewable development resource assessment—a process usually called measure, correlate, and predict (MCP). The simplicity of these methods and their successful use in load estimation and long-term generation output makes their use appealing.

However, it is much more difficult to use this type of statistical relationship to estimate hourly or more granular wind and solar generation, because the relationships between quantities cannot be described with linear or even multivariate relationships. For instance, wind and solar observations at one location are often used to estimate wind and solar generation at other locations.

Sometimes, even more indirect connections are attempted; for instance, a relationship may be created be-

Models that synthesize weather data for use in power system analysis should ideally capture the physical and dynamical relationships between weather variables and produce weather states that are physically plausible, evolve realistically in time and space, and produce distributions of conditions like those that are observed in reality.

tween temperature at a site and the expected wind generation at that location (or even some other location). Attempts to fit data in this way rarely produce accurate time series data at the granularity needed for power system analysis. Any suggestion that such modeling is possible should be viewed with deep skepticism in all but the simplest cases. Because they are not physics-based, these methods typically exhibit large errors when used to produce hourly (or more frequent) time series even if the average bias is low, and they usually do not correctly reflect the dependence of each weather input on the others, and thus on different components of the electricity system. Where data are derived in this way, it is important that they be validated, not just to verify that the overall distribution of outcomes for wind or solar generation looks realistic, but to confirm that the data produced are representative

¹ "Meteorology 101: Meteorological Data Fundamentals for Power System Planning" provides a longer, more in-depth version of this overview and can be found at <https://www.esig.energy/weather-data-for-power-system-planning>.



of actual concurrent and chronological measurements—otherwise, the data will not represent the overall balance of supply and demand situations that actually occur.

Physics-Based Models

Physics-based models solve mathematical equations that represent physical laws describing atmospheric processes and the connections between atmospheric quantities.

They can be diagnostic, in which case they relate one quantity to another, or prognostic in which case they can predict the evolution of the atmosphere in time and space. NWP models are a class of prognostic model that mathematically represents the physical laws governing the weather and can be used together with observations to estimate the conditions at a later time. Not only are these models able to predict future conditions but, when used together with past observations, they can estimate a denser array of historical meteorological data

than is available from observations alone. NWP models produce data that are usually much more accurate than non-physics-based methods, but synthetic data produced this way can still contain large errors even when appearing to be realistic. The errors are related to the data used as inputs to the NWP process and to unavoidable imperfections specific to the model configuration used.

The NWP Modeling Process

NWP models can be used to forecast weather conditions in the future or to create historical datasets by “forecasting” weather conditions in the past. In either case, NWP modeling starts with an initial condition produced by taking a “first guess” of the atmospheric state from a prior model run (usually a short-range prediction of 1, 3, or 6 hours) and adjusting it using as many sources of observational weather data as possible, including surface observations, balloon soundings, radar data, ground- and space-based remote-sensed information,

and aircraft data. This complex process incorporates the observations into the model in a way that considers both model and observational uncertainty. This becomes the new initial condition for the next time step of the model.

The same weather model can produce vastly different output depending on how it is configured and initialized. Atmospheric processes are highly non-linear; small changes in one variable can result in large changes in another. This means that even a slight difference in the initial condition and/or the model representation of atmospheric processes, or even just the level of computer rounding, may amplify and change a weather pattern’s evolution. This is the so-called butterfly effect, where the pressure change produced by the flapping of a butterfly’s wings may later affect the course of a hurricane thousands of miles away.²

Figure 2 illustrates the typical cyclical NWP process where weather ob-

² See Lorenz (1972), and <https://science.howstuffworks.com/math-concepts/butterfly-effect.htm>.

FIGURE 2
The NWP Cycle and Representation of Atmospheric Data on a Model Grid

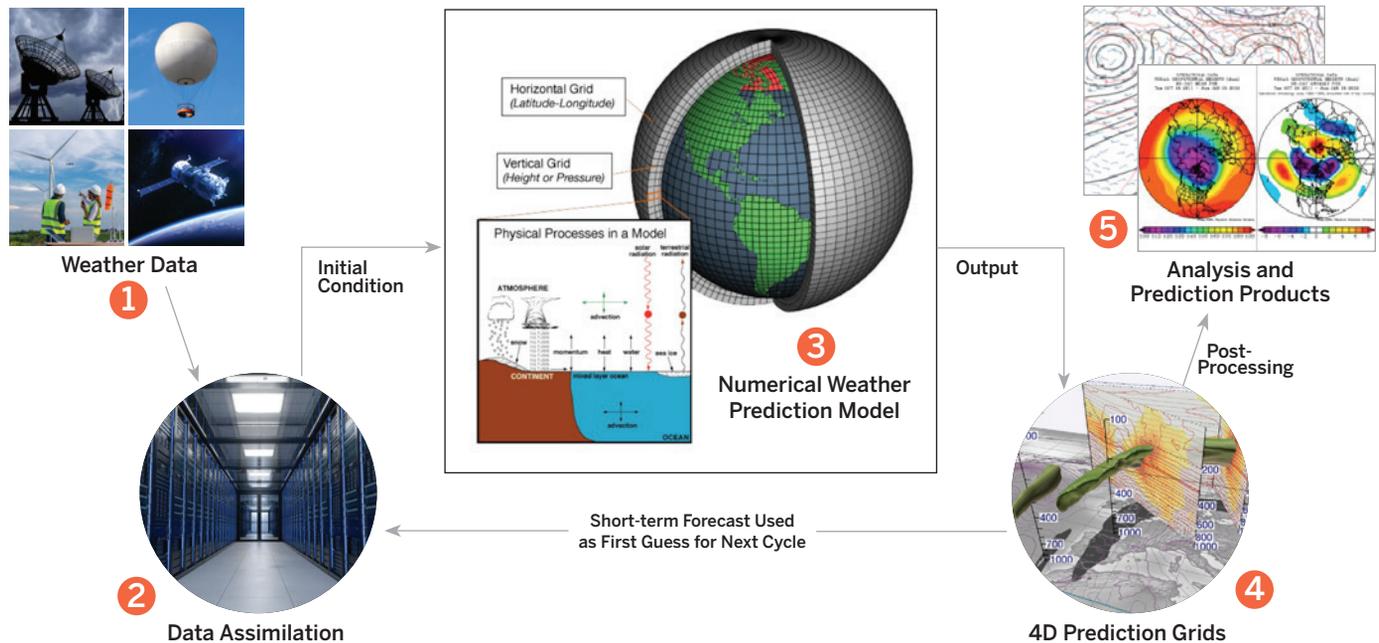


Illustration of the cyclical NWP process. Gridded weather data output from a prior NWP iteration becomes the background field (or first guess) to the next iteration. This first guess is then nudged toward observations, while keeping it consistent with differences between how the model configuration represents the physical world. The NWP calculations are then performed and the result post-processed according to the use case, while a short-range forecast feeds the next cycle. Source: Justin Sharp.

servations and the first guess field are melded in the data assimilation process to produce the model initial condition. The NWP model then iteratively solves equations that are mathematical representations of the laws governing atmospheric evolution until the desired forecast horizon is reached. This process is called model integration. The weather forecast data that are generated are then post-processed to produce useful products for specific end users, and one of the short range forecasts (usually 1, 3, or 6 hours beyond the initial condition time) is fed back to the assimilation step to produce the initial condition for the next cycle. When carried out to forecast future weather, the collection and processing of weather data, the assimilation process, and integration must be done as quickly as possible so that the data are a forecast of the future state of the atmosphere. However, the same NWP process

can also be used on historical observational to synthesize a higher-fidelity (in time and space) estimate of the state of the atmosphere than is possible with the available observations alone. In this case, more observations are usually available, and the assimilation and integration processes can be configured to prioritize accuracy over timeliness by, for example, using smaller grid spacing and more sophisticated representations of physical processes.

Resolution

Processes used to produce datasets for use in power system planning must provide sufficient spatial resolution to accurately resolve the phenomena impacting supply and demand. This means:

- Knowing temperature in enough detail to accurately predict its impact on load

- Specifying variables driving wind and solar in enough detail to quantify the generating potential at every plausible generation site
- Having information about weather phenomena at a scale that can be used to estimate their impact on thermal generation derates and outages, transmission, and distribution

Wind resource is the limiting factor in determining how to use models to fill in gaps in observations, because the wind field is heavily influenced by topography and near land and water interfaces. To estimate the output from wind plants at the granularity needed for system planning will require that the data points are no more than 2 km from the point of interest, and ideally much closer.

NWP models can be run at different grid spacing in both the horizontal

It is often mistakenly believed that lower-resolution models will predict the broad features of air flow in complex topography and that this output can then be statistically corrected. However, if the model topography cannot properly support conditions that cause a phenomenon, the phenomenon may be absent altogether from model output.

and the vertical, which determines the granularity of the geography and attendant physical processes that the model can simulate. Model resolution is crucial, as small-scale features can strongly affect weather; the effects of topographical features that occur at scales smaller than the grid spacing will be represented inaccurately in the model or not at all (Figure 3, p. 12). Discrepancies between model data and reality are particularly important to consider in regions with hilly or mountainous topography. Where model topography differs significantly from actual topography, even if a large-scale weather pattern is correctly modeled, the projection of it onto a smaller scale will be consistently incorrect, and modeled values may be very different from those of reality.

While it is generally understood that lower-resolution models will not properly predict the details of air flow in complex topography, it is often mistakenly believed that these models will predict the broad features of the flow and that this output can then be statistically corrected. However, if the model topography cannot properly support conditions that cause a phenomenon, the phenomenon may be absent altogether from model output.

Limitations of Model-Synthesized Weather Data

The same physics-based weather model can produce vastly different output depending on how it is config-

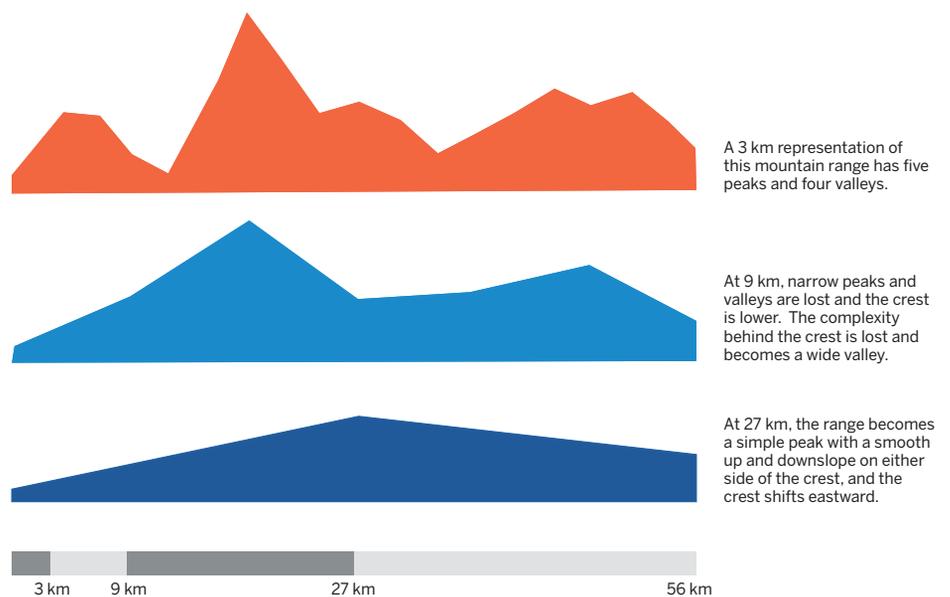
ured. While physics-based methods produce detailed outputs with realistic weather patterns that reflect the input observations, the uncertainty of the model output is vastly greater than that of direct meteorological observations. The model output uncertainty is also not uniform in time and space or between different weather regimes and geographies. And it is a function of model configuration and model parameterizations—settings that allow models to simulate phenomena that cannot be explicitly modeled because they are too small, are too poorly understood, occur too rapidly, or are too complex to model explicitly.

Given that synthetic weather data have much more inherent uncertainty than data coming from weather observations, validation and uncertainty quantification are essential to prevent invalid conclusions from being drawn from studies utilizing synthetic weather inputs. Few synthetic model data have been robustly validated against observations, largely because

in many cases such validation is not possible because the modeling was performed specifically to fill gaps where observations were unavailable.

NWP is a complex subject with many nuances. It requires expert knowledge to understand the inherent uncertainties in the modeling process, and it changes for particular locations, weather variables, and weather regimes. Expert knowledge is required to determine what model resolution, parameterizations, and parameter settings are best for the problem being solved and/or determine the best compromise between accuracy and computational burden. When performing long simulations across broad regions, configurations that work well in one region or season may perform poorly in others. And even with well-chosen selections of resolution, parameterizations, and other configurable options, NWP models can sometimes be inconsistent. Differences in performance are not random and are often related to specific at-

FIGURE 3
Hypothetical Cross Sections Showing Model Representations of a Complex Topography at Different Grid Spacing



The top plot shows a cross-section of hypothetical complex topography represented at 3 km grid spacing. The middle plot uses the average of sets of three 3 km points for each 9 km point. In the bottom plot, three 9 km points were averaged to get to each 27 km point.

Source: Justin Sharp.

atmospheric conditions and/or geographies. When factors adversely affecting model performance align with weather situations that stress the electricity system, the weather inputs going into power system models may compromise the downstream results.

It is crucial, for any study using NWP data as a proxy for observations, that the data not be utilized as a black box dataset as if it contained quality-controlled observations. Users need to have at least a basic understanding of how the data were produced or engage with a meteorologist who has an NWP background—and ideally an understanding of how weather data are used in power system models—who can guide them in whether the data are appropriate for the application at hand. As part of this process, to ensure the appropriateness and accuracy of a modeled dataset for power system planning, users should review a comprehensive validation report for NWP data being used that has been performed within the context of the power system modeling

Even with well-chosen configurations, NWP models can sometimes be inconsistent. Differences in performance are not random and are often related to specific atmospheric conditions and/or geographies. When factors adversely affecting model performance align with weather situations that stress the electricity system, the weather inputs going into power system models may compromise the downstream results.

use case. If a comprehensive validation report is not available, such a validation should be performed.

Some meteorologists without deep NWP backgrounds are not fully aware of these limitations and may recommend inappropriate usage of these models in power system planning. Even meteorologists with NWP

backgrounds are sometimes not aware of how the data are being utilized and might recommend different approaches if they were. It is essential to have a feedback loop between power system modelers and NWP experts when NWP data are being used for weather inputs into power system analysis.

Estimating Generation: Extrapolation Versus Synthesis

Ideally, a planning study will have high-quality, clean generation data (free from contamination from curtailment or other effects impacting output in ways we don't want to incorporate into the study) covering the period of interest. However, it is very rare that quality generation data will exist for a long enough period and/or at all sites of interest to use on its own. Therefore, once weather data have been identified that describe the resource (the fuel) available at a current or planned renewable energy facility, the next step is to convert that resource weather data into a generation estimate. The options are



to extrapolate an existing generation dataset to a longer record or produce a completely synthetic estimate of output. Both methods have advantages and disadvantages, but it is worth noting that while the use of empirical correlations to extrapolate longer generation time series for renewable resources is intuitively easy to grasp for non-meteorologists, it should be regarded with skepticism even if other options seem limited.

Extrapolation methods relate the observed generation to meteorological variables to create an empirical power curve in a similar fashion to creating the relationship between temperature and load. If done at the level of an individual wind or solar facility, this will implicitly account for loss factors like wind plant wakes, inverter losses and clipping,³ collector system losses, and sub-station losses. However, unless the data used to create the empirical power curve are carefully prepared, the function will also implicitly account for the average effects of other loss factors like output curtail-

ment, equipment availability, icing, snow on panels, or high wind cut-out. These are factors that it would be best not to include in an extrapolation because they lower the output across all time periods, instead of just specific times.

Synthesizing generation estimates without reference to actual generation data uses power curves specific to the installed equipment (for example, model specification for the wind turbine, PV panel, and inverter). The advantage of this is that it is more generic and can be used for hypothetical future plants, but the disadvantage is that loss factors are not based on actual power plant configurations in the field. Thus, factors we do want to consider, like location-specific wake losses, are not included.

Whether extrapolation or synthesis methods are used, if aggregated estimates of output for an area are needed, the aggregation usually needs to be done by estimating the output at each facility and summing the results,



to recognize the fact that the resource changes over short times and distances and different technologies may be used at different plants. Some current practices attempt to extrapolate production at a regional level, but at best this produces a coarse relationship between regional meteorological conditions and renewable output and is generally not recommended. ●

SUMMARY REPORT

Weather Dataset Needs for Planning and Analyzing Modern Power Systems

A Summary Report of the Energy Systems Integration Group's Weather Datasets Project Team

This summary report, the full report (and a high-resolution version for printing), "Meteorology 101: Meteorological Data Fundamentals for Power System Planning," and fact sheets are available at www.esig.energy/weather-data-for-power-system-planning.

To learn more about ESIG's work on this topic, please send an email to info@esig.energy.

The Energy Systems Integration Group is a nonprofit organization that marshals the expertise of the electricity industry's technical community to support grid transformation and energy systems integration and operation, particularly with respect to clean energy. More information is available at www.esig.energy.



³ Because of the variable shape of solar output through the day and year, and because inverter capacity is very expensive, solar facility inverters are often sized smaller than the installed capacity of solar panels, because the energy lost during the relatively limited times that output exceeds the inverter sizing is worth less than the cost of a larger inverter. The resultant effect is called clipping.

CODES & STANDARDS

ANSI/CAN/UL/ULC 2200



Jeff Jonas

*Senior Staff Engineer – Global
Product Compliance
Generac Power Systems Inc.*



Curtis Flint

*Staff Engineer – Global Product
Compliance
Generac Power Systems Inc.*

ANSI/CAN/UL/ULC 2200 is the standard for safety for Stationary Engine Generator Assemblies. The first edition of UL 2200 was released in 1998, second edition in 2012 and third edition in 2020. Each edition has several revisions for minor updates. The third edition, including the revision in 2022, is the most current. The third edition is the first to be a bi-national standard, which means it harmonizes the requirements of the United States and Canada into one cohesive standard. Multiple editions and revisions of the standard are needed to keep up with changing technology of the prod-

uct and the ever-changing installation standards.

Several years ago, the 2020 edition of NFPA 70 – National Electrical Code (NEC) added a Listing requirement to article 445-Generators. Section 445.6 specified “Stationary generators 600 volts and less shall be listed.”¹ In the 2023 edition of the NEC, the 600V limit, was removed resulting in the requirement changing to “Stationary generators shall be listed.”² The majority of Stationary Engine Generator Assemblies installed in the United States before 2020 were listed to UL 2200 as many authorities having jurisdiction required a listed product.

The NEC defines “listed” as “Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose Listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.”² The means, or system, for identifying listed equipment may vary for each Nationally Recognized Testing Laboratory(NRTL), some of which do not recognize equipment as listed unless it is also labeled. Use of the system employed by the listing organization allows the authority having jurisdiction to identify a listed product.

Stationary Engine Generator Assembly manufacturers demonstrate that a Stationary Engine Generator Assembly meets the requirements in UL/ULC 2200 by working with a NRTL to evaluate the product. When the results of the NRTL evaluation show the product complies with the re-

quirements in the standard, the NRTL issues a Listing. Currently, Stationary Engine Generator Assemblies listed by UL, Intertek/ETL, or other NRTLs are being listed to the second edition of UL 2200 but have the option to be listed to the third edition ahead of the effectivity date. The current effectivity date for compliance with the third edition of UL/ULC 2200 is March 31, 2026.

The hazards addressed by UL/ULC 2200 include electrical (energy, shock, explosion, and fire), mechanical (hot and moving parts), fuel related (explosion and fire), and prime mover related hazards.

UL/ULC 2200 requirements apply to construction, performance, and markings.

Construction requirements can be generally divided between mechanical and electrical. The common mechanical requirements pertain to the materials used in electrical enclosures, materials used to support live parts, insulating/guarding of hot surfaces, guarding over moving parts, fuel flow control, materials for fuel confining parts, corrosion resistance for all enclosures and structural components (ferrous and some non-ferrous materials), and intake and exhaust systems. The common electrical requirements pertain to electrical spacings, conductor/busbar sizing, component bonding, overcurrent protection, field wiring provisions, and functional safety of the control system.

Performance requirements are validated through testing and commonly include tests to evaluate safe system temperatures at rated load, dielectric strength, output voltage and frequency fluctuation, integrity of the combustion air filter and muffler under backfire conditions, safe operation or shutdown under blocked inlet condi-

tions, strength of terminal insulating bases and supports, bonding integrity, impact resistance of guards and viewing panes, fuel hose integrity (aging, vibration, strength), and water intrusion. In addition, abnormal tests are conducted at overload, over speed, and short circuit conditions to ensure hazards are not created. UL/ULC 2200 also includes further performance requirements not mentioned here that are unique to specific components or applications.

Marking requirements include various markings to declare the product ratings, the environment it can be used in, and how to connect and operate it in a safe manner. UL/ULC 2200 is a binational standard, therefore Caution

and Warning markings are required to be in English and French.

UL/ULC 2200 does not cover requirements for generator assemblies for use in hazardous locations or marine use. Additionally, it does not cover requirements for snow loading, wind loading, or seismic forces.

UL 2200, in the past, and UL/ULC 2200 now has served the Stationary Engine Generator market well for 25 years by providing a minimum set of requirements for the design, manufacture, and certification of product. UL/ULC 2200 will continue to evolve to meet the requirements of the product and the markets in which they are installed. ●

Endnotes

¹ NFPA 70®, *National Electrical Code*® (Quincy: National Fire Protection Association, 2019)

² NFPA 70®, *National Electrical Code*® (Quincy: National Fire Protection Association, 2022)



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How To Store And Handle Diesel Exhaust Fluid Effectively

By Brian Ponstein
Senior Product Manager, Rolls-Royce Group

Selective catalytic reduction (SCR) technology has been utilized globally for more than 50 years to reduce emissions of nitrogen oxides (NOX). Since the EPA mandated its use for diesel-powered vehicles and equipment in 2010, SCR has become increasingly commonplace in the United States and in many other regions. SCR systems require replenishing diesel exhaust fluid (DEF) on a periodic basis to ensure emissions system performance. Understanding a few simple tips on how to store and handle DEF will help keep your SCR system running efficiently.

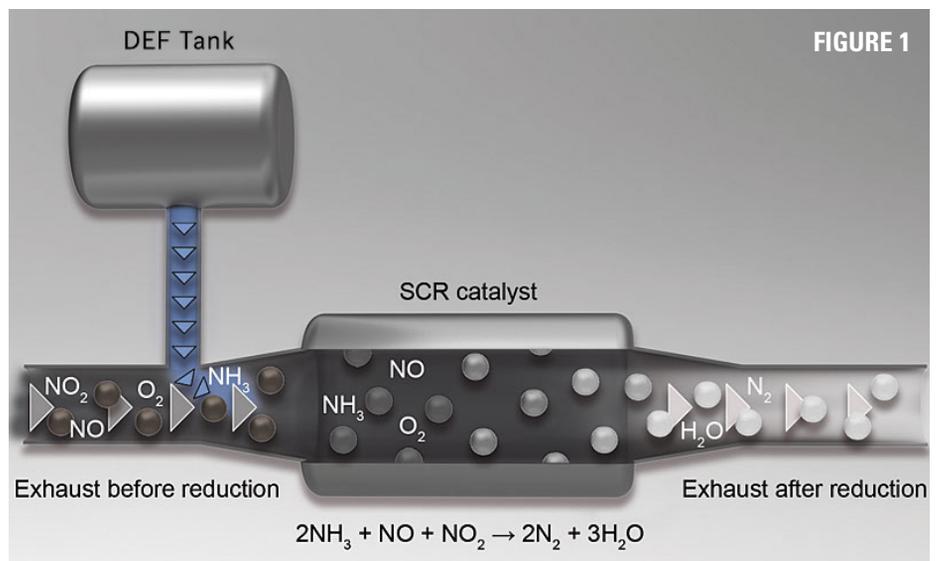
What is SCR?

SCR is an advanced aftertreatment system that treats exhaust gas downstream of the engine. Small quantities of DEF are injected into the exhaust upstream of a catalyst, where it vaporizes and decomposes to form ammonia and carbon dioxide. When the NOX from the engine exhaust reacts inside the catalyst with ammonia, harmful NOX molecules in the exhaust are converted to harmless nitrogen and water, which are released from the tailpipe as steam.

Shelf life of DEF

Shelf life depends on the temperature of your storage facility. According to ISO22241 standards, ideal storage temperatures for DEF should be between 12°F and 86°F. When stored at lower temperatures, shelf life is extended.

SCR System



ISO22241 DEF Storage Specifications

Constant ambient storage temperature (°C/°F)		Minimum shelf life (Months)
≤ 10	50	36
≤ 25 ^a	77	18
≤ 30	86	12
≤ 35	95	6
> 35	95	— ^b

Note: The main factors considered to define the shelf life in this table are the ambient storage temperature and the initial alkalinity of AUS 32. The difference in evaporation between vented and non-vented storage containers is an additional factor.

^a To prevent decomposition of AUS 32, prolonged transportation or storage above 25°C should be avoided.

^b Significant loss of shelf life: check every batch before use.

Storing DEF in a climate-controlled environment and out of direct sunlight is recommended. Note that the chart shows recommended shelf life at a constant temperature. When calculating shelf life at your site, consider daily temperature fluctuations, as well as seasonal. In general, the shelf life for DEF will be a minimum of one year in most U.S. areas. Proactive monitoring and maintaining recommended concentration specifications will help prevent issues when operating beyond ISO guidelines. In most markets and applications, DEF will be consumed before the shelf life expires. Based on more than ten years of using DEF in the U.S. and Europe, storage requirements for DEF have not been a concern.

Cold conditions

Proper storage of DEF is required to prevent the liquid from freezing at temperatures below 12°F. The 32.5% concentration of urea in DEF was determined as ideal by the ISO committee because it has the lowest freeze point of any other urea/water mixtures. DEF's composition enables it to freeze and thaw just like water and ice.

When frozen 32.5% urea DEF thaws, it will not leave any solids behind or change the effectiveness of the fluid. When operating at extreme cold temperatures, it's important to keep DEF from freezing. If the DEF freezes, it will not allow the unit to be in compliance, and for Tier 4-certified equipment, inducement shutdowns will be implemented.

Formulated to last

Diesel exhaust fluid is formulated with 32.5% urea and 67.5% deionized water. Engines with SCR are specifically engineered for optimal performance at this ratio. If stored too long, theoretically the DEF can become off-spec. However, formaldehyde, biuret, or any other metal ions are not going to appear in the solution while the product sits in stor-



age for an extended period of time. The only change that could occur is alkalinity as ammonia, therefore these items that could theoretically come out of spec are not a concern as ammonia is the target.

Over time and at higher temperatures, a portion of the urea can react with the water to form ammonia and CO₂. However, these compounds will quickly dissolve. While it is possible for DEF to decompose and lose ammonia, this does not impact the quality of the DEF. Field-testing DEF is fairly easy and similar to checking coolant. It's typically preferred to use a refractometer to check the concentration of urea.

Handling

DEF is a non-hazardous, easy-to-use operating fluid. It is not a fuel, nor a fuel additive, but a high purity urea solution that must be stored within a dedicated DEF tank (separate to the diesel tank), that is refilled as/when required. In most cases, the DEF tank and fuel tank are sized propor-

tionally, and will empty at about the same rate. To maintain a proper supply, operators should refill the DEF tank every time they refuel.

A 32.5% urea concentration must be maintained in the DEF solution for optimal operation of the emissions control system. SCR reduces levels of NO_x using ammonia as a reductant within the catalyst system. If the concentration is lower, less ammonia is produced. Precise controls for the injection of DEF for the SCR system must be in place to automatically inject DEF to get the proper NO_x reduction, while controlling NH₃ slip.

The best solutions to maintain optimal DEF concentration are closed loop control systems that continuously monitor inlet and outlet NO_x emissions. Most injection control systems can handle minor concentration fluctuations. If an operator notices the concentration of the urea is out of spec and needs to be adjusted, consult with your DEF supplier on the best method for your site to correct

this issue. Below are several general guidelines.

If the urea concentration is 40-50%, it is best to add deionized water to the tank in increments of 10% of the volume of DEF in the tank, until it is within specification. Do not use tap water. If the DEF concentration is above 50% (generally crystallized urea is present in the tank), it is best to clean out the DEF system and begin with fresh DEF.

Use heated lines and a heated tank to keep the DEF above the freeze point during the winter months. Often the DEF tank is insulated to lower the heating requirements for the tank. It is ideal to use a vacuum/pressure vent that opens and closes when there is a change in pressure. This will limit evaporation of the water in the DEF and help keep the concentration constant over time.

Always store DEF in High Density Polyethylene (HDPE) or stainless-steel tanks. Since DEF reacts with copper, make sure even connections use the appropriate materials

like stainless steel. If copper is used on a connection it can easily be seen, as the DEF will change to a blue color quickly. DEF may seep through connections. If DEF dries and forms crystals, simply use warm water and a rag to remove.

Consumption

DEF is an integral part of the emissions control system and must be present in the tank at all times to assure continued operation. This is important to maximize uptime for equipment in construction, farming, marine, rail, and power generation applications. In the standby generator market, DEF consumption is fairly minimal since units generally only operate a few hours per year, usually for maintenance/ readiness checking. However, during an outage there may be several hours—or days—of operation at full load of fuel and DEF on site. Make sure DEF is topped off periodically to ensure there is enough to operate in an emergency. Mission-critical applications may be put at risk if ample supply is not readily available.

Conclusion

SCR systems use DEF to limit the NOx emitted from the equipment's exhaust system. To ensure your SCR system continues to perform effectively and is protected from the risk of damage, you need to follow some simple storage and handling guidelines to prevent your DEF from being compromised.

When working on new installations, it is recommended to discuss all aspects of DEF and SCR systems with your local Rolls-Royce Solutions representative or factory rep. Selecting the proper solution for your equipment's specific needs ensures maximum reliability for the most demanding applications. ●

Rolls-Royce provides world-class power solutions and complete lifecycle support under our product and solution brand mtu. Through digitalization and electrification, we strive to develop drive and power generation solutions that are even cleaner and smarter and thus provide answers to the challenges posed by the rapidly growing societal demands for energy and mobility. We deliver and service comprehensive, powerful and reliable systems, based on both gas and diesel engines, as well as electrified hybrid systems. These clean and technologically advanced solutions serve our customers in the marine and infrastructure sectors worldwide.

Within its Net Zero at Power Systems program, Rolls-Royce has set out to sustainably reform its product portfolio so that by 2030, new technologies can save 35% of greenhouse gas emissions compared to 2019. This near-term target plays a significant role in Rolls-Royce Group's ambition to achieve net zero by 2050 at the latest. A key element in achieving these goals is the release of the highest volume mtu engine products and systems to run on sustainable fuels as quickly as possible.

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ANA, Inc.

Who is ANA, Inc.?

Serving customers across the United States and Canada, ANA, Inc. is a leading supplier of innovative technology solutions in the energy sector and a game-changer for the power industry. Established in 2017, a single location in Southern California, ANA has quickly grown into four manufacturing locations nationwide. Southern and Northern California, South Carolina, and Nevada. Additionally, corporate headquarters are in Henderson, NV.

ANA provides the most reliable, highest quality equipment, and support, along with the lowest overall cost of ownership. ANA is the North American distributor of AIRMAN generators and air compressors and is the exclusive North American supplier of MAC3 pneumatic air tools. In the renewable energy space, ANA offers a product lineup that includes low-emission generator options such as Hybrid Energy Systems.

As a company, ANA serves several industries, including Power Generation, Construction and Rental Companies, Events, Mining, Oil and Gas, Telecommunications, Municipalities, Temporary Power, Cell Towers, and more.

ANA Solutions

At ANA, Inc., we provide high-quality solutions that improve productivity, reliability, and sustainability along with world-class service and parts support. It is our unwavering commitment to quality and excellence that shows through in our product offerings, covering a wide range of applications within the power industry.

AIRMAN generators range in size from 13kVA to 400kVA and are designed to meet a wide range of power requirements. They are renowned for their longevity, efficiency, and consistent power

supply, making them suitable for a variety of jobs. These generators have industry-leading low dBA levels that increase usability for applications from construction sites to events. We have since designed and developed a load banking system, SmartLoad™, to help eliminate light loading issues with Tier4F generators, improving reliability and reducing engine wear. Providing a wide range of power solutions, Airman generators are a leader in the power generation industry.

A pioneering innovation from ANA and a champion of sustainability and green solutions, the Energy Boss™ represents a new era in energy efficiency. In addition to reducing fuel consumption, extending generator life, reducing maintenance costs, and emitting fewer greenhouse gases, this hybrid energy system offers numerous other benefits. With a 15kW battery with a 30-year life cycle at an average load of 3kW, our 30kVA/24kW system delivers maximum power with a low environmental impact. This unit offers three-phase and single-phase output voltages simultaneously and is made to withstand any environment. Switching to greener, sustainable energy sources is easier than ever with the Energy Boss. Keep an eye out for more details on the new Energy Boss models launching in 2024.

Additionally, ANA offers AIRMAN Mobile air compressors with capacities of up to 400 CFM, with larger units on the way in 2024. Our air compressors are complemented by a full range of pneumatic MAC3 air tools, from breakers to hammers.

Rather than merely being a supplier, we strive to become a partner to identify mobile power generation and air compressor technology solutions that increase an organization's value



and help reduce its risk. We are committed to quality, dependability, and sustainability in our operations. Providing high-quality and sustainable equipment for the power sector and a wide range of other industries allows our customers to prosper in an ever-changing world.

Application Optimization

Every customer has unique power requirements. Therefore, we provide customized and tailored solutions to meet each organization's specific needs. The focus is on improving equipment productivity, serviceability, profitability, and eco-friendliness. Our commitment to our customers is to Make Your World Easier™, by answering the phone, understanding their needs, and taking ownership to provide solutions. With a large parts inventory and more than 90% of all orders shipping within 24 hours, never worry about spare parts. We help keep your prime power project running and your rental fleet in top condition with our friendly support department. As a resource, they provide training on our equipment and are available 24 hours a day, 7 days a week.

We place a high value on customer satisfaction, which is why we only sell equipment of the highest quality that offers the most reliable uptime, supports the highest return on investment, and the lowest total cost of ownership. Our commitment to exceptional service ensures a dependable power supply and peace of mind. ●

2023 FALL CONFERENCE RECAP

Hyatt Regency Hill Country Resort | San Antonio, TX | October 1-3

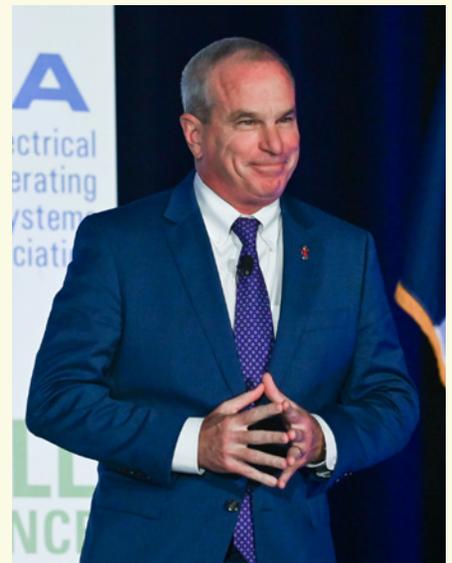
By Sarah Cullen, *Manager of Membership and Marketing*

The Electrical Generating Systems Association (EGSA) recently hosted its enriching Fall 2023 Conference at the picturesque Hyatt Regency Hill Country in vibrant San Antonio. Embracing our conference mantra of "Network. Learn. Advance.," this event was a joyful and significant milestone in the EGSA journey. It served as a perfect blend of a professional meet-up and a celebration, highlighting the dynamic and innovative spirit at the heart of the power generation industry.

KEYNOTE HIGHLIGHTS: Insights from Reggie Jackson and Robert Bryce

The conference was graced by keynote speakers Reggie Jackson and Robert Bryce, whose insights set a powerful tone for the event. Jackson, renowned for his expertise on and off the diamond, emphasized the importance of building inclusive environments in every industry. His talk resonated with the audience, underscoring the need for diverse perspectives in driving innovation.

Robert Bryce, a celebrated energy journalist and author, provided a comprehensive overview of the energy landscape. His session delved into the complexities of power generation, offering a critical analysis of current trends and future possibilities. Bryce's ability to distill intricate subjects into digestible insights was highly appreciated, sparking engaging discussions among attendees.



INNOVATIVE SESSIONS: Exploring New Technologies and Industry Challenges

The conference featured a series of educational sessions that focused on the latest technologies and pressing issues facing the power generation industry. These discussions, led by experts and thought leaders, provided

valuable knowledge and foresaw industry trajectories. Participants had the opportunity to engage with topics ranging from renewable energy integration to advancements in generator design, reflecting the diverse interests and expertise of the EGSA community.



**NETWORKING AND INTERACTIVE EXPERIENCES:
Beyond Conventional Learning**

True to the theme of networking, the EGSA Fall 2023 Conference provided ample opportunities for professionals to connect and collaborate. Along with the entertaining armadillo races at the opening reception, the EGSA Fall 2023 Conference featured a range of unique and engaging activities beyond conventional settings. The golf tournament, a perennial favorite, provided a relaxed yet competitive backdrop for professionals to mingle and discuss industry trends amidst the camaraderie of the game. In the same spirit, the pickleball tournament emerged as a lively and energetic alternative, offering a fast-paced and fun-filled way to build connections. Pickleball, a sport rapidly gaining popularity, facilitated effortless networking in a dynamic and informal atmosphere. Adding to the mix, the skeet shooting event offered a distinct and exhilarating networking opportunity. It combined the excitement of the sport with the chance for attendees to engage in friendly competition and conversation, fostering connections in an environment filled with shared enthusiasm. Adding a flavorful twist to the networking events, the margarita and salsa making class was a delightful experience. This interactive session taught attendees the art of making these classic Mexican staples, fostering engaging conversations and shared laughter.

The Gear Head Tours at EControls and Southwest Research Institute (SwRI) were standout events, offering attendees a behind-the-scenes look at cutting-edge research and development in power systems. These tours were not only educational but also a testament to the practical applications of the theories and concepts discussed in the conference sessions.



DIVERSE EXHIBITOR HALL: A Showcase of Industry Innovations

The Exhibitor Hall was a microcosm of industry's diversity and innovation. Companies from various sectors of power generation displayed their latest products and services, providing a tangible sense of the industry's direction and growth. The hall served as more than a display area; it was fertile ground for idea exchange, partnerships, and insights into new market trends.



Attendee Feedback

"Love the variety!"

"Great conference and enjoyed the company."

"The App was fantastic to use."

"Robert Bryce was an excellent speaker. Thank you for including him."

"Enjoyed the inverter presentation by Oztek/Trystar. Very informative."

"Venue and food were exceptional this meeting."

"I believe EGSA is pointed in the right direction, and we appreciate what you do."

96.67% of attendees said the Fall 2023 Conference met or exceeded their expectations.

LOOKING AHEAD: EGSA Spring 2024 Conference in Miami

Reflecting on the success of the Fall 2023 Conference, EGSA eagerly anticipates the Spring 2024 Conference in Miami, set to offer extensive learning, networking, and industry advancement opportunities. The Fall event marked a key step in our journey of innovation and growth. We warmly invite you to join us in Miami, where we'll continue to delve into the latest in power generation, foster new connections, and collaboratively propel our industry forward. Network. Learn. Advance. - The EGSA mantra that continues to drive us towards a brighter, more connected future in power generation. Join us in Miami for the Spring 2024 Conference and be a part of this ever-evolving journey. ●

2024 SPRING CONFERENCE

EGSA
Electrical Generating Systems Association

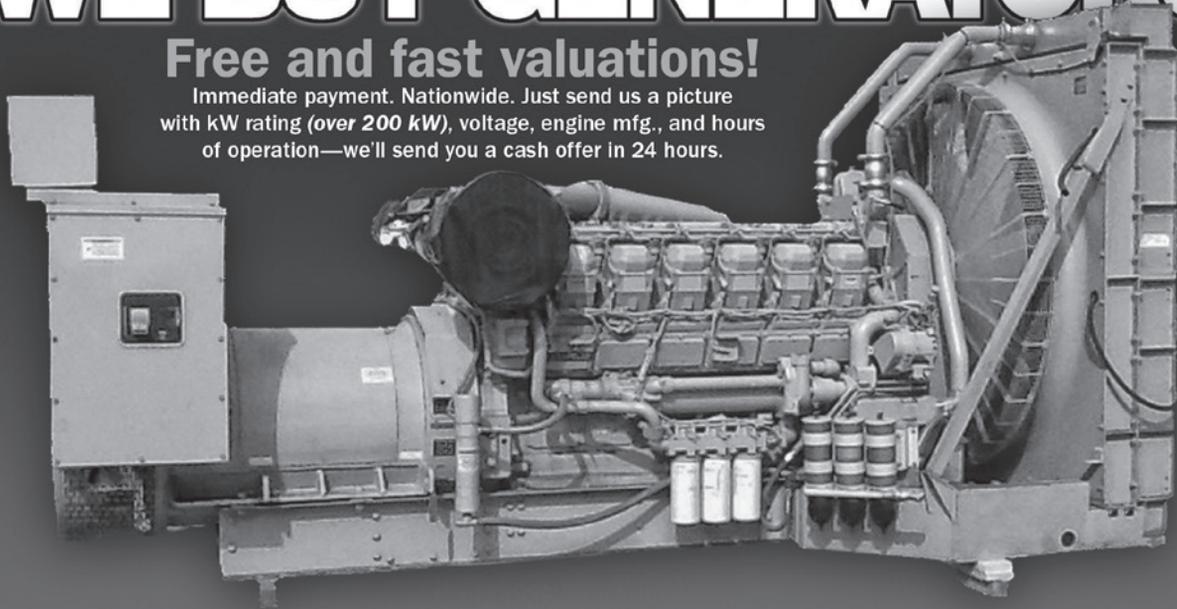
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These live virtual schools are taught by the same knowledgeable and professional instructors who have been teaching at the in-person schools across the country. One of the best parts of physically going to the in-person school is the ability to speak directly with the instructors and ask questions. Rest assured, we have made our live virtual schools as interactive as possible and instructors are still able to answer your questions on the spot.

Virtual Basic Schools

March 18-20

December 9-11

Virtual Advanced School

July 15-18

Pre-Recorded Sessions

All live virtual sessions are recorded and access to the recordings are provided when you register for the live virtual school. These recorded sessions will also be available on EGSA.org as individual sessions or a package of the complete school. As we continue to complete live virtual schools, our library of recorded content will grow and be made available.

Check out EGSA.org for more information and available courses.

EGSA Enriches & Unites the On-Site Power Generation Industry with ***POWERLINE Magazine!***

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POWERLINE Magazine is one of the best ways to stay on top of the rapidly changing landscape of On-Site Power. From codes and standards, emerging technologies, best practices and education to industry trends, **POWERLINE** Magazine is the BEST vehicle to reach thousands in the Industry, with a targeted approach and vehicle.

Published quarterly, **POWERLINE** is the only magazine that thoroughly and exclusively covers On-Site Power, electrical generation or any method of producing power at the site in which it is generated. No other publication can match **POWERLINE** for its focus on On-Site Power.

If you sell products or services in this constantly expanding Industry, **POWERLINE** will deliver your advertising message to the key decision-makers you want to reach!

Our readership includes Manufacturers, Distributor/Dealers, Manufacturer's Representatives, Consulting and Specifying Engineers, Facility Managers, Service Firms, and end-users around the world who make, sell, distribute, and use generators, engines, switchgear, controls, voltage regulators, governors, and related products and services!

Every issue of **POWERLINE** includes important articles covering diverse industry issues, such as international markets, contracts, financing, trade agreements and more. Technical and "case studies educate readers about emerging technologies and commonly misunderstood applications. In addition, regular columns on industry codes and standards, news from Europe, manufacturer's representative issues, industry events and other compelling news keeps our readers engaged and informed year after year.

The EGSA member Job Bank is also a great industry resource for members and job applicants alike!

Harness the energy by advertising in POWERLINE today!

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- Contractors
- End-users
- Consulting & Specifying Engineers

They read **POWERLINE** to gather product, market and trends information and make an informed final decision when recommending purchases or specifying components, services and equipment for new projects, upgrades, routine maintenance and retrofits.



Submit Your On-Site Power Article!

POWERLINE Magazine is continually seeking feature articles (1,500 - 2,500 words) addressing any one of the many issues pertinent to On-Site electrical generating systems and equipment. To be considered, please e-mail a title, brief summary and highlights of your article to the Editor, Nathan Harris via n.harris@EGSA.org.

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1/2 Page <i>Horizontal</i> <i>Vertical</i>	7.375" x 5" 3.687" x 10"	\$800 B&W \$1,770 4-Color	\$700 B&W \$1,600 4-Color	\$900 B&W \$1,975 4-Color	\$800 B&W \$1,770 4-Color
1/4 Page	3.687" x 5"	\$475 B&W \$1,445 4-Color	\$410 B&W \$1,310 4-Color	\$525 B&W \$1,600 4-Color	\$475 B&W \$1,445 4-Color



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In the event of cancellation of a multiple-month advertising space order prior to the final issue of the contract, the advertiser agrees to repay EGSA any discounts granted for multiple insertions. All cancellations must be received in writing prior to the advertising sales deadline.

MECHANICAL REQUIREMENTS

Electronic files are required. Materials may be submitted as high-resolution CMYK Adobe Acrobat files with embedded fonts. All full-page ads should be submitted at bleed size with 1/8" bleed included. For additional information, e-mail Marc Charon at m.charon@EGSA.org

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Please contact Marc Charon via email (m.charon@egsa.org) if you wish to pay by credit card.

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**We will do our best to honor placement requests, but reserve the right to decide placement.*

We Can Come To You!

Looking for a cost effective way to get all of your staff up to speed on power generation all at once? Need to introduce basic principles of on-site power to your team? EGSA will work with you to provide the most appropriate training for your team at your facility or virtually.

Customize your school by selecting from the 23 Basic and/or Advanced school modules for your core program. Contact us for more information.

BASIC SCHOOL

Perfect for staff new to the power generation industry or someone who needs an introduction to basic concepts and technologies, this school is appropriate for students seeking a foundation in generator technology. Whether you are in sales, marketing, management, application engineers, engine technicians, or administrative personnel, you will find great value in this course! The Basic School is a general, yet technical, overview of On-Site Power.

2024 IN-PERSON BASIC SCHOOL SCHEDULE

New Orleans, LA – January 22-24

San Antonio, TX – September 29-October 3

2024 VIRTUAL BASIC SCHOOL SCHEDULE

Virtual – March 18-20

Virtual – December 9-11

Basic Course Modules

- Introduction to EGSA
- Basic Electricity
- Prime Movers
- Introduction to Generators/ Alternators
- Starting Systems
- Introduction to Automatic Voltage Regulators
- Introduction to Governors/Speed & Load Controls
- Introduction to Transfer Switches
- Load Bank Fundamentals
- Generator Set Instrumentation
- Codes and Standards
- Generator Set Systems: Putting the Pieces Together
- Understanding Bid & Specification Documents

ADVANCED SCHOOL

Our Advanced School is designed for those who have a good understanding of the basic mechanical and electrical systems found in an on-site generator site. A minimum of three years of experience in the industry is recommended. It will be particularly useful for those employed in engineering, project management, service positions, and business owners.

2024 IN-PERSON ADVANCED SCHOOL SCHEDULE

Charlotte, NC – May 13-16

2024 VIRTUAL ADVANCED SCHOOL SCHEDULE

Virtual – July 15-18

Advanced Course Modules

- Advanced Generators/Alternators
- Generator Set and Critical Power System Controls
- Generator and System Protection
- Advanced Automatic Voltage Regulators (AVRs)
- Advanced Governors/Speed and Load Controls
- Advanced Transfer Switches
- Multiple Generator Paralleling Switchgear
- Engine Emissions
- Noise Control
- Communications
- Advanced Generator Systems: Sizing to Service

LOAD BANK CERTIFICATION

EGSA's Load Bank Certification is a 3-day course which includes classroom and hands-on training sessions. This school is designed specifically for experienced technicians looking to increase their knowledge and abilities. The school concludes with EGSA's Load Bank Certification test.

2024 LOAD BANK CERTIFICATION

Atlanta, GA – February 27-29

Dallas, TX – June

Location TBD – November

Load Bank Certification Modules

- Safety protocols
- Deciphering nameplate ratings of generators
- Different types of load tests
- Connections
- Testing requirements of the local authority having jurisdiction (AHJ)
- Applying the appropriate loads for the test required
- Gathering/calculating/documenting load test parameters and results
- Site and environmental conditions
- Potential problems/corrective actions.

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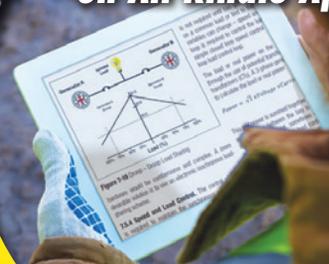
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