

EFFICIENCY

THE OFFICIAL MEMBER MAGAZINE OF THE
ASSOCIATION OF ENERGY ENGINEERS

Technical Articles
Member Stories
Events Run Up
Chapter News

Plus+

HOW ENERGY PROJECTS GET DONE

Jerry Zolkowski and Amy Glapinski explain the factors behind getting a green light for your project



HOPE FOR A ZERO CARBON WORLD

Samer Adnan Zawaydeh reviews some global events related to energy and the environment



A PASSION FOR PEOPLE AND EVENTS

A personal story about our founder by Lauren Lake, AEE's Director of Events



<< COVER IMAGE STORY

EFFICIENCY

Published By

The Association of Energy Engineers,
3168 Mercer University Drive,
Atlanta, GA 30341. Copyright, 2021.
Contributed material expresses the
views of the authors, not necessarily
those of the Association of Energy
Engineers or the editors. While
every attempt is made to assure the
integrity of the material, neither the
authors, association, nor the editor is
accountable for errors or omissions.



Editor

Michael Hewson

Contributors

Diane McCullum
Laurie Beth Nix
Lauren Lake
Mary Elise Cox
Mel Claus
Teresa Piazza



Connect
with Us



Contents

6 MAKE COMPLIANCE SIMPLE

Exploring State and Local Energy
Benchmarking Policies.



8 ILLUMINATING LIGHT QUALITY

Stephen A. Roosa demystifies the
measures of light quality.



13 OUR FOUNDER, HIS PASSION FOR PEOPLE AND EVENTS

A personal story from Lauren Lake.



16 EARTH'S ENERGY ENGINEERS

A look behind the campaign celebrating the impact AEE
members have on reducing the effects of climate change.



29 HOW ENERGY PROJECTS GET DONE

Jerry Zolkowski and Amy Glapinski explain the factors
behind getting a green light for your project.



38 CELEBRATING LONGTIME MEMBERS

Have you been with AEE for over two decades?

20+

44 HOPE FOR A ZERO CARBON WORLD

Samer Adnan Zawaydeh reviews some global events
related to energy and the environment.



IN EVERY ISSUE

EDITOR'S LETTER

MEMBER NEWS

EVENT NEWS

CWEEL NEWS

TRAINING CALENDAR

CHAPTER NEWS

THE OFFICIAL MEMBER MAGAZINE OF AEE

Welcome

From Bill Kent, Executive Director,
Association of Energy Engineers

It is a great pleasure to welcome you to the inaugural issue of "Efficiency," the official magazine of the Association of Energy Engineers (AEE). In 1977, my predecessor, and founder of AEE, Al Thumann, had a vision for this organization. He built that vision by building a community. It was only with the direct help of the new members and certified industry experts that allowed AEE to grow into a global voice for energy professionals. This magazine is an extension of that vision that aims to celebrate our community and our need for technical information. We hope you will embrace it, share it and contribute to it, for we wish this to be a magazine for AEE members by AEE members.

As Executive Director, I have been fortunate to travel to many countries where we have chapters. I have met members from all walks of life and heard their stories. Last year, before the pandemic, I traveled through Africa and the Middle East. It was there I met Mr. Selwyn Govender, C.E.M. (Pictured Above). He provided a tour and overview of the energy efficiency projects implemented at the Supreme Spring plant in Nigel, South Africa.

Traditionally, financial aspects were the primary driver of energy efficiency projects. More regularly, I see energy efficiency as a mainstream means for driving economic growth, creating jobs, developing healthier buildings, and fighting climate change. Energy and efficiency are now much more than individual pieces of equipment; they are an



Connect with Bill Kent



integral part of the sustainable communities in which we live. Selwyn's is just one of many stories propelling AEE forward - every member has a story. Included in this edition, we recognize members that have been with us for 20+ years. Are you still on your 20-year or more membership journey with us? What is your story?

Our growth and success depend on our ability to overcome the challenges that face us. To that extent, a large portion of these pages will be technical in nature, such as the articles provided by Stephen A. Roosa, Jerry Zolkowski, and Amy Glapinski - All AEE Members. We will also bring you pertinent articles that will inform you of changes in the industry or help you be more successful in business, such as the benchmarking information offered by ENERGY STAR.

Inside this magazine, you will also hear from various AEE staff members and gain a glimpse of the inner workings of AEE and what motivates us. Over the past 18 months,

we have all dearly missed connecting with our members face to face. We cherish the time we get with you at our in-person events. This month, Lauren Lake, AEE's Director of Events, shares a heartfelt and timely story of "Our Founder; His Passion for People and Events."

I often say "We are local, we are global, we are AEE," because I believe it is true. As an AEE member or certified professional, we are honored you are part of the AEE family, grateful for your continued support,

and cherish the continuation of memories made together to change the world. For those of you on the fringes, you too can get involved and participate. I invite you to share your expertise and best practices with our community. Take the first step by submitting an article, nominating a colleague for an award, or attending an event. I would love to read your story in the next edition or even better, hear it from you directly at our next in-person event.

Member Q&A



John Nott
*Principal Energy Engineer
Griffith Engineering*

John has been an AEE Member for 11 years and holds both CEM and CMVP certifications. He has attended numerous AEE World Conferences and presented at AEE East, AEE World, and a Monthly Membership Webinar. John is active in the Atlanta Chapter and enjoys the informative presentations and connecting with industry leaders and businesses. We met with John to talk about being an AEE member and how his CMVP Certification helps him with projects and his career.

What was your introduction to AEE?

When I started getting into energy engineering, it was part of our company's policy to become a CEM. Our company's founder thought it was a required certification for people doing energy consulting as a baseline knowledge and understanding that people doing the work have those core principles.

What is your favorite part about being an AEE Member?

It is involved in the local chapter by attending events and connecting with other industry professionals in the Atlanta area. It's really useful to see some of the projects people are doing.

How long have you had your CMVP Certification?

I have had my CMVP Certification since 2017.

What was the deciding factor in becoming a CMVP?

At Griffith Engineering, we work with all kinds of ESCO's and Utilities, and M&V was an aspect that we were less qualified to support at the time. We had been doing a little bit of M&V work and felt like we needed to get certified to be fully in line with industry standards and practices involved with that.

How has becoming a CMVP helped you in your career and your company?

Since we offer full-service engineering for performance contracting and act as a flex resource for a lot of large ESCO's and Utilities, with that in mind, we wanted to round out our offerings for that. We get about 10-20 projects a year; we are doing annual M&V now that we weren't doing before. It's been a shift in the industry where companies are more willing to outsource M&V to a third-party consultant. Even



SUBSCRIPTION PREFERENCES

If you are receiving this publication in error or wish to be removed from our distribution lists, please contact marketing@aeecenter.org.

If you received a copy of this publication digitally via email and want to update your subscription preferences, please use the links provided in the email you received.

when we're not actually doing the M&V for our clients, understanding what needs to be done and the processes involved in that can help us provide some synergy with what they are doing. Our efforts may be more involved in energy modeling or calculating savings for a particular energy conservation effort. Still, we can take measurements that may have been for us before but now, with witnessing and doing the documentation required for M&V so our client can take those measurements and use them later on. It also helps mold our approach to certain calculations and energy engineering tasks, knowing that things will be done later. I think it's given us a better product for our customers and makes us more valuable to them and has given us additional revenue streams.

Why should someone become a CMVP?

If you're involved in measurement and verification either through performance contracting or a rebate program with utility, I think the M&V process can be a little non-intuitive. I think it's very important for the industry to stick to standards like the IPMVP and consistency across the board. I found the CMVP Certification helpful to frame the mental approach you take to M&V to create a solid plan and process. I think the industry strongly encourages people to get this certification if they are involved in measurement and verification. I believe this is the only M&V certification out there that is widely known and respected.

SEE JOHN'S VIDEO>>



#ExploreTheEfficiency



Whether it's hiking, biking, or scuba diving, AEE encourages you to explore and enjoy the world our members are making more sustainable and efficient. Share your expeditions with us using our newest hashtag, **#ExploreTheEfficiency**.

From the heights of Lebanon to Niagara Falls, right down to the South Pole, wherever you go, enjoy the world we are making better together.



Trending 15%

of the US commercial building floor space, eleven billion square feet, is now covered by an energy benchmarking and disclosure policy.

With the building sector consuming 40% of total US energy consumption and representing up to 80% of a city's greenhouse gas emissions, state and local governments have targeted more efficient built environments critical to their environmental and economic improvement goals. Local and state-level ordinances are an established and growing strategy for governments to understand the amount of energy commercial buildings consume, show their greenhouse gas footprints, and develop strategies to mitigate resulting emissions.

More and more frequently, these laws designate that a certified professional participates in a portion of the compliance process, representing a business opportunity for AEE members. With that in mind, you may want to know what these requirements are, what markets are they in, how these initiatives

are evolving, and how you can help your customers comply. As you begin supporting compliance, you can use the results to engage customers in discussions about energy and water efficiency improvement projects to improve their publicly disclosed scores.

The ongoing story of state and local benchmarking ordinances dates back over a decade. In 2005, Washington State legislation required all state buildings benchmark using EPA ENERGY STAR's Portfolio Manager. Shortly after, in 2007, California followed suit and went beyond state-owned and managed properties to include larger private sector buildings in its legislation. The trend has continued, with more local governments passing their

"the building sector consumes 40% of total US energy consumption and represents up to 80% of a city's greenhouse gas emissions"

variations of ordinances that require owners to benchmark in Portfolio Manager and share the results with the city for compliance and public disclosure. Since Washington and California's initial efforts, the list of state and local governments with benchmarking ordinances has grown to nearly 40, including those shown in the graphic below.



An interactive version of this map can be found at www.energystar.gov/policiesandprograms.

A number of these ordinances, including those in Atlanta, New York City, San Francisco, and Seattle, require buildings to take the next step in identifying energy performance improvements via energy audits and retro-commissioning (often with an exemption available for properties that have earned ENERGY STAR certification). Upon completion of the assessment, laws may require owners to pay for upgrades in cases where buildings are under performing or otherwise show potential for a strong return on investment. The increase in the scope of benchmarking laws also encompasses water tracking, with 24 local governments, DC, and New Jersey now requiring that water data be submitted to Portfolio Manager. These additional requirements create significant business opportunities for AEE members to help owners assess, optimize, and/or upgrade buildings to meet compliance. More specifically, opportunities exist for CEAs and CEMs in some jurisdictions where the ordinance requires that a certified professional sign off on energy audits, complete data quality

verifications, or support other aspects of compliance.

Boulder, CO and Montgomery County, MD are examples of these jurisdictions. Boulder lists CEMs and CEAs as qualified professionals to complete periodic energy assessments and retro-commissioning requirements. Montgomery County requires that building owners have their performance data verified by a professional before submission. CEMs and CEAs are listed as professionals identified as acceptable verifiers by the County.

Another trend for jurisdictions that want to raise the bar is a focus on GHG or energy building performance standards. Building performance standards require that buildings owners implement building improvements until they meet certain performance thresholds. Currently Washington state, DC, NYC, and St. Louis have these types of requirements in place, and it is worth noting that quite a few other state and local governments are considering similar performance standards.

Certainly, the increase in scope of the laws is a trend but perhaps the biggest trend is toward the laws increasing in building coverage and the overall number of laws being passed. Several jurisdictions have updated their laws to incorporate more buildings typically by lowering the square footage threshold or adding a new property type (often multifamily). Then there is the trend for smaller cities to pass laws. Initially large cities led the way and smaller cities have taken note of the success with more and more proposing and passing their own laws. A few examples include Reno, NV, Evanston, IL, and Columbus, OH.

With varying scopes and approaches, benchmarking ordinances are a significant trend, and one that AEE members should be aware of. If a benchmarking ordinance is not impacting a customer of yours now, it is likely not too long before your customers will be asking about compliance.

For more information on ENERGY STAR, go to www.energystar.gov



AEE's headquarters in Atlanta, GA was Energy Star Certified in 2017.



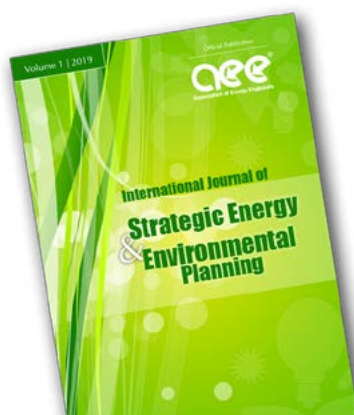
illuminating Light Quality

By Stephen A. Roosa, Ph.D., CEM, CSDP, REP, BEP

Continuous improvements in lighting technologies are occurring at a dizzying pace. Lamp manufacturers have strived for move light, better quality, higher efficiencies and a wider range of colors. Many energy-efficiency projects for buildings include energy conservation measures that involve strategically replacing lamps or light fixtures. In such cases, energy managers often propose more resilient lighting solutions, replacing outdated lighting systems with new technologies to reduce costs. While there is a drive to capture the potential savings, it is important that changes to lighting systems do not sacrifice light quality. When a lighting system replacement is properly engineered, new technologies can be employed that provide both energy savings and improve light quality.

How do we ensure that we are providing quality light for our building's occupants? This article addresses this important issue. Human physiological responses to light and the primary measures of light quality are considered. It further demystifies the various measures of light quality and explores their applications. These measures include color temperature, color rendering index and visual comfort probability. It also provides suggestions on how light quality can be improved and details the characteristics of quality lighting.

Read the Expanded Article in the **International Journal of Strategic Energy & Environmental Planning**



PSYCHOLOGICAL RESPONSES TO LIGHT

The human eye has evolved by exposure to natural daylight. When artificial lighting is provided, lighting designers are concerned with both the quantity and qualities of the light produced. While levels of illumination are important, so is light quality.

The human eye is capable of adjusting its vision to widely-variable light conditions. The amount of light (light level) that is needed depends on the task. These variable requirements pose a strong argument for natural lighting or artificial lighting that approximates the qualities of daylight; however, such light often produces glare when used indoors on sunny and cloudless days. The human eye responds to the portion of the visible light spectrum roughly between 400 nm (violet) to 700 nm (dark red). While sunlight can be seen and felt (due to heat), ultraviolet (UV) light cannot.

Light quality influences human behaviors, attitudes and performance. People have surprising physiological responses to light quality and color. Studies have indicated that ultraviolet rays in sunlight make people feel good, releasing beta-endorphins. However, exposure to high levels of UV light (10 nm to 400 nm) can be harmful to humans and is used to sanitize for viruses. Lamps that emit higher levels of blue light produce serotonin, which makes people more focused, keeping them more awake and alert [1]. It also serves as a natural mood stabilizer and aids with sleeping and digesting. Lamps that emit no or lesser levels of blue light waves allow for our brains to naturally produce melatonin, causing us to feel relaxed and drowsy [2]. Excessive amounts of melatonin, especially during waking hours, may also create moodiness and irritability.

(Article continues on page10)



Virtual in Turkey

AEE Instructors, Tim Janos and Louis Lagrange taught a Virtual Certified Energy Manager (CEM) course for Turkish engineers hosted by the AEE Turkey Chapter and the Turkish Society of HVAC and Sanitary Engineers.

The CEM program was first presented in Turkey 4 years ago as part of the scope of the "Promoting Energy Efficiency in Buildings Project". The program was implemented by the Directorate General of Renewable Energy of Ministry of Energy & Natural Resources of Turkey and the United Nations Development Programme (UNDP). This recent program continues to build local capacity and certify local engineers in energy management and energy auditing, while also creating a sustainable pathway to AEE's certification programs through developing local trainers.



Industrial Energy

The first two internationally presented Certified Industrial Energy Professional (CIEP) programs were held virtually in November and December 2020 in Saudi Arabia, instructed by Albert Williams with remote proctored certification exams.



Albert Williams is CEM, CEA, CIEP, CMVP, CRM, REP, and BEP Certified, and a UNIDO International Energy Expert

"Industrial sector consumes more than 45% of total primary energy in Saudi Arabia, most of this percentage goes to the industries of steel, petrochemical and cement with 70% of the total consumption in this sector while the rest of the energy is consumed by other industries such as paper, glass, ceramic, etc. For this reason, an initiative was launched to provide the Association of Energy Engineer's Certified Industrial Energy Professional (CIEP) program, which will significantly contribute to the knowledge of local human resources working in the field of industrial energy efficiency."

Saudi Energy Efficiency Center (SEEC), AEE's Training Partner in Saudi Arabia



المركز السعودي لكفاءة الطاقة
Saudi Energy Efficiency Center

"I would recommend to my colleagues"

"I am a chemist, but most of my experience is process engineering in cement industry - very valuable"

"As a utility engineer I appreciated the program's organization and the reference data"

On-Demand Training Programs



Watch pre-recorded videos easily, anytime, and anywhere. Each video has been recorded explicitly with the on-demand viewer in mind.

Currently Available Programs

CEM[®]

STREAMING CONTENT

ON-DEMAND TRAINING PROGRAM

24 Program Hours | Earn 2.4 CEU

PCF

STREAMING CONTENT

ON-DEMAND TRAINING PROGRAM

6 Program Hours | Earn 1.2 CEU

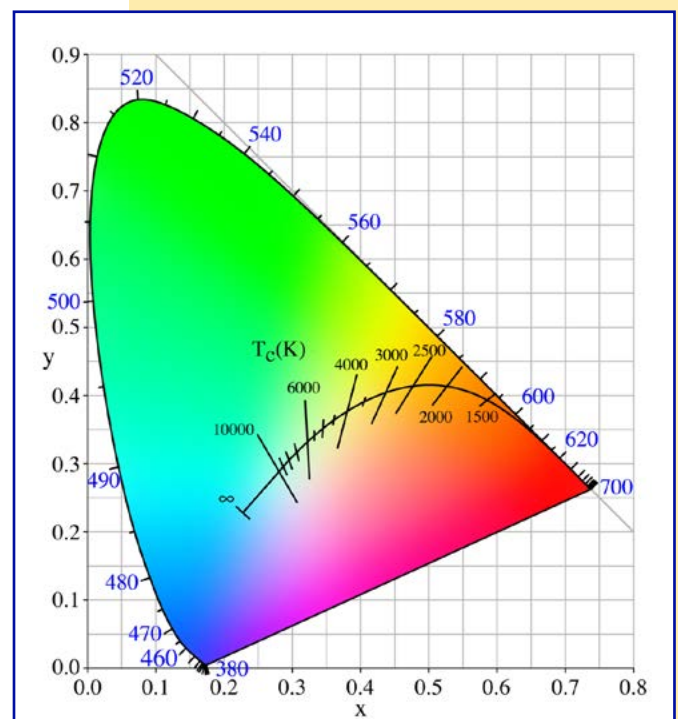
education.aeecenter.org/on-demand



<< FIND A
PROGRAM

DEMYSTIFYING MEASURES OF LIGHT QUALITY

Lighting system design focuses on the need to provide the appropriate quantity and quality of light for a given task. Good quality light does not produce glare, is not too dim nor overly bright, provides uniform illumination and has appropriate qualities for the task. Providing quality illumination is complicated since human vision varies widely. For example, elderly people often require higher light levels for tasks such as reading. In places where some natural lighting is available, the amount and quality of artificial light required may vary. How is light quality measured? There are a number of ways to measure light quality. Common measures of light quality include the color temperature, the color rendering (rendition) index, and the visual comfort probability.



The CIE 1931 x,y chromaticity space, also showing the chromaticities of black-body light sources of various temperatures (Planckian locus), and lines of constant correlated color temperature.

Color Temperature

The correlated color temperature (CCT) is a measure of the color of a light source relative to a black body at a particular color temperature. It is expressed using the Kelvin (K) scale [2]. This classification scale was first invented by Lord Kelvin in 1848 in Belfast, Ireland. The lower the color temperature number, the warmer or more yellow the light. The higher the color temperature, the colder or the bluer the light. Daylighting has a color temperature of about 4500°K. Incandescent lamps have a lower color temperature and a red-yellowish tone or a color similar to that of glowing fire [2]. Soft white lamps (2700°K to 3000°K) provide a yellowish light and offer a smoother, more relaxing feel. Cool white lamps (4100°K) emit a whiter light mimicking daylight and are often used for kitchens, work areas and outdoor lighting.

Lamps rated between 5000°K and 6000°K emit a slightly bluish white light resembling noon on a cloudless day [2]. Lamps above 6000°K tend to have a stronger bluish cast [2]. To add perspective, the color temperature of sunlight typically ranges from 5000°K to 5400°K. This color temperature range reproduces the effect of direct sunshine, considered to be a preferred color for most outdoor activities as it is native to human eyesight. However, sunlight varies widely based on atmospheric conditions, the angle of the sun and weather. The CCT of a uniform to moderately overcast sky ranges from 6500°K to 8000°K.

Color Rendering Index

While both are measures of light quality, the correlated color temperature should not be confused with the color rendering (or rendition) index (CRI). The CRI is a quantitative measure of the ability of a light source to reveal the colors of various objects faithfully in comparison with an ideal or natural light source [3]. Light with higher CRIs makes it easier for humans to distinguish colors.

The CRI is determined by the spectrum of the light source and values normally range from a low of 0 to a high of 100. However, some low-pressure sodium (LPS) lamps actually have negative CRI values [3]. Higher CRI values equate to sharper, crisper and more natural colors [2]. Sources of light with a CRI less than 45 provide poor color rendition while light sources with CRIs greater than 75 provide excellent color rendition. A CRI of 100 is identical to standardized daylight. For merchandizing applications, higher CRIs (>90) are important to highlight products, enabling them to be visually characterized by potential purchasers. For specific tasks (e.g., color printing, art restoration, food preparation, and in emergency or operating rooms) providing light with a high CRI is important to allow occupants to distinguish colors without risking errors in judgment.

Visual Comfort Probability

The visual comfort probability (VCP) is a subjective rating assigned to a light fixture that indicates the percentage of people who are comfortable with the glare being produced at a scene (specific location) by the light source [4]. Glare is the effect of sufficiently high differences in brightness within the visual field to cause annoyance, discomfort or loss of visual performance [4]. The VCP rating scale (also from 0 to 100) is applied only to indoor light fixtures and is designed to indicate how well the fixtures are accepted by the occupants. It is usually provided in a luminaire's (entire fixture with lamps) photometric test report.

A VCP rating of 75 indicates that 75% of the occupants in the scene's area with the poorest conditions would not be bothered by direct glare. Most specifications for office areas mandate a VCP rating ranging from 70 to 80. To minimize glare, lighting designers use indirect lighting, obscure bare lamps from the occupant's field of view, relocate existing light fixtures, or replace them with ones that have a higher VCP [4].

What Light Quality Is Best?

Energy engineers understand that luminaire and lamp selection must be carefully considered to deliver quality lighting. Lighting systems must be designed to provide both the correct amount of light and the appropriate quality of light for a given task while not creating glare. This goal is not easily accomplished and there is often no optimum solution that meets all requirements. Light quality can be complicated by a number of variable conditions. For example, the introduction of natural light in an occupied space can cause variable light quality and levels. Various tasks can be performed in a common space, creating the need to vary light quantity or quality. While this might seem easier to resolve in new construction, lighting systems in new buildings are often over-designed to compensate for losses of illumination that will occur during the operating lifecycle of the lighting system used. Since lighting technologies are rapidly evolving, lighting designers have a wide-range of new options to consider. For existing buildings, retrofit solutions can successfully improve light quality while reducing energy and maintenance costs.

What light quality is considered to be perfect? This is a difficult question that lighting engineers grapple with daily. This is because the best light quality for an occupied space varies based on the design parameters. There is actually not a perfect light quality for all people and all tasks. Typically, areas with higher quality artificial lighting have a correlated color temperature in the range of 2800°K to 4100°K, a color rendering index of 75 or higher, and a visual comfort probability greater than 70.

IMPROVING LIGHT QUALITY

Lighting system designers have many simple ways to improve light quality in occupied spaces. For residential applications, a focal point is selected for the light fixture placement. Otherwise, the human eye naturally tends to gravitate to visual clarity without focusing on a specific location. Balanced lighting is achieved by adding layers of light with a minimum of three sources in every space [5]. During daylight hours, windows and skylights can be used as a natural source of light. In smaller spaces, lamp wattage and fixture size can be reduced to better match the smaller illuminated areas [5]. Other ways include changing fixture placement, scaling, using light control applications, spot lighting for tasks, and varying fixture height when possible [5]. Mechanical approaches to reducing glare include changing surfaces to lower their reflectance, adding parabolic louvers or diffusing media, and installing blinds or shades to better control the transmittance angle of direct sunlight penetrating the occupied space.

In this era of the world-wide Covid-19 pandemic, home offices and home schooling are becoming the norm. Improving light quality in such spaces can be challenging. Many were rarely designed for such purposes and lighting conditions in these spaces vary widely. To confound this issue, existing ambient lighting is usually not functional lighting for home offices or educational purposes meaning supplementary light sources must be added [6]. It is important to avoid glare. Ways to manage this include having natural light available and providing ways to diffuse the ambient light entering the occupied space, especially at task. Effective solutions require keeping the light sources indirect with respect to the tasks, illuminating the entire space without creating undue glare or contrast, and avoiding the creation stark shadows [6].

Offices offer another set of priorities. The U.S. General Services Administration (GSA), one of the country's largest office providers, understands that every type of

work environment requires a certain amount of light to improve workers performance. Office lighting standards for a typical workstation requires 500 lumens/m² [7]. The GSA suggests that fluorescent ceiling fixtures offer the best office lighting. The layout of the lighting should provide an even amount of illumination across the entire office space [7]. It should also mitigate the effects of shadows from cubicle walls or partitions, and be adjusted to minimize these and other problem areas [7]. In open-plan office areas, the most direct light must be provided in the workstation itself, while allowing dimmer light in areas such as corridors and walkways [7]. It is important to provide individual task lighting that allows workers to adjust workstations to their personal needs and preferences [7]. For areas with computer workstations, computers should not be placed against a contrasting light source, such as nearby windows, or directly beneath the line of sight [7].

CONCLUSIONS

Humans have interesting physiological responses to light and light quality. It is important that when changes to lighting systems are proposed, the quality and quantity of light provided is maintained or improved. There are many strategies for improving light quality. Appropriate light quality can be accomplished by matching the lighting system design to appropriate measures of color temperature, color rendering and visual comfort. It was stated that the common measures of light quality used for artificial lighting include the correlated color temperature, the color rendering index, and the visual comfort probability.

The need for quality lighting systems supports continuous innovation in the lighting industry. Lighting technologies are continuously evolving, with newer and improved lamps and fixtures becoming available. The focus has been to incrementally improve light quality, lower lamp and luminaire costs while significantly reducing energy use and maintenance costs.

[1] EarthLED (2018). How to choose the best LED light bulb. <https://www.earthled.com/blogs/light-2-0-the-earthled-blog-led-lighting-news-tips-reviews/37176324-how-to-choose-the-best-led-light-bulb-for-any-room-in-your-home>, accessed 6 July 2018.

[2] The LED Light, Inc. What is... LED definitions. <http://www.theledlight.com/led-definitions.html>, accessed 6 July 2018.

[3] Wikipedia (2020). Color rendering index. https://en.wikipedia.org/wiki/Color_rendering_index, accessed 13 December 2020.

[4] Roosa, S. (ed.) (2018). Energy Manager's Handbook, 9th edition, pages 373-405. The Fairmont Press: Lilburn, Georgia.

[5] BH&G Editors (2020, January 2). 15 ways to instantly improve your home's lighting. Better Homes and Gardens, <https://www.bhg.com/home-improvement/lighting/planning/how-to-improve-lighting/> accessed 6 December 2020.

[6] Desmond, M. (2019, February 2). How to create better home office lighting. <https://www.thespruce.com/tips-for-better-home-office-lighting-1812436>, accessed 6 December 2020.

[7] Grainger (2016, December). 5 things about office lighting you should know. <https://www.grainger.com/content/supplylink-office-lighting-standards>, accessed 6 December 2020.

Our Founder

His Passion for People and Events

A personal story from Lauren Lake, AEE's Director of Events.

More than four decades ago, a spirited and innovative engineer from New York had a vision. He saw a need to bring professionals in the energy efficiency industry together. He left his corporate job and moved his family to Atlanta, and with no financial backers or grants, he started the Association of Energy Engineers (AEE).

Today, Al Thumann's mission is still thriving, with over 18,000 members in more than 100 countries—a truly global organization.

Al always said, "AEE is a family," and he backed that up with action. I'm sure it's no coincidence that when Al founded AEE in 1977, he immediately built a flagship event. The first World Energy Engineering Congress® was in Atlanta, GA, at the Royal Coach Inn in 1978, and thus began more than 43 years of conference and expo events at AEE.

Al was very focused on fostering education at events for attendees, so he always emphasized finding the best speakers for these events. But when someone recently asked me about what events meant to Al, I think about something else he

would say, "events bring the AEE family together." Building relationships that feel like family, the ones that change our lives, must start somewhere. They allow us to connect over a common interest and make the global community seem more local and personal. Al loved people and enjoyed bringing everyone together to network and make friends.

"AEE is a family,"

Since we haven't met in person in more than a year, I've been reflecting on what makes networking at industry events so significant.

We can recreate the educational content in a virtual environment and deliver timely and relevant updates from experts in the field. What we cannot replace virtually is the value of face-to-face interactions.

Here are some reasons I think networking is so powerful and a cornerstone of why Al loved events so much:

- 1 Helping Others** — Attendees enjoy helping others with connections, career goals, and technical information; it feels good to help others. And the more you help others, more help comes your way. You'll find the advice from your connections can guide you from what a potential client might like to tips on interviewing at a certain company. The more people you know and help the more likely you are all to say "been there, done that, how can I help you succeed?"

Al Thumman, Founder AEE - 1978



2 Being More Visible & Get Promoted — Whether you are looking for a job or looking to stand out at your current position, networking helps you stay visible. Be the person that everyone knows and the one who can introduce others. Many studies have shown that having a great network makes you more visible and valuable to your boss, which may be rewarded with promotions and salary increases.

3 New Opportunities & Opened Doors — When you are more visible, there are more opportunities for conversations that lead to career growth, promotions, new jobs, or just meeting that important person who changes your career path for the better.



First WEEC Event - 1978



Keynote Speaker - Andrew Young, Atlanta Mayor - 1983



Chapter President Workshop - 1992



International Delegation - 1998



Recognition Awards - 2000

4 Expressing Opinions and Sharing Fresh Ideas

— Your family and friends are probably not your go-to for sharing your ideas about the industry and trends or your thoughts on a new project at work. Fellow attendees will welcome this and can give you valuable advice and share insights.

Continuing education and research can help you stay up to date on the ever-changing energy field, but speakers and other attendees have a wealth of knowledge you can grasp through a simple conversation.

5 Self-Esteem Lift

— People need to connect to people. And even if you are an introvert like me, you'll benefit from sharing your advice and opinions, and knowledge with others. You have a lot to offer!

6 It's the Best Resource

— Sometimes you can't search online for that answer. You need one-on-one opinions from professionals in your field.

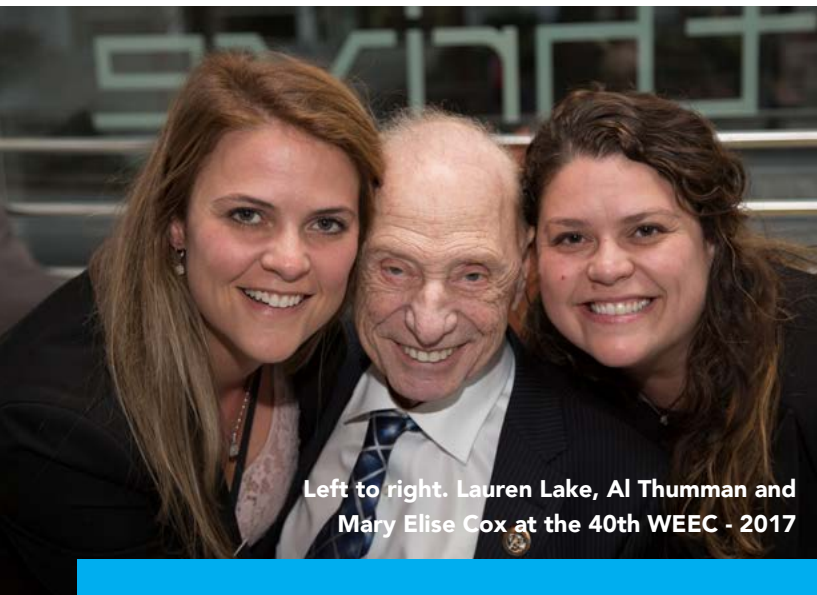
7 Influencers

— The more extensive your professional network, the more likely you'll know and have access to the right influencer at the right time, whether it's to help you excel in your current job or someone who will put a good word in for a new job. OR, you can be that influencer for someone else.

When you can brush up on your technical knowledge AND gain lifelong friends and a sense of belonging, you've found why industry events can be so valuable. That's why we build these events for you as a member benefit and pack them with so many networking opportunities.

I bet Al realized that he would cherish relationships and experiences most when he looked back over his life. He believed in continuing education and being together, and he loved his AEE family. Events allowed him to be with all of you from around the world. If you knew Al, you know he was one-of-a-kind, had a heart of gold, and his energy was contagious. His passion for life and people will always be an inspiration.

I'm grateful Al trusted me with his vision for events 17 years ago, and I'll continue to do my best to keep our conferences fun and rewarding. After all, it's the connections we make and the relationships we build that help shape who we become and have the power to change our lives.



Left to right. Lauren Lake, Al Thumman and Mary Elise Cox at the 40th WEEC - 2017

If you have a story of how an AEE event changed your life, please email me at lauren@aeecenter.org. Every story I hear motivates me to make events better for our members, and I love what I do because it furthers Al's vision.

aee® ENERGY
CONFERENCE & EXPO

WORLD

Oct. 20-22, 2021 New Orleans, LA

In-Person + Virtual



aee.world.org

Earth's Energy Engineers

Our members and certified professionals put their energy into slowing climate change.

Why? Because energy efficiency reduces carbon emissions, which offsets climate change. We think that's energy well spent.

earthsenenergyengineers.com



A VIRTUAL EVENT
earthsenenergyengineers.com

CLIMATE ACTION
CONNECT

JUNE 23
2021

Connecting Energy Engineering & Energy Efficiency for a Sustainable Energy Future

Behind the Campaign

In early 2020, the AEE Board of Directors requested an initiative to promote the great work you [AEE members] do to people outside of the industry. We engaged with an external agency to get creative, and in November 2020, we launched the Earth's Energy Engineers campaign.

The concept was simple and accurate. No matter where our members are or what they are doing, they are thinking about how they can be more energy efficient. Whether they know it or not, they are making significant impacts to offset the effects of climate change.

The digital advertising campaign ran for three months, and we also posted to our social

accounts. The ads gained a lot of positive feedback for their creativity and humor. They over performed against industry benchmarks, generated over 2.6 million impressions, and sent over 53 thousand people to the earthsenergyengineers.com website to learn more about what you do and the impact you make.

We are continuing the campaign with a one-day virtual event - Climate Action Connect. Mark it in your calendars to attend, and it's free to AEE Members. Also, keep an eye out as we continue the campaign; maybe you have a story to tell? Did you see the ads online? Let us know your favorite at: **marketing@aeecenter.org**.



**Our members slow
climate change by
removing gas from
the atmosphere.**



The Leading Data Analytics Solution for Energy Analysis, MBCx and M&V

SkySpark® Analytics automatically analyzes data from building automation, metering systems and other smart devices to identify issues, faults and opportunities for savings. Learn why SkySpark has been deployed to over 1 Billion square feet of facilities around the world for energy management, optimization, monitoring-based commissioning and fault detection.

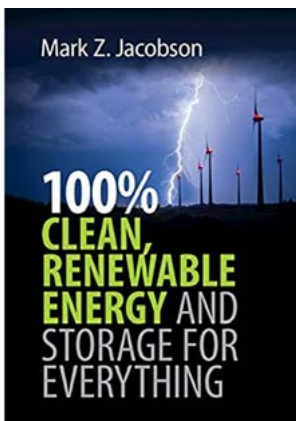


Find What Matters™ to Improve Equipment Performance and Reduce Operational Costs.

www.skyfoundry.com

SkyFoundry

 **Project Haystack**
Founding Member

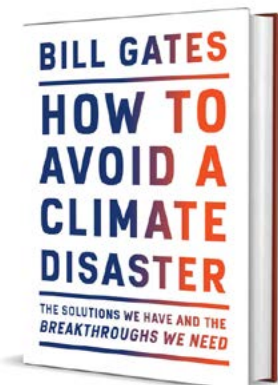


Recommended Reads

100% Clean, Renewable Energy and Storage for Everything

Prof. Mark Z. Jacobson

Focusing on solutions and how to solve the significant problems, eliminate pollution, stabilize temperature, and eliminate the insecurities to unequal distribution of fossil fuels. Electrification, storage, demand response, and how to supply the global energy demand using clean, renewable energy systems are outlined in the book.



How to Avoid a Climate Disaster

Bill Gates

Bill covers how the world needs many breakthroughs to transform to clean energy businesses, live healthy lives while emitting zero GHG. Avoiding a climate disaster is the greatest challenge for all humans. The power of group work, scalable inventions, trust, cooperation, accepting failure, helping others, and picking up where they left off to find better solutions is paramount to human survival.



Empowering Growth in Africa

AEE's Ghana Chapter, the Association of Energy Professionals Ghana (AEPG), recently created an Editorial Committee and a CWEEL group. The committee will communicate and help educate on energy-related matters specific to Ghana and the African Continent at large. The CWEEL group will help promote women and their roles in this normally male-dominated industry. AEPG hope both initiatives will help bring a renewed focus on energy, the environment, sustainable development, and climate change in the region.



The Members of the Editorial Board of AEPG include Ing. Bismarck Otoo, Nurideen Abdulai, Jonas Henry, Dominic Obeng, Sharon Flora Frimpong, Marina Agortimevor, and Kafui Dei.

Current AEE Chapters





(Country | Chapter Name | Date Established)

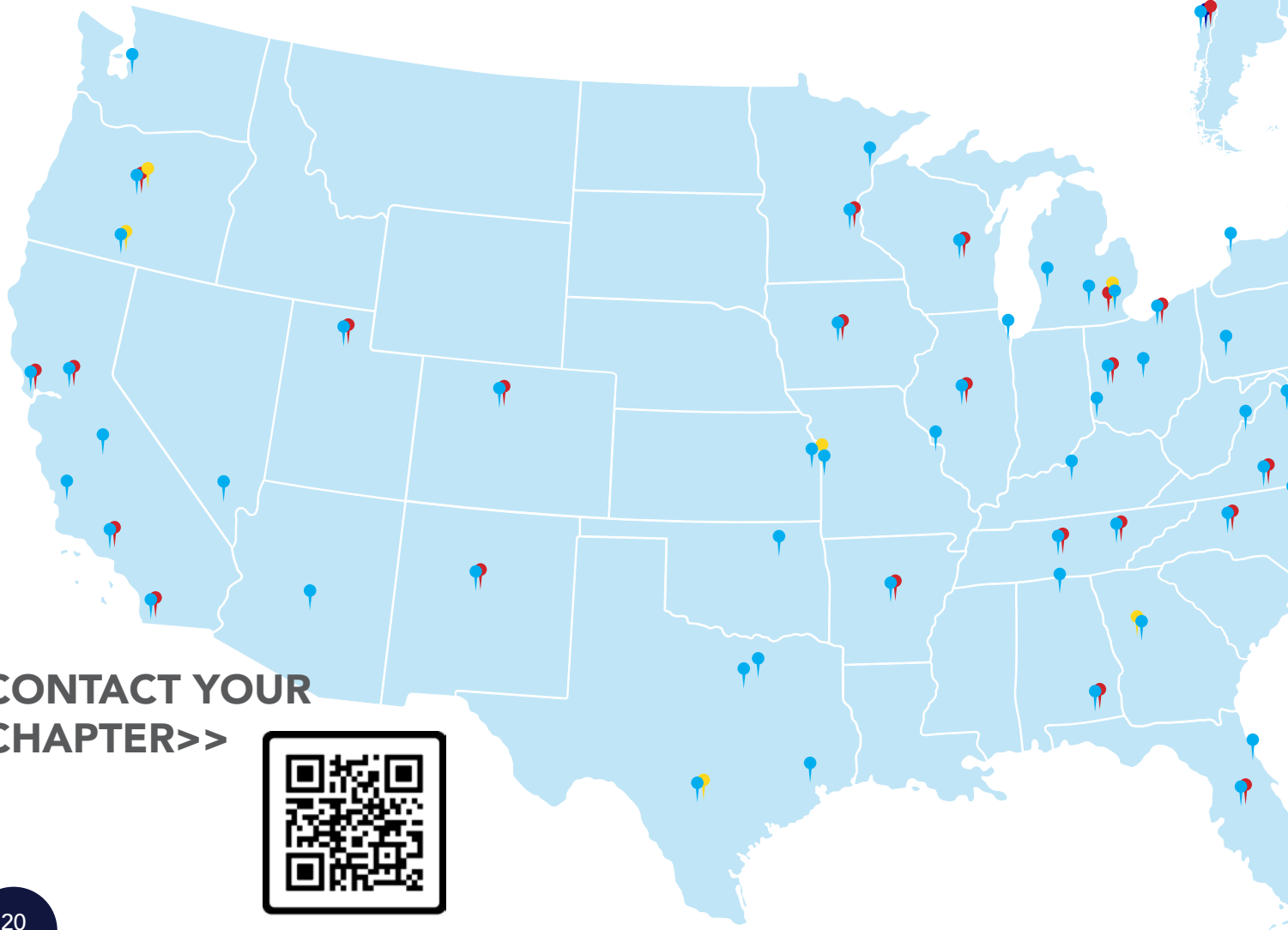
Algeria | Algeria Chpt. | 2021
 Bangladesh | Bangladesh Chpt. | 2011
 Brazil | AEE CEFET-MG Stdnt. Chpt. | 2020
 Brazil | Brazil Chpt. | 2016
 Bulgaria | Plovdiv Chpt. | 1995
 Canada | Alberta Chpt. | 2015
 Canada | East Canada Chpt. | 2017
 Canada | Greater Toronto Area Chpt. | 1999
 Canada | Hamilton Chpt. | 2015
 Canada | Metro Vancouver Chpt. | 2019
 Canada | Southwestern Ontario Chpt. | 2016
 Canada | Univ. of Windsor Stdnt. Chpt. | 2019
 Chile | Capitulo Chileno Chpt. | 2014
 China | Central China Chpt. | 2019
 China | China Chpt. | 2014
 China | Hong Kong Chpt. | 1980
 Cyprus | Cyprus Chpt. | 2005
 Dominican Republic | Dominican Rep. Chpt. | 2015
 France | France Chpt. | 2015
 Georgia | Georgia Chpt. | 1999
 Ghana | Ghana Chpt. | 2020
 Hungary | Hungary Chpt. | 1993
 Hungary | Hungary Stdnt. Chpt. | 2006
 India | Amity Univ. Stdnt. Chpt. | 2015
 India | Delhi Chpt. | 2012
 India | Kolkata Chpt. | 1996
 India | Kolkata Stdnt. Chpt. | 2019
 India | Vellore Institute of Tech. Stdnt. Chpt. | 2015
 India | Western India Chpt. | 2015
 Ireland | Ireland Chpt. | 2007
 Jamaica | Jamaica Chpt. | 2009
 Jordan | Al al-Bayt Univ. Stdnt. Chpt. | 2020
 Jordan | Al Balqa Applied Univ. Stdnt. Chpt. | 2018
 Jordan | Al Hussein Tech. Univ. Stdnt. Chpt. | 2019
 Jordan | German Jordanian Univ. Stdnt. Chpt. | 2016
 Jordan | Hashemite Univ. Stdnt. Chpt. | 2020
 Jordan | Jordan Univ. of Science & Tech. Stdnt. Chpt. | 2015
 Jordan | Middle East Univ. Stdnt. Chpt. | 2020
 Jordan | Princess Sumaya Univ. of Tech. Stdnt. Chpt. | 2015
 Jordan | Tafila Tech. Univ. Stdnt. Chpt. | 2020
 Jordan | Univ. of Jordan Stdnt. Chpt. | 2016
 Kazakhstan | Kazakhstan Chpt. | 2014
 Kenya | Eastern Africa Chpt. | 2014
 Kuwait | Kuwait Chpt. | 2004
 Lebanon | Lebanese American Univ. Stdnt. Chpt. | 2020
 Lebanon | Lebanon Chpt. | 1999
 Lebanon | ULFGII Stdnt. Chpt. | 2018
 Lebanon | ULFS3- PNRJ Stdnt. Chpt. | 2018
 Lebanon | Univ. of Balamand Stdnt. Univ. Stdnt. Chpt. | 2018
 Malaysia | Malaysia Chpt. | 2014
 Mexico | Nuevo Leon Chpt. | 2008

(Chapter list continues on page 26)

We Are Local, We Are Global

Chapters promote AEE's goals and programs on the local level while establishing themselves in their various communities as the "go-to" organization for all energy related matters.

-  AEE Chapter
-  AEE Student Chapter
-  CWEEL Representation
-  Training Partner



**CONTACT YOUR
CHAPTER>>**





AEE Employee *Spotlight*



Mel Claus, AEE's
Membership Director
and her dog Onyx.



Mel is one of the most recent additions to our team. She is our Membership Director and is responsible for overall management of AEE membership, enhancing member benefits and membership growth. Mel holds a Bachelors Degree in Strategic Communications from West Virginia University, USA. Mel likes to go to the lake on the weekends with her dog Onyx. She can be reached by email at mel@aeecenter.org, or phone at (770) 447-5083, ext. 238.

Connect with Mel



Global, Recognized, Accredited.



Certified Energy
Auditor



Certified Energy
Manager



Certified Building
Commissioning Professional



Business Energy
Professional



Carbon Auditing
Professional



Certified Demand Side
Manager



Certified Energy
Procurement Professional



Certified GeoExchange
Designer



Certified Industrial
Energy Professional



Certified Lighting
Efficiency Professional



Certified Measurement &
Verification Professional



Certified Sustainable
Development Professional



Certified Water
Efficiency Professional



Distributed Generation
Certified Professional



Energy Efficiency
Practitioner



Green
Building Engineer



Performance Contracting
& Funding Professional



Renewable Energy
Professional



What Makes You Stand Out?

Contribute *To Your Magazine*

For Members, By Members



Write a Technical Article

Do you have a technical article, research paper, success story, or news that you think would be of interest to AEE Members?

—Email marketing@aeecenter.org with the details.



Tell us about Your Chapter

Tell us about your stories. Maybe your chapter or its members has been instrumental in an energy efficiency project or defining policy that impacts your local communities.

—Email marketing@aeecenter.org with the details.



Share Your Stories and Photos

Do you have something unique to share? The easiest way is to post to your social accounts while adding a relevant tag, such as @AEE, #exploretheefficiency #AEEworld. Or you can email them to marketing@aeecenter.org with a short story.



Advertise in Efficiency

As a non-profit organization, advertising helps offset production costs and enables us to do more for our members. Email inquiries to marketing@aeecenter.org. Only products and services relevant to our members will be considered for placement. Space is limited.

Next Edition - Fall 2021





Current AEE Chapters

(Country | Chapter Name | Date Established)

Morocco | Morocco Chpt. | 2021
Nepal | Nepal Chpt. | 2019
Nigeria | Nigeria Chpt. | 2007
Pakistan | Dawood Univ. of Engineering & Tech. Stdnt. Chpt. | 2018
Pakistan | Pakistan Chpt. | 2018
Pakistan | Univ. of Engineering & Tech., Peshawar Stdnt. Chpt. | 2018
Palestine | An-Najah Stdnt. Chpt. | 2016
Palestine | Palestine Chpt. | 2015
Palestine | Palestine Polytechnic Univ. Stdnt. Chpt. | 2019
Palestine | Palestine Technical Univ. Stdnt. Chpt. | 2018
Romania | Cluj-Napoca Chpt. | 1994
Saudi Arabia | Saudi Chpt. | 2012
Slovakia | Slovak Univ. of Tech. in Bratislava Stdnt. Chpt. | 2019
Slovakia | Slovakia Chpt. | 1999
South Africa | Southern Africa Chpt. | 2003
Spain | Spain Chpt. | 2012
Sudan | Omdurman Islamic Univ. Stdnt. Chpt. | 2021
Sudan | Univ. of Khartoum Stdnt. Chpt. | 2021
Tajikistan | Tajikistan Chpt. | 2017
Tunisia | National School of Engineers of Monastir Stdnt. Chpt. | 2019
Tunisia | Tunisia Chpt. | 2016
Turkey | Turkey Chpt. | 2001
Uganda | Uganda Chpt. | 2018
Ukraine | Central Ukraine Chpt. | 1997
United Arab Emirates | UAE Chpt. | 2005
United Kingdom | UKAEE | 2012
USA | Arizona Chpt. | 1980
USA | Arkansas Chpt. | 1999
USA | Atlanta Chpt. | 1980
USA | Austin/San Antonio Chpt. | 1992
USA | Baltimore Chpt. | 1998
USA | Central Alabama | 2012
USA | Central Illinois Chpt. | 2014
USA | Central Pennsylvania Chpt. | 2006
USA | Chicago-Illiana Chpt. | 1990
USA | Columbia River Chpt. | 2008
USA | Connecticut Chpt. | 1984
USA | Cooper Union Stdnt. Chpt. | 2016
USA | Danville Chpt. | 2013
USA | East Michigan Chpt. | 1998
USA | East Tennessee Chpt. | 2011
USA | George Mason Univ. Stdnt. Chpt. | 2018
USA | George Washington Univ. Stdnt. Chpt. | 2018
USA | Greater Philadelphia Chpt. | 2005
USA | Hawaii Chpt. | 1998
USA | Huntsville Chpt. | 2010
USA | Iowa Chpt. | 2001
USA | Kansas City Chpt. | 1981
USA | Kennesaw State Univ. Stdnt. Chpt. | 2016
USA | Kentucky Chpt. | 2012
USA | Lehigh Valley Chpt. | 2012
USA | Long Island Chpt. | 1990
USA | Long Islant NYIT Stdnt. Chpt. | 2017
USA | Maine Chpt. | 2015
USA | Middle Tennessee Chpt. | 1994
USA | National Capital Chpt. | 1981
USA | Nevada Chpt. | 2012
USA | New England Chpt. | 1981
USA | New Jersey Chpt. | 1980
USA | New Mexico Chpt. | 1988
USA | New York Capital Region Chpt. | 2003
USA | New York City Chpt. | 1983
USA | NorCal Chpt. | 2009
USA | North Carolina Chpt. | 2010
USA | North Texas Chpt. | 1984
USA | Northern Ohio Chpt. | 1986
USA | Ohio Capital City Chpt. | 2009
USA | Oklahoma Chpt. | 1993
USA | Oregon Institute of Tech. Stdnt. Chpt. | 2013
USA | Oregon State Univ. Cascades Stdnt. Chpt. | 2014
USA | Pacific Northwest Chpt. | 1980
USA | Piedmont Chpt. | 2013
USA | Rock Mountain Chpt. | 1998
USA | San Diego Chpt. | 1981
USA | San Joaquin Valey Chpt. | 1985
USA | San Luis Obispo Chpt. | 2008
USA | Silicon Valley Chpt. | 1984
USA | Southeastern Virginia Chpt. | 2009
USA | Southern California Chpt. | 1980
USA | Southwest Ohio Chpt. | 1980
USA | Southwest Virginia Chpt. | 1994
USA | St. Louis Chpt. | 2008
USA | Sunshine Chpt. | 2004
USA | Tampa Bay Chpt. | 1999
USA | Texas Lone Star Chpt. | 2014
USA | Twin Cities Chpt. | 1985
USA | Univerisity of Maryland Stdnt. Chpt. | 2008
USA | Univ. of North Texas Stdnt. Chpt. | 2012
USA | Utah Chpt. | 2008
USA | Voyager Chpt. | 2008
USA | West Central Ohio Chpt. | 1996
USA | West Michigan Chpt. | 1988
USA | Western New York Chpt. | 2009
USA | Western Pennsylvania Chpt. | 1985
USA | Wisconsin Chpt. | 2007

The Power of Mentorship

A mentoring pair from the Council on Women in Energy & Environmental Leadership (CWEEL), Kjrsten and Cissy, have coauthored an Energy Management article for the International Journal of Strategic Energy and Environmental Planning (IJSEEP). "Kjrsten encouraged me to discuss a granular energy data methodology I developed...She also provided constructive feedback to enhance the discussion. I'm grateful to have her as my mentor," said Cissy.

The duo has been working to empower and professionally

develop Cissy's skills and strengths in energy engineering since May of 2019. One of Cissy's professional development goals was to publish an article in a recognized journal, and Kjrsten helped to provide recommendations and resources to support her goals.

Kjrsten is a licensed environmental professional engineer and Certified Energy Manager (CEM). Cissy works as an energy consultant, specializing in analytics related to clients' energy portfolio.



For over 14-years, CWEEL has been committed to supporting career development for professional women and advancing gender equality in a historically male-dominated industry. Visit cweel.org to get involved or learn more about CWEEL's mentoring program.

Chapter Liaisons in the US and Canada.

Many of our chapters have specific liaisons to develop and support the goals of CWEEL. Contact your liaison to get more involved. Don't See Your Chapter Listed? Visit the website to volunteer.

USA

Alabama, Central | Nagea Littleton
Arkansas | Nicole Davis
Baltimore, MD | Nandini Mouli
California, San Diego | Celia Hoag
California, Southern | Amrit Peck
California, Bay Area | Nicolette Sowa
California, San Joaquin Valley | Diana Medina
Colorado | Emily Beck
Columbia River, OR | Elin Shepard
Greater Philadelphia, PA | Ami Amegan
Danville, VA | Heather Wheeler
Illinois, Central | Angela Holloway

Iowa | Kjrsten Bobb
Michigan, Southeastern | Shelley Sullivan
National Capital, DC | Christina DiBerardino
New England | Andrea Moshier, CEM
New Mexico | Tara Trafton
New York, NY | Mazhengmin Bai
Capital Region, NY | Tricia Cioni
Orlando, FL | Melissa Boutwell
Ohio, Northeast | Laura Sherman
Ohio, Southwest | Maryanne E. McGowan
Piedmont, NC | Jennifer Todd
Tennessee, Middle | Leslie Marshall

Tennessee, Nashville | Kathryn Traxler
Twin Cities, MN | Michelle Gage
Utah | Leah Milcarek
Wisconsin | Kathy Leifer

Canada

Alberta | Kelsey Chegus
Southwestern Ontario | Mark Lambert
Southern Ontario | Suzanne Maddar

Growing CWEEL Groups in AEE Chapters

CWEEL has seen tremendous growth across our international chapter network in recent months through the development of CWEEL Groups. These groups, made up of local AEE members, help extend the reach of CWEEL's message as a forum to promote women in the energy industry.

One example of this is the Chilean Chapter (Est. 2017) and the associated CWEEL Group. More than 700 people between 2017-2020 have benefited from the strong representation of women in chapter leadership roles.

"Our purpose of working as founders of the CWEEL Chile Group was to open a space for meeting and empowering women who have chosen the world of energy...we are proud to have laid the foundations for this purpose," said Maria Veronica Tapia, former Director.

"a space for meeting and empowering women who have chosen the world of energy"



The group has been awarded national and international acknowledgments while reducing gender gaps within the energy sector. "It was very gratifying to collaborate with this group of women... we responded to them with training, visibility, and communication of our capacities," said Yahaira Fiallos, former Director. As the women depart their leadership roles, they open these leadership seats to new leaders who wish to drive further success for women in energy. "We have decided to leave and open spaces to new leaders who wish to see the CWEEL Group in Chile with greater success based on the contribution and virtuosity generated by gender parity in work groups, associations, and for course in the energy sector," said Romina Cid, former President (2017-2020).

Join Us

Clean Energy & Career Opportunities Series

A Four-Part CWEEL Career Advancement Webinar Series

This series will examine emerging initiatives and trends in technology, policy, etc., including the Biden Administration, e.g. *American Jobs Plan*, *American Rescue Plan*, and other efforts to help guide people in their prospective career moves and opportunities in the future.

May 5th Save The Dates
May 19th Register Online
June 2nd
June 16th



International CWEEL Groups

— *Bangladesh* — *Palestine*
— *Chile* — *Tunisia*
— *France* — *Turkey*
— *Ghana* — *Ukraine*
— *Jamaica*
— *Jordan*
— *Kenya (East Africa)*

Don't See Your Chapter Listed? Visit the website to Setup a CWEEL Group
cweel.org

How Industrial Projects Get Done

By Jerry Zolkowski, PE, CEM
and Amy Glapinski

While energy consumption and efficiency are a concern for most companies, it is not a top issue. In fact, energy efficiency may not even be on the radar. It is trumped by more pressing problems such as meeting customer demands, workforce capacity, quality, and reliability.

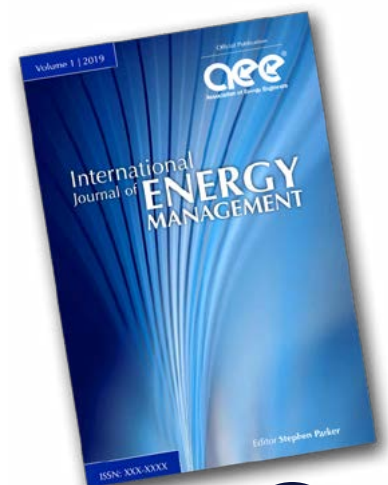
Because these concerns affect the very core operation of a business, saving energy is a lower priority. This is compounded by the fact that energy spent at most sites is a minor cost (less than 3%). It takes money and effort to execute energy projects that may not be as important as other issues. Because of the money and effort it takes to execute energy efficiency projects, these projects have a lower priority.

Yet many companies are actively implementing energy efficiency improvements. The reasons vary and include the following:

- **Some projects, such as lighting, have a good payback based only on the energy savings.**
- **Antiquated equipment eventually gets replaced, and new efficiencies are included.**
- **Expansions bring new capacity that may offer far better efficiency.**
- **Market demands for greener products.**
- **Some ways efficiency projects are implemented in this business environment**
- **An energy review for capital expenditures.**
- **Selling projects that also contribute to business goals such as higher reliability, lower maintenance, or greener products.**
- **An active identification process for new projects.**

Manufacturers exist to make a product, not save energy. Using less energy contributes to the company goals of staying profitable, but not as much as other improvements. For energy use to reduce in this environment, energy projects must coexist and support other business goals.

This article was originally published in the **International Journal of Energy Management (Vol 2. Issue 2)**



CONSUMERS ENERGY IEM PROGRAM

Consumers Energy runs an Industrial Energy Management (IEM) program as part of the larger efficiency incentive program. The goal of IEM is for sites to continually seek energy savings and use the incentive program. Companies start by forming an energy team and receiving some energy management training and Level 1 assessment (about a half day on site total). The Level 1 assessment is only an identification of prospective energy saving measures. Sites that register for the ENERGY STAR® Challenge for Industry or commit to ISO 50001 receive a Level 2 audit that quantifies some of the measures. There is no fee for these services.

The goal for any audit is to identify as many opportunities as possible and show a large percentage reduction in energy expenditure. While that is a noble quest, a limited amount of “free” resources constrains the IEM audits focus on projects that have a higher probability of getting done. Ferreting out which projects the site might be willing to conquer during the audit process requires learning their motivations and limitations.

WHY PROJECTS **DO NOT** GET DONE

First, a look at why great projects do not get done. Every auditor and energy manager has the experience of identifying an energy saving opportunity with a great payback that appeared to be a no-brainer to proceed but did not. There is always a reason why this happens, and some of them include the following:

Not My Job The person receiving the recommendation might want it done, but the task of executing it falls elsewhere – and it is not a priority for the other party. For example, a maintenance manager could show a good return for a new variable-frequency drive (VFD) air compressor, but the project must be done by engineering, and it is not a priority for engineering.

It Is Not Important Enough An energy saving project with a good return is always a great idea, but when it is not as important as other priorities, it does not receive time or financial resources. Other priorities can include just keeping the place running, expansions, and bringing new products to market.

Risk Anytime something changes, there is a chance it will not work as planned. There are different aspects to risk. One is risk that the new equipment may not work as planned, but a larger concern is that the change upsets something more valuable. It is possible that new lighting or controls do not illuminate as intended, but if that shortfall disrupts production then it becomes costly.

Another aspect to risk is “outside the box” changes for upgrades that exceed the

implementer’s comfort level. Directing the cooling air from an air-cooled air compressor into a space that needs to be heated is widely accepted, but adding a heat exchanger to the oil circuit to warm water modifies the OEM (original equipment manufacturer) equipment, which many will not consider.

Insufficient Resources Sometimes it is money or competition for money. There may not be enough to go around, or money just goes to better projects.

More often it is staff time or expertise. Companies have processes for allocating funds and selecting projects. Somebody must get vendor proposals and assemble the business case. When that responsibility falls on someone who is not available, the project does not get done.

Expertise can be another hurdle. When our efficiency program discusses frequency drives for pumps or fans, facilities that have staff capable of installing and programming them perceive it as something they can readily install. Sites that must hire a contractor have the burden of getting a proposal, funding, scheduling, and communicating their needs to the contractor. That can be enough to discourage some folks from acting.

WHY PROJECTS **DO** GET DONE

For all the reasons things do not get done, a great many projects move forward. Some of the reasons successful organizations implement improvements are discussed below.

Money Many projects have strong returns, and the company acts to implement cost saving measures. This is how most vendors try to sell projects, and it is an important factor. Despite the frustration of great projects that do not move forward, most companies operate with the logic that cost reduction is important. Money is also at the root of the next reasons. Some companies seek out incentives to help overcome financial barriers.

Continuous Improvement When we discuss energy management principals with sites, one question we always ask is "Do you have a continuous improvement program?" This seems to be a strong indicator of the company's interest and ultimate success in getting energy savings. When these programs are in place, all employees are seeking cost reductions, and the only cost many can influence is energy use. When an energy saving idea goes into the continuous improvement program, it is assigned to someone that becomes responsible for it, and its progress is tracked. Everyone has a job responsibility to participate in the process, and it is part of the culture. Energy reduction becomes another way to improve.

Continuous improvement has been around awhile, and that is the basis for ISO standards including ISO 50001, the energy standard.

Companies that are already part of such programs find it easy to include energy aspects, but are loathe to take on the burden of an additional system, such as ISO 50001, unless it is required by their customers or supply chain.

Green Aspects The environmental impacts of a project can give more weight to an energy saving proposal. For most companies, their largest environmental impact is the air emissions created from their energy consumption.

Reducing the environmental footprint is something that can be used in marketing. Consumer products and markets where lower environmental impact has value to the customer can use energy savings as a positive product attribute.

Aside from consumer products, some industrial customers are asking their suppliers to implement energy saving measures. Some automotive companies actively seek savings and ask their suppliers to do so as well.

And a final benefit of being green is for the employees. In a period of low unemployment, a company can distinguish itself and look more attractive to folks that want to be associated with a responsible employer.

GET MORE TRACTION

Piggyback on Other Projects Take advantage of production equipment upgrades such as adding an optional meter, taking efficiency upgrades, or including special controls. Upgrading new equipment when it is purchased is less expensive than trying to retrofit it after installation. Due to all the reasons projects do not get done, a retrofit may never happen.

If an expansion needs more central plant services (compressed air, chilled water, steam, etc.), use that chance to upgrade to VFD compressors, VFD pumps, high efficiency chillers, etc. Sometimes the central services can be upgraded, and the existing equipment can be used for backup.

Reliability Everything breaks down eventually. While the notion that a \$100,000 compressor might be down for several hours or days can be taken in stride, it becomes critical when that breakdown disrupts product deliveries and stops hundreds of employees and machines from working, which might be worth thousands of dollars per hour.

Companies deliver products and services. If they are motivated to acquire new equipment because of issues such as repair cost and downtime, a new piece of equipment can be acquired that will also provide energy savings. Often the old equipment is retained as backup.

New Options for Professional Development

Energy efficiency is now at the forefront of conversations related to worldwide sustainable development, electrification, energy equity, and climate action. It is incredible how the pace at which changes occur in our (energy management) sector. AEE's Training Department is continually looking for ways to help support our members with the knowledge and skills needed to further their efforts in improving energy efficiency, including how we support existing certification programs. After all, just because you obtained a certification does not mean you should stop learning.

TRANSPORT

To help support the lifelong learning of our members, we are pleased to announce new Certificate Programs. Each certificate program will focus on one specific technical or industry area in depth. Our first Certificate Program focuses on **Transport Energy Management and Efficiency**, which will be available to virtual participants early summer of 2021. Participants that undertake the online sessions and complete an assessment to demonstrate comprehension and proficiency gain a Certificate of Completion. Certificate programs do not require renewals.



LEADERSHIP



We also want to provide our members with personal development support throughout their careers. Our first program in this area is **Lead Your Life and Energy Career** and aims to help energy professionals become more effective leaders. Participants will have the opportunity to set personal and professional goals, plus learn how to focus on what really matters. This course should be open for registration by the fall of 2021.



Teresa Piazza
AEE Director of Training

Keep a look out for more information on these programs in the coming months.

Being Green Meeting a target payback is often the first hurdle, but after that other aspects influence which projects move forward. Marketing may be able to leverage the company's efforts to reduce their environmental footprint.

Money Quite often the return on an energy projects compliments other cost saving projects, and it gets done. When incentives can be leveraged, the likelihood the project gets implemented increases.

Aside from just the monetary aspect, energy projects are usually lower risk. For example, lower wattage lights will consume less energy, but investing to introduce a new product carries the risk that sales will not reach a sufficient level to provide the expected return.

Better Performance "Everybody loves the new lights." Lighting with superior color or illumination is one example of how modernization can bring better performance and efficiency.

Another example would be how an efficient VFD air compressor can deliver more consistent air pressure to the plant. And another example is how modernized building controls might reduce temperature and humidity variations thereby increasing comfort and productivity.

TAPPING INTO PROJECT MOTIVATORS

First and foremost, discover what is motivating the person or company. Focus on what fits with their goals, even if it is not the project with the best financial return. These motivators include the following:

- "I have to do an energy project every year." When it is part of the job, they will try to find a project that will meet their job expectation. The more control they have over the project, the more they will favor it. A facilities manager might have a budget under his control where he can install some VFDs on pumps and fans, but might have to go through capital approvals for a new piece of equipment and thus favor doing the VFDs.
- Reliability/downtime. Even when central plant equipment is not causing production downtime, high service requirements such as getting technicians to the site or getting rental equipment are headaches. Reducing this stress can motivate folks to do the work it takes to assemble a capital project for approval.
- Money. Sometimes it really is all about the money. The better the return, the better the project looks.
- Operating problems/system not delivering. When unable to meet the mission (e.g., compressed air

(Article continues on page 34)

Online Training Programs

Get Certified, Upskill or Earn CEUs

- Accelerated Certified Energy Manager (CEM®)
- Certified Business Energy Professional (BEP™)
- Certified Demand Side Management Professional (CDSM™)
- Certified Renewable Energy Professional (REP™)
- Developing an Energy Management Master Plan
- Electrical Engineering for Non-electrical Engineers
- Energy Auditing Fundamentals: Essential Strategies and Techniques for Optimal Results
- Energy Conservation in Industrial and Commercial Environments
- Energy Efficiency Practitioner (EEP™)
- Finance, Accounting and Engineering Economics for Energy Professionals
- Life Cycle Costing for Energy Professionals
- Microgrid Fundamentals
- Project Management for Energy Engineers and Energy Managers
- Renewable Energy Hot Topics

education.aeecenter.org/online



<< FIND A
PROGRAM

pressure, space temperatures, cooling water temperatures or flows) all the time, the plant will want to find a fix to the problem along with getting an energy savings.

- Sustainability. If marketing aspects happen to carry any weight at the organization, they will favor projects that can be leveraged to promote sustainability. It may be difficult to communicate many of the central plant services upgrades to consumers, but others such as lighting and instant water heaters are quite easy to understand.

While these are all great motivators to leverage when deciding which projects to pursue, the key is to find out what matters to the site or the person that is responsible for getting the project done. Ask them where their priorities lie, what is causing them problems, and what projects they want to do to meet goals beyond saving energy. Adding energy savings to one of those projects increases the likelihood it will get done.

Tapping into multiple drivers makes it easier for the

project owner to get approval. For example, at one company the initial driver to do energy projects came from the plant engineers or maintenance managers. It was part of their job to execute a continuous improvement project (expectations), and energy was the only controllable expense they had. The projects were cost justified (money) and got done. Later, marketing leveraged the projects to demonstrate how the company was reducing their environmental footprint (marketing).

CONCLUSIONS

There are always reasons why great projects do not get done. These center around the project not being as important as other activities or projects to the person responsible for implementing the project. While it appears the failure to seize upon great energy and cost saving opportunities flies in the face of logic, the person responsible has higher priorities.

The key to advancing energy projects in such an environment is to discover what those other priorities are, and then find a way to save energy while meeting the more pressing needs.

AUTHOR BIOGRAPHIES

Jerry Zolkowski, PE CEM,

is senior engineer at DNV GL (part of the Det Norske Veritas® group). He works on the consumers energy business energy efficiency programs in Michigan with a focus on making industrial plants more efficient. Prior to DNV GL, he worked at Dow Corning, supporting global manufacturing energy efficiency efforts, and Shaw Industries, evaluating energy conservation opportunities. He also worked at the State of Georgia's industrial extension service at Georgia Tech. That work included energy conservation, environmental compliance, and plant and design engineering. Jerry has BS in Mechanical Engineering from the University of Rochester and an MBA from Columbus State College. He may be contacted at Gerard.Zolkowski@dnvgl.com.



Amy Glapinski is the

commercial and industrial specialty and multifamily senior programs manager for Consumers Energy. Amy has been implementing and managing commercial energy efficiency

programs for 8 years with Consumers Energy. She has been intimately involved with the development and implementation of over 20 different pilot and specialty programs serving a wide variety of market segments in Michigan, including agriculture, industrial, education, income qualified multifamily and government municipalities. Ms. Glapinski has a bachelor's degree in architecture from Ball State University. She may be contacted at Amy.Glapinski@cmsenergy.com.



Event News

A Look Ahead - 2021 Keynote Speakers



Bear Grylls has become known worldwide as one of the most recognized faces of survival and outdoor adventure. He has traveled across the globe to many natural and extreme environments. You may recognize him from Discovery Channel's Emmy Award-nominated *Man vs. Wild* TV series, which became one of the most-watched shows on the planet, reaching an estimated 1.2 billion viewers. His global hit TV show *Running Wild with Bear Grylls* has allowed him to take some of the world's best-known stars on incredible adventures, including President Obama, Julia Roberts, Roger Federer, Will Ferrell, Zac Efron, Channing Tatum, and Kate Winslet, to name but a few.

Bear will share his unique experiences with attendees of AEE World 2021 during the opening session and explain how courage, kindness, and a never-give-up attitude are all you need to succeed.



Robert Swan will be the keynote speaker that closes the AEE World Energy Conference & Expo. During the 2019 AEE World Energy Conference and Expo, Robert gave a compelling keynote speech before embarking on the Last 300 Expedition. Over the past three decades, Robert has worked to preserve the Antarctic, championed sustainable development, and has undertaken a wide range of global and local environmental missions.

Attendees of AEE World 2019 found him to be genuinely inspiring. The ideals he expressed in his presentation and his personal goals align with AEE's core mission of fostering sustainable energy for our planet. We anticipate Robert to challenge, entertain and motivate attendees again in 2021, when he provides an update on his journey to the South Pole in January 2020.

A Word to Our Event Supporters

The Association of Energy Engineers would like to thank our sponsors, supporters and exhibitors for making all AEE events possible. It is due to these partnerships, and the contributions made, that allow us to deliver exceptional events that focus on education and networking. We thank you for your support in the past 18 months as we adjusted to virtual events, and we are looking forward to meeting everyone in person again at AEE World 2021, and at our in-person events in 2022.



Diane McCullum
AEE Exhibit Sales Director

Winner

AEE World 2021

AEE held a competition during the AEE World 2020 Virtual Conference. The winner received an expense paid trip to New Orleans, LA, to attend the AEE World 2021 conference in person. Anthony Scaparra, CEM, is our lucky winner!

Anthony is a graduate of Texas A&M University and currently works for Aramark Engineering and Asset Solutions. On behalf of Aramark, he is one of the Energy Managers at the Lewisville Independent School District (LISD). He supports the energy program, which consists of achieving energy savings from 100+ schools and administrative facilities totaling over 10 million square feet. He has worked on energy engineering studies, lighting project development, HVAC scheduling, and system analysis using direct digital control systems, utility bill reviews, energy-use baseline analysis and has performed energy savings calculations.

If you see Anthony at AEE World 2021, please congratulate him.



Anthony Scaparra
Energy Manager
Aramark



AEE Europe Postponed

We know there is nothing like attending events in-person to do business, learn new technical content, forge partnerships, and network. We were excited to launch the debut AEE Europe event in October 2020. But, due to the pandemic it was re-scheduled for this year. Again, we are saddened to announce, the postponement of the event until 2022. Look out for upcoming announcements of dates and locations for all AEE Events in 2022.

Energy Events
Mark Your
Calendars



New Orleans, LA
Conference Oct. 20 – 22, 2021
Expo: Oct. 20 & 21
aee.world.org



Spring 2022
Dates and Location to
be Announced
east.aeecenter.org



Summer 2022
Dates and Location to
be Announced
west.aeecenter.org



Dublin, Ireland
2022 Dates to be Announced
europe.aeecenter.org



BOOKS



Now available at aeecenter.org/books

River Publishers is now the official publisher for the AEE book catalog, which includes over 100 books that focus on energy management, energy efficiency, engineering, renewables, clean energy and sustainability. They offer full publishing services with global distribution to all AEE members. **AEE Members can also apply their member benefit discount to any book purchased from the AEE catalog.**



New Releases



Data Driven Energy Centered Maintenance

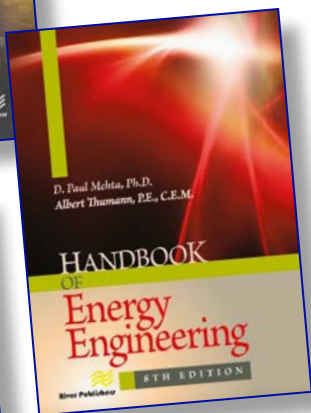
By Fadi Alshakhshir and Marvin T. Howell

ISBN: 2370000874948

e-ISBN: 9788770223560

Price: \$154.5 after 15% Discount \$131.33

Available: April 2021



Handbook of Energy Engineering

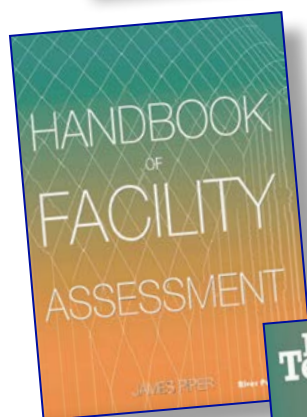
8th Edition By D. Paul Mehta & Albert Thumann

ISBN: 2370000874931

e-ISBN: 9788770223447

Price: \$160 after 15% Discount \$136.00

Available: April 2021



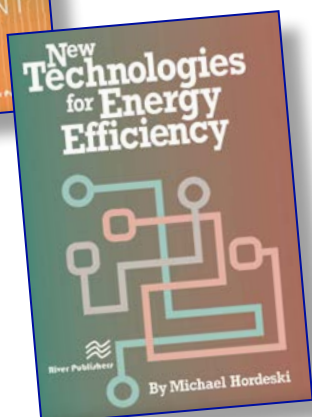
Handbook of Facility Assessment

By James E. Piper

ISBN: 2370010911947

Price: \$175 after 15% Discount \$148.75

Available: January 2021



New Technologies for Energy Efficiency

By Michael Frank Hordeski

ISBN: 2370010911312

Price: \$119.95 after 15% Discount \$101.96

Available: January 2021

SEARCH
BOOKS >>



Celebrating Member Dedication

Have you been with AEE for over two decades?

In this first edition of AEE's Efficiency Magazine, we would have liked to celebrate all AEE members. But there is not enough space to list over 18,000 professionals in more than 100 different countries. So, we opted to draw the line at 20+ years. We wondered what it takes to be part of something for over two decades and what you gain in return — member dedication, commitment, value, knowledge, experience, and the list goes on.

There was no such thing as an "Energy Manager" when the association was founded in 1977. This list of individuals has helped define what it means to save energy and increase energy efficiency. By doing so, they have changed individuals' lives, corporations' success, and nations striving for energy efficiency and sustainable solutions. Are you or one of your colleagues or friends on this list? Reach out to them, congratulate them, and ask about their achievements and what it means to be a recognized Energy Manager.

20+

AEE Fellows

Fotouh Al-Raqom | Kuwait | 22 Years
Paul Allen | USA | 37 Years
John Avina | USA | 21 Years
George (Buster) Barksdale | USA | 21 Years
Barry Benator | USA | 43 Years
Alfonso Cabrera | USA | 26 Years
Bruce Colburn | USA | 30 Years
Graham Croman | USA | 22 Years
Jeff Deem | USA | 23 Years
David Eberly | USA | 31 Years
Denis Enberg | USA | 40 Years
William Fleming | USA | 43 Years
Fredric Goldner | USA | 34 Years
Stephen Hamstra | USA | 21 Years
Warren Heffington | USA | 29 Years

Rusty Hodapp | USA | 33 Years
Timothy Janos | USA | 39 Years
Arun Jhaveri | USA | 22 Years
Kenneth Kogut | USA | 42 Years
Andrew Kozak | USA | 24 Years
Michael Langton | USA | 39 Years
Richard Lubinski | USA | 25 Years
John Masiello | USA | 22 Years
Thomas McGeachen | USA | 42 Years
John McGowan | USA | 37 Years
Prem Mehrotra | USA | 35 Years
John Mench | USA | 26 Years
Jeffrey Myrdek | USA | 26 Years
Steven Parker | USA | 30 Years
Graham Parker | USA | 29 Years

Michael Parker | USA | 26 Years
Douglas Pearson | USA | 26 Years
Stephen Roosa | USA | 26 Years
Peter Rumsey | USA | 31 Years
Mark Sankey | USA | 27 Years
Boggarm Setty | USA | 22 Years
William Stein | USA | 26 Years
Wayne Turner | USA | 41 Years
Keith Willis | USA | 33 Years
David Wolcott | USA | 40 Years
Eric Woodroof | USA | 27 Years
James Yokota | USA | 23 Years

Life Members

Kasey Abbott | USA | 29 Years
John Ackerman | USA | 24 Years
Wajdi Aghnati | USA | 23 Years
William Aird | USA | 31 Years
John Aiton | USA | 36 Years
William Alexander | USA | 29 Years
Benjamin Alkhas | USA | 24 Years
Peter Allen | USA | 27 Years
G. Mark Allen | USA | 27 Years
Jim Allen | USA | 23 Years
Robert Allender | Hong Kong | 29 Years
James Anderson | USA | 34 Years
Thomas Arms | USA | 22 Years
Lindsay Audin | USA | 32 Years
Bruce Ayres | USA | 36 Years
Neal Bach | Canada | 24 Years
Carolyn Banks | USA | 22 Years
Douglas Barnard | USA | 21 Years
John Basic | USA | 26 Years
Maneck Bharucha | USA | 41 Years
Robert Biddiscombe | USA | 23 Years
J. Scott Biggers | USA | 22 Years

Jeffrey Blaevoet | USA | 33 Years
Elliot Boardman | USA | 25 Years
John Boderocco | USA | 38 Years
Frederick Bova | USA | 32 Years
Steven Boyce | USA | 23 Years
Todd Boyer | Canada | 31 Years
Louis Braquet | USA | 35 Years
David Brender | USA | 25 Years
Thomas Broderick | USA | 41 Years
David Brown | USA | 40 Years
Eddie Bullington | USA | 23 Years
Sally Burt | USA | 35 Years
Anthony Burton | USA | 32 Years
Khaled Bushnaq | United Arab Emirates | 29 Years
Robert Caldwell | USA | 36 Years
Edward Carney | USA | 27 Years
Millard Carr | USA | 24 Years
Mike Case | USA | 24 Years
William Castle | USA | 23 Years
Nicholas Cavagnaro | USA | 23 Years
William Chambers | USA | 32 Years

Richard Sou-Tung Chan | Hong Kong | 40 Years
Elisia Chapnerkar | USA | 21 Years
Jon Chestnut | USA | 20 Years
Ronald Chin | Hong Kong | 28 Years
Salvatore Ciampo | USA | 37 Years
John Cilia | USA | 22 Years
James Clark | USA | 25 Years
Richard Claytor | USA | 25 Years
Thomas Colvin | USA | 27 Years
Matthew Conkling | USA | 21 Years
Gregg Cox | USA | 24 Years
Brian Crafts | USA | 23 Years
Buckner Creel | USA | 22 Years
John Dain | USA | 27 Years
Steven Day | USA | 20 Years
Mauro De Maio | USA | 28 Years
Howard Dickinson | USA | 23 Years
Jesse Dillard | USA | 25 Years
Alberto Dolojan | USA | 21 Years
Michael Downey | USA | 36 Years
Alan Dufur | USA | 22 Years

Member Spotlight



Since joining AEE in 2000, I could not have wished for a better professional family. While I reside in another continent,

I have never felt away from AEE's support, guidance and encouragement. The personal direction, training, and professional development have helped me succeed in my own country, Kuwait, and neighboring countries. With AEE's support, I have managed to get certified, trained, and win awards, not just from AEE but also from other prestigious organizations. I have made the most of the opportunities because of the skills I learned from AEE. I wanted to give back, so with AEE's support, I also helped establish and run Kuwait's local AEE chapter.

Even though AEE provided me with the technical knowledge and expertise in energy efficiency and energy management, which empowered me to lead national projects, AEE never forgot to treat me as a friend or family member. I often receive personal greeting cards, congratulation notes, and emails whenever I have a birthday or achieved a milestone, such as a promotion. To me, it was enough to know that they know me as a person, not just a name on a membership list.

Fotouh Al-Ragom | AEE Fellow | 22 Years
Energy Efficiency Technologies Program Manager
Energy and Building Research Center
Kuwait Institute for Scientific Research

Michael Duncan | USA | 27 Years
James Eaton | USA | 23 Years
Charles Effinger | USA | 25 Years
William Efrid | USA | 42 Years
John Eggink | USA | 22 Years
Walter Elyon | USA | 20 Years
Erik Emblem | USA | 22 Years
David Emery | USA | 23 Years
Robert Emrich | USA | 21 Years
Bernard Erickson | USA | 29 Years
John Fanning | USA | 26 Years
Yadi Farhadi | USA | 21 Years
Raymond Fischer | USA | 43 Years
Jim Fischer | USA | 30 Years
Luis Felipe Flores Torres | Mexico | 21 Years
Michael Foraker | USA | 21 Years
George Frank | USA | 24 Years
Anthony Frattali | USA | 23 Years
John Fung | Hong Kong | 40 Years
Guy Gadola | USA | 20 Years
Donald Galamaga | USA | 21 Years
Rebecca Garland | USA | 30 Years
Douglas Garrett | USA | 24 Years
Joseph Glorioso | USA | 40 Years
John Glover | USA | 20 Years
Patrick Goggin | USA | 25 Years
Roger Goode | USA | 21 Years
Paul Goodman | USA | 42 Years
Glenn Goodwin | USA | 31 Years
Terry Grabau | USA | 26 Years
Steve Greenberg | USA | 21 Years
Hans Greene | USA | 21 Years
Teresa Greis | USA | 36 Years
Luis Grunauer | USA | 23 Years
Armando Guerra | USA | 25 Years
Manuel Guzman | USA | 22 Years
Richard Hankins | USA | 41 Years
Anthony Hardy | USA | 24 Years
Teri Harper-Dufur | USA | 20 Years
Terence Harrigan | USA | 24 Years
Earl Hartmen | USA | 42 Years
James Haven | USA | 22 Years
Jon Haviland | USA | 42 Years
James Hedin | USA | 27 Years
Mohamed Helal | Egypt | 24 Years
Larry Helpert | USA | 35 Years
Larry Henson | USA | 22 Years
Jeff Hightower | USA | 31 Years
Patrick Hilleary | USA | 29 Years
Paul Hoemann | USA | 37 Years
Victor Hoffman | USA | 22 Years
Mark Hollo | USA | 30 Years
George Hon-Cheung Hung | Hong Kong | 40 Years
Keith Hood | USA | 38 Years
Len Horewitz | USA | 22 Years
William Hudson | USA | 25 Years
Sam C. M. Hui | China | 28 Years
Benjamin Hunter | USA | 22 Years
Edward Jackson | USA | 21 Years
Syed Jafri | USA | 24 Years
Glenn Johnson | USA | 25 Years
Dan Johnson | USA | 22 Years
John Jolly | USA | 21 Years
Art Jorgensen | USA | 23 Years
Lawrence Kaminsky | USA | 30 Years
William Kean | USA | 40 Years
Amitabh Kedia | India | 24 Years
Richard Kelly | USA | 26 Years
John Kinkela | USA | 43 Years

Thomas Kiser | USA | 32 Years
Harry Kociencki | USA | 26 Years
Russell Koehler | USA | 21 Years
Donald Koenig | USA | 25 Years
Mark Koski | USA | 22 Years
Paul Kotowicz | USA | 38 Years
Alan Krupski | USA | 24 Years
Douglas Lancashire | USA | 26 Years
Dennis Landsberg | USA | 22 Years
Terry Lang | USA | 26 Years
Regina Larrabee | USA | 21 Years
James Larson | USA | 22 Years
John Lavin | USA | 24 Years
Qadri Lawal | USA | 31 Years
Philip Le Grand | USA | 23 Years
Lester Lieberman | USA | 42 Years
Evans Lizardos | USA | 43 Years
Armando Llamas Terres | Mexico | 21 Years
Susan Lotz | USA | 28 Years
Morris Lovett | USA | 22 Years
Alfred Lutz | USA | 24 Years
Aandy Ly | USA | 21 Years
Matthew Lyczak | USA | 23 Years
Mark MacBride | USA | 22 Years
Marshal Maggard | USA | 22 Years
John Magliano | USA | 21 Years
Mike Magyary | USA | 29 Years
Steven Maliszewski | USA | 24 Years
Jose' Marrero | USA | 22 Years
Paul Martin | USA | 28 Years
James Matheson | USA | 39 Years
Charles Maxwell | USA | 34 Years
Malcom Maze | USA | 37 Years
Peter McCone | USA | 28 Years
John McEwan | USA | 35 Years
Russ McIntosh | USA | 27 Years
Paul Meierdierck | USA | 35 Years
Edward Mergens | USA | 25 Years
Kirk Michael | USA | 22 Years
Richard Miller | USA | 42 Years
Michael Miller | USA | 24 Years
John Wesley Miller | USA | 21 Years
Kenneth Mitchell | USA | 26 Years
Thomas Moore | USA | 21 Years
Robert Morey | USA | 21 Years
John Morrill | USA | 31 Years
Samuel Morris | USA | 24 Years
Harvey Morris | USA | 23 Years
Martin Mozzo | USA | 43 Years
William Mutscheller | USA | 33 Years
Donald Naiser | USA | 24 Years
Armando Nava | Mexico | 28 Years
James Nelson | USA | 24 Years
James Newman | USA | 27 Years
James Noe | USA | 21 Years
Albert Nunez | USA | 21 Years
Nariman Nusserwanji | USA | 27 Years
Teri Orr | USA | 23 Years
Deanne Ottaviano | USA | 27 Years
Angelo Padro | USA | 25 Years
Gary Painter | USA | 24 Years
James Parker | USA | 21 Years
Michael Pasky | USA | 26 Years
Leonard Pattison | USA | 21 Years
Thomas Peterson | USA | 31 Years
Arnold Peterson | USA | 26 Years
Jon Pietruszkiewicz | USA | 36 Years
George Pudlo | USA | 42 Years
Mark Purinton | USA | 42 Years
Albert Putnam | USA | 23 Years

Chen Qigao | China | 30 Years
 Michael Quimbey | USA | 39 Years
 T.V. Ramachandra | India | 23 Years
 John Ramsden | USA | 28 Years
 Gary Ramus | USA | 21 Years
 Stephen Rawski | USA | 31 Years
 Raborn Reader | USA | 23 Years
 James Redden | USA | 30 Years
 Carmine Rende | USA | 22 Years
 Kenneth Riead | USA | 27 Years
 Howard Rivers | USA | 26 Years
 Nancy Rorabaugh | USA | 20 Years
 Lenny Rose | USA | 23 Years
 Dany Safi | Canada | 25 Years
 Jerry Saulter | USA | 20 Years
 Joseph Savala | USA | 27 Years
 John Saxton | USA | 33 Years
 Stephen Schaffner | USA | 23 Years
 Steven Schlegel | USA | 28 Years
 Robert Schubert | USA | 23 Years
 C Chet Schuelein | USA | 23 Years
 Ken Schwartz | USA | 26 Years
 Erick Seelinger | USA | 26 Years
 William Seldon | USA | 26 Years
 Yan Shen | USA | 24 Years

Jitendra Singh | USA | 41 Years
 Irwin Smiley | USA | 41 Years
 Robert Smith | USA | 28 Years
 Gary Smith | USA | 23 Years
 Scott Spiewak | USA | 35 Years
 Michael Spishock | USA | 33 Years
 Teerachai Srisirikul | USA | 23 Years
 Zachary Stern | USA | 22 Years
 Asmus Stoyke | Canada | 36 Years
 Samuel Sugarman | USA | 27 Years
 Hollis Sumrall | USA | 22 Years
 Paul Super | USA | 22 Years
 James Sura | USA | 27 Years
 Dennis Svalstad | USA | 24 Years
 Kar Tam | Hong Kong | 32 Years
 Wai Tang | Hong Kong | 25 Years
 James Taylor | USA | 22 Years
 Terry Taylor | USA | 22 Years
 Frances Tegnazian | USA | 20 Years
 Sabaratnam Thamilseran | USA | 22 Years
 John Theisen | USA | 21 Years
 Steven Thompson | USA | 21 Years
 Michael Torchio | USA | 40 Years
 Matthew Traum | USA | 21 Years
 Darrell Trimble | USA | 20 Years

Matt Urquhart | USA | 24 Years
 Denis Vazquez-Gascot | USA | 23 Years
 Frantz Vincent | USA | 24 Years
 Charlotte Wagner | USA | 27 Years
 William Wahl | USA | 26 Years
 Bruce Walker | USA | 20 Years
 James West | USA | 33 Years
 G. Peter Westerhoff | USA | 23 Years
 Garth White | Canada | 22 Years
 Anna Williams | USA | 38 Years
 Roy Williams | USA | 28 Years
 Daniel Williams | USA | 22 Years
 Darryl Winer | USA | 24 Years
 David Wolfe | USA | 23 Years
 Everett Wolverton | USA | 27 Years
 Carol Woodyard | USA | 28 Years
 J. Mark Young | USA | 21 Years
 Zhang Yunming | China | 33 Years
 Joseph Zahora | USA | 23 Years
 Yunming Zhang | China | 32 Years
 D Malone Zimmerman | USA | 20 Years
 Cory Zittlow | USA | 23 Years
 Salah Zoma | USA | 22 Years

Members

Jamal Aboueljoud | USA | 26 Years
 Yousef Abouzelof | USA | 32 Years
 Joseph Acquaviva | USA | 20 Years
 Mark Adams | USA | 21 Years
 Carolyn Adkins | USA | 29 Years
 Robert Adkins | USA | 28 Years
 Jairam Agaram | USA | 35 Years
 Mohammad Al-Homoud | Saudi Arabia | 24 Years
 Richard Alaimo | USA | 41 Years
 W. John Albrecht | USA | 26 Years
 Michael Albright | USA | 25 Years
 Kenneth Allen | USA | 27 Years
 R. Scott Allen | USA | 21 Years
 Randy Altergott | USA | 26 Years
 Angel Alvarez | USA | 23 Years
 Robert Amundsen | USA | 34 Years
 Edmund Anderson | USA | 28 Years
 Kristofer Anderson | USA | 24 Years
 Martin C.T. Anderson | USA | 24 Years
 Lawrence Anderson | USA | 21 Years
 Clifford Andrews | USA | 20 Years
 Wilfredo Arce | USA | 25 Years
 Steven Armour | USA | 21 Years
 Andrew Arnold | USA | 35 Years
 Eric Arnold | USA | 20 Years
 David Ashwood | USA | 24 Years
 C. Douglas Auburg | USA | 39 Years
 Daniel Bacik | USA | 25 Years
 Kevin Baer | USA | 25 Years
 William Bagnell | USA | 26 Years
 Bruce Bailey | USA | 22 Years
 Jeff Baker | USA | 35 Years
 Edward Baker | USA | 26 Years
 Jeannie Baker | USA | 24 Years
 Matthew Baker | USA | 20 Years
 Srinath Balachandran | USA | 20 Years
 David Baldwin | USA | 36 Years
 Paul Banks | USA | 35 Years
 Anil Bansal | USA | 30 Years
 Michael Barancewicz | USA | 25 Years
 Timothy Barnish | USA | 20 Years
 Anthony Barone | USA | 24 Years

M. Renee Barr | USA | 23 Years
 Michael Bartlett | USA | 20 Years
 Michael Barton | USA | 21 Years
 Jonathan Baty | USA | 27 Years
 Stephen Beck | USA | 23 Years
 Gerard Beddington | USA | 36 Years
 Andrew Beggs | USA | 27 Years
 Daniel Begin | USA | 21 Years
 Mark Begle | USA | 22 Years
 Eugene Bell | USA | 25 Years
 William Bellamy | USA | 22 Years
 James Benoit | USA | 28 Years
 Michael Bergeron | USA | 24 Years
 Timothy Bernadowski | USA | 28 Years
 Michael Berning | USA | 24 Years
 Robert Berninger | USA | 22 Years
 Kevin Betz | USA | 28 Years
 Ajay Bhargava | USA | 23 Years
 Larry Bironas | USA | 43 Years
 Margaret Bishop | USA | 33 Years
 Stacy Black | USA | 20 Years
 Peter Bloch | USA | 24 Years
 Mark Boraski | USA | 21 Years
 Martin Borenstein | USA | 33 Years
 Vicente Bortone | USA | 27 Years
 Robert Botelho | USA | 31 Years
 Francis Boucher | USA | 21 Years
 Keith Boulton | Canada | 23 Years
 Martin Bowen | USA | 23 Years
 John Bowles | USA | 25 Years
 Marijn Braadbaart | USA | 20 Years
 Marko Bradica | USA | 24 Years
 Todd Bradley | USA | 23 Years
 Tim Brancheau | USA | 20 Years
 Thomas Brannen | USA | 25 Years
 Bruce Bremer | USA | 36 Years
 Duane Bronson | USA | 20 Years
 Benjamin Brooks | USA | 25 Years
 Bruce Brooks | USA | 25 Years
 Philip Brown | USA | 38 Years
 Bruce Brown | USA | 30 Years
 John Brown | USA | 26 Years
 Jeffrey Brown | USA | 26 Years

Michael Brown | USA | 24 Years
 Scott Brown | USA | 20 Years
 Bobby Browning | USA | 20 Years
 Beth Brummitt | USA | 30 Years
 Richard Buchanan | USA | 23 Years
 Patrick Buchanan | USA | 23 Years
 John Burgan | USA | 23 Years
 Diane Burger | Canada | 23 Years
 Nelson Burgess | USA | 20 Years
 Eric Burgis | USA | 24 Years
 Brian Burke | USA | 22 Years
 Sandra Burton | USA | 20 Years
 Rae Butler | USA | 23 Years
 Ricardo Cabanit | USA | 29 Years
 James Call | USA | 23 Years
 Thomas Callahan | USA | 36 Years
 Michael Calogero | USA | 37 Years
 Norman Campbell | USA | 24 Years
 R Card | USA | 35 Years
 Curtis Carl | USA | 30 Years
 Malcolm Carley | USA | 25 Years
 Scott Carlson | USA | 21 Years
 James Carlson | USA | 20 Years
 David Carpenter | USA | 41 Years
 Mark Casell | USA | 20 Years
 Salvatore Castro | USA | 30 Years
 Rafael Castro | USA | 23 Years
 Rolly Catapia | Canada | 26 Years
 Robert Catell | USA | 42 Years
 Lloyd Cavey | USA | 20 Years
 Vladimir Ceaus | Canada | 21 Years
 Richard Chalker | USA | 23 Years
 Guy Chamberlain | USA | 41 Years
 Maurice Chaput | USA | 23 Years
 Wayne Chase | USA | 27 Years
 James Chemplanikal | USA | 22 Years
 Peter Chiaravalle | USA | 22 Years
 Dan Clark | USA | 26 Years
 Marco Clerx | USA | 29 Years
 Robert Clifton | USA | 24 Years
 John Coath | USA | 22 Years
 Keith Cockerham | USA | 26 Years
 Christopher Collins | USA | 22 Years

Daniel Collins | USA | 21 Years
 John Connell | USA | 28 Years
 Neil Connelly | USA | 22 Years
 Jeffrey Conner | USA | 28 Years
 Ward Connors | USA | 25 Years
 Paul Consoli | USA | 22 Years
 Michael Conway | USA | 30 Years
 David Cooper | USA | 28 Years
 Charles Copeland | USA | 21 Years
 Thomas Coughlin | USA | 24 Years
 Thomas Cowing | USA | 23 Years
 William (Ed) Cox | USA | 35 Years
 Douglas Cox | USA | 25 Years
 Michael Coyne | USA | 26 Years
 Gary Crabtree | USA | 25 Years
 John Crawford | USA | 22 Years
 Joseph Cristino | USA | 35 Years
 Alan Croll | USA | 27 Years
 John Cross | USA | 24 Years
 Richard Crowson | USA | 36 Years
 Steven Croxton | USA | 26 Years
 Gerald Culbert | USA | 43 Years
 Jeffrey Czarniecki | USA | 26 Years
 Michael Daigneault | USA | 21 Years
 Michael Dalton | USA | 26 Years
 John Daniel | USA | 29 Years
 Annette Dann | USA | 22 Years
 Nancy Davies-Flickinger | USA | 23 Years
 Richard Davis | USA | 32 Years
 Craig Davis | USA | 22 Years
 Stephen Davis | USA | 21 Years
 Vicki Davis | USA | 20 Years
 William Dean | USA | 23 Years
 Michael DeBoer | USA | 37 Years
 Steven DeBusk | USA | 26 Years
 Kenneth Decker | USA | 25 Years
 Bruce Deetken | USA | 21 Years
 Ramon Delgadillo | USA | 21 Years
 Antonio Delgado | USA | 20 Years
 Agostino Dell'Oso | USA | 20 Years
 David Dellinger | USA | 22 Years
 Russ Dent | USA | 24 Years
 McLellan Deremer | USA | 23 Years
 Harry Devine II | USA | 23 Years
 Jeffrey DeVore | USA | 30 Years
 Mitchell Dexter | USA | 22 Years
 Thomas Dey | USA | 23 Years
 Joseph Dezamits | USA | 22 Years
 Robert Di Giandomenico | USA | 28 Years
 Keith Dias | USA | 24 Years
 R. Mark Dickson | USA | 20 Years
 William Diffley | USA | 21 Years
 Stephen DiGiacomo | USA | 38 Years
 Saadeddine Dimachkieh | USA | 23 Years
 Karen DiMeglio | USA | 25 Years
 Gregory DiNome | USA | 22 Years
 Mark DiPetrillo | USA | 28 Years
 Douglas Dixon | USA | 28 Years
 Paul Dobry | USA | 37 Years
 Daniel Donnelly | USA | 31 Years
 Russell Donnici | USA | 31 Years
 Judy Dorsey | USA | 21 Years
 Douglas Dougherty | USA | 24 Years
 Richard Doughty | USA | 24 Years
 Pharis Douglas | USA | 40 Years
 Gary Downes | USA | 22 Years
 Jonathan Driskill | USA | 23 Years
 Lance Duellman | USA | 22 Years
 Paul Duerre | USA | 26 Years
 John Duffy | USA | 20 Years
 Daniel Duncan | USA | 27 Years

William Dunnivant | USA | 26 Years
 David Dusenbury | USA | 26 Years
 Michael Eby | USA | 23 Years
 Michael Eckhardt | USA | 26 Years
 John Eckmann | USA | 28 Years
 Robert Ehrhardt | USA | 22 Years
 Tom Eldred | USA | 20 Years
 Michael Elliott | USA | 26 Years
 Richard Ellison | USA | 20 Years
 Joseph Elovich | USA | 25 Years
 Mark Enochs | USA | 22 Years
 Eric Erickson | USA | 30 Years
 Eric Erickson | USA | 22 Years
 Paul Erickson | USA | 21 Years
 Jeffrey Euclide | USA | 20 Years
 Garyne Evans | USA | 22 Years
 John Everts | USA | 22 Years
 David Evers | USA | 27 Years
 Jeffrey Fahey | USA | 24 Years
 Peter Fairbanks | USA | 30 Years
 Joe Fangman | USA | 30 Years
 Rodney Fanning | USA | 23 Years
 Louis Farquhar | USA | 26 Years
 Boyce Farrar | USA | 37 Years
 Roger Farrer | USA | 21 Years
 Robert Fegan | USA | 20 Years
 Vincent Ferguson | USA | 27 Years
 Ernesto Fernandez | USA | 26 Years
 David Ferrante | USA | 27 Years
 Nicholas Finia | USA | 21 Years
 Dennis Flynn | USA | 37 Years
 Kevin Folsom | USA | 21 Years
 Richard Ford | USA | 20 Years
 Dale Foster | USA | 21 Years
 Allen Foust | USA | 21 Years
 Jon Fox | USA | 23 Years
 Mark Franke | USA | 30 Years
 Jesse Frederick | USA | 31 Years
 Steven Frederickson | USA | 33 Years
 Joel Freeman | USA | 26 Years
 Harvey Freville | USA | 23 Years
 Steve Frohling | USA | 25 Years
 John Frugard | USA | 21 Years
 Mark Frye | USA | 23 Years
 Kenneth Fulk | USA | 32 Years
 Steven Funk | USA | 22 Years
 Peter Funk | USA | 21 Years
 James Gabler | USA | 24 Years
 Richard Gabrielson | USA | 24 Years
 Francis Gaffney | USA | 25 Years
 Richard Galipeau | USA | 24 Years
 Paul Garcia | USA | 24 Years
 Peter Garforth | USA | 25 Years
 Paul Garrison | USA | 23 Years
 Michelle Gerace | USA | 23 Years
 Suresh Ghadia | USA | 26 Years
 Abdul Ghalayini | USA | 29 Years
 Kevin Gilleran | USA | 25 Years
 Jayson Gilliam | USA | 28 Years
 Paul Gillis | USA | 25 Years
 Ronald Gillooly | USA | 30 Years
 Leroy Givler | USA | 33 Years
 James Glasspool | Canada | 27 Years
 Jeffrey Glick | USA | 26 Years
 Brian Glynn | USA | 21 Years
 David Goemaere | USA | 30 Years
 Steven Goldberg | USA | 25 Years
 Edwin Goodwin | USA | 42 Years
 Joseph Gorecki | USA | 28 Years
 C. Andre Gouin | USA | 21 Years
 Dakers Gowans | USA | 24 Years

Paul Graves | USA | 36 Years
 Scott Greenbaum | USA | 21 Years
 Walter Greenwood | USA | 36 Years
 Bruce Grenier | USA | 25 Years
 Manmohan Grewal | USA | 26 Years
 Mark Grichen | USA | 22 Years
 Steven Gridley | USA | 28 Years
 Craig Griffin | USA | 26 Years
 David Grimason | USA | 26 Years
 Paul Grisafi | USA | 24 Years
 Thomas Gross | USA | 20 Years
 Joseph Guagno | USA | 21 Years
 Sonny Ha | USA | 23 Years
 Michael Hahn | USA | 26 Years
 Stanley Hahn | USA | 25 Years
 Benjamin Haight | USA | 25 Years
 Randolph Haines | USA | 24 Years
 Matthew Haley | USA | 22 Years
 Joseph Hall | USA | 23 Years
 Dan Hall | USA | 22 Years
 Christopher Halpin | USA | 22 Years
 Kerry Hamamura | USA | 22 Years
 Mark Hamann | USA | 21 Years
 Kirk Hamilton | USA | 26 Years
 Chris Hamon | USA | 29 Years
 Michael Hanson | USA | 33 Years
 John Hardesty | USA | 23 Years
 Timothy Harper | USA | 25 Years
 David Harrell | USA | 23 Years
 Joseph Harrell | USA | 22 Years
 Greg Harrell | USA | 21 Years
 John Harris | USA | 22 Years
 Michael Hart | USA | 32 Years
 James Harvey | USA | 35 Years
 Fred Hauber | USA | 20 Years
 Shaun Hayes | USA | 23 Years
 Philip Hayet | USA | 24 Years
 Vivekanand Hegde | USA | 21 Years
 Steven Heinz | USA | 21 Years
 R. Scott Helm | USA | 28 Years
 Marcus Hendrickson | USA | 23 Years
 Ron Henry | USA | 29 Years
 Donald Herrmann | USA | 26 Years
 John Hester | USA | 22 Years
 Mark Hillman | USA | 22 Years
 Brian Hines | USA | 33 Years
 Adam Hinge | USA | 24 Years
 Gregory Hochstetler | USA | 22 Years
 David Hoelke | USA | 20 Years
 Garret Hoffman | USA | 26 Years
 James Hoffman | USA | 22 Years
 Martin Holich | USA | 23 Years
 Thomas Honeycheck | USA | 35 Years
 David Hopper | USA | 26 Years
 Harrison Horning | USA | 26 Years
 Valerie Houchin | USA | 20 Years
 Houssin Hourieh | USA | 31 Years
 Scott Houtz | USA | 32 Years
 Philip Howard | USA | 20 Years
 Thomas Howe | USA | 20 Years
 Peter Hoyle | USA | 24 Years
 George Hubbell | USA | 20 Years
 Ferdinand Hudencial | USA | 25 Years
 Scott Hults | USA | 25 Years
 William Hunt | USA | 29 Years
 Scotty Hutto | USA | 25 Years
 John Hyfantis | USA | 43 Years
 Pat Impollonia | USA | 21 Years
 Nevena Iordanova | USA | 24 Years
 Ronald Ishii | USA | 32 Years
 Gary Israel | USA | 21 Years

Venkateswaran Iyer | USA | 26 Years
 Pamela Janney | USA | 28 Years
 Joseph Jansz | Canada | 21 Years
 Gilbert Jaramillo | USA | 26 Years
 M. Todd Jarvis | USA | 28 Years
 Robert Jeffries | USA | 28 Years
 Robert Jennings | USA | 20 Years
 Harold Jepsen | USA | 31 Years
 John Jirka | USA | 23 Years
 Robert Joba | USA | 24 Years
 Frank Johnson | USA | 43 Years
 Marcus Johnson | USA | 37 Years
 Leelan Johnson | USA | 22 Years
 Thomas Johnston | USA | 30 Years
 Tim Jones | USA | 26 Years
 Riccy Jones | USA | 21 Years
 David Jurgens | USA | 24 Years
 John Kamman | USA | 22 Years
 Merrill Kaney | USA | 28 Years
 Dimitris Kapsis | USA | 22 Years
 Mark Kauffman | USA | 23 Years
 John Keefe | USA | 28 Years
 Leif Keely | USA | 27 Years
 Ron Keenan | USA | 23 Years
 Mark Keiser | USA | 25 Years
 James Kelsey | USA | 23 Years
 Robert Kenney | USA | 26 Years
 Gerald Kettler | USA | 28 Years
 Marion Keyes | USA | 38 Years
 Darshan Khalsa | USA | 21 Years
 Saleem Khan | USA | 27 Years
 Patrick King | USA | 20 Years
 Michael Klaassen | USA | 30 Years
 Robert Knowles | USA | 28 Years
 Paul Knowles | USA | 20 Years
 James Kobbe | USA | 27 Years
 Premdat Kokilepersaud | USA | 22 Years
 Diamond Kongoletos | USA | 33 Years
 William Kosik | USA | 24 Years
 Farouk Kothdiwala | Canada | 21 Years
 Brian Kowalski | USA | 23 Years
 Kevin Kramer | USA | 24 Years
 Fritz Kreiss | USA | 26 Years
 Milton Kruk | USA | 24 Years
 Gregory Kurpiel | USA | 27 Years
 Gary Kuzma | USA | 35 Years
 David Kwaske | USA | 33 Years
 Edward Lagoy | USA | 29 Years
 Peter Laiho | USA | 22 Years
 Michael Lam | Canada | 22 Years
 Frank Lamphere | USA | 24 Years
 David Landman | USA | 29 Years
 Charles Lane | USA | 23 Years
 MaryAnne Lauderdale | USA | 20 Years
 MaryAnne Lauderdale | USA | 20 Years
 Robert Lawson | USA | 21 Years
 James Letsinger | USA | 27 Years
 Glen Lewis | USA | 22 Years
 Philip Ling | Canada | 21 Years
 Andrew Lippert | USA | 24 Years
 Larry Lisenbee | USA | 32 Years
 Eric List | USA | 24 Years
 Douglas Litwiller | USA | 23 Years
 Edward Locke | USA | 28 Years
 Scott Locke | USA | 23 Years
 Robert Loprete | USA | 23 Years
 Gregory Lowe | USA | 29 Years
 Donald Lowe | USA | 22 Years
 Bradley Lowe | USA | 21 Years
 Kenneth Lucci | USA | 29 Years
 Holger Lukas | USA | 34 Years

Russell Luke | USA | 42 Years
 Lee Lundberg | USA | 23 Years
 Catherine Luthin | USA | 23 Years
 Dan MacDougall | Canada | 24 Years
 Mark Macpherson | USA | 29 Years
 Jesse Maestas | USA | 21 Years
 Edward Mahler | USA | 24 Years
 John Mahnken | USA | 23 Years
 Dan Mailath | USA | 29 Years
 W. Wallace Majors | USA | 33 Years
 Shahdad Makarechi | USA | 20 Years
 Neil Maldeis | USA | 27 Years
 Michael Malley | USA | 21 Years
 Colin Manahan | USA | 25 Years
 Sean Mancuso | USA | 23 Years
 Gary Marciniak | USA | 22 Years
 Russell Marcus | USA | 21 Years
 Lyle Mardis | USA | 25 Years
 Blas Marin | USA | 31 Years
 Ronald Markus | USA | 33 Years
 Jay Martin | USA | 21 Years
 Ruben Marty | Chile | 21 Years
 William Marzano | USA | 26 Years
 Thomas Massey | USA | 21 Years
 Geraldine Massey | USA | 21 Years
 Thomas Matonti | USA | 27 Years
 Michael May | USA | 31 Years
 Jeffrey May | USA | 21 Years
 Joe Maynard | USA | 21 Years
 Gary McAvoy | USA | 28 Years
 Paul McConvey | USA | 26 Years
 Wesley McDaniel | USA | 24 Years
 William McElrath | USA | 26 Years
 Edward McGlynn | USA | 25 Years
 Hollis McKee | USA | 23 Years
 Scott McKee | USA | 21 Years
 Jim McMann | USA | 28 Years
 Dave McMillan | USA | 25 Years
 Patrick McNamara | USA | 25 Years
 Jack Meador | USA | 27 Years
 Charles Mehanna | USA | 23 Years
 David Meisegeier | USA | 25 Years
 Alex Melathe | USA | 20 Years
 James Melton | USA | 21 Years
 Mark Melvin | USA | 24 Years
 Timothy Mense | USA | 25 Years
 Ronald Mesaros | USA | 26 Years
 Joseph Milam | USA | 23 Years
 Brian Miller | USA | 29 Years
 David Miller | USA | 24 Years
 Daniel Miller | USA | 23 Years
 Gary Miller | USA | 22 Years
 Richard Minetto | USA | 21 Years
 Joseph Mitchell | USA | 23 Years
 Ronald Mixer | USA | 29 Years
 Charles Mize | USA | 22 Years
 Michael Mizinski | USA | 21 Years
 Lori Moen | USA | 21 Years
 James Moncrief | USA | 22 Years
 Carlos Montanez | USA | 23 Years
 Robert Montgomery | USA | 26 Years
 William Moore | USA | 23 Years
 Robert Moran | USA | 27 Years
 Todd Morgan | USA | 28 Years
 Charles Morgan | USA | 26 Years
 John Morgan | USA | 21 Years
 Dan Mori | USA | 20 Years
 John Morris | USA | 36 Years
 Linda Morrison | USA | 23 Years
 Rodney Morrow | USA | 26 Years
 Daniel Moses | USA | 23 Years

Stephen Mueller | USA | 25 Years
 Bruce Mueller | USA | 20 Years
 Rene Mulero | USA | 22 Years
 Matthew Mullen | USA | 22 Years
 Paul Mullican | USA | 22 Years
 Michael Mullins | USA | 24 Years
 James Mulloy | USA | 29 Years
 Don Munroe | USA | 22 Years
 Renet Murad | USA | 23 Years
 Christopher Murphy | USA | 27 Years
 Gregory Murphy | USA | 21 Years
 Robert Musgrave | USA | 21 Years
 David Muzzy | USA | 31 Years
 J. Michael Myrick | USA | 20 Years
 Earl Naab | USA | 41 Years
 Santanu Nath | USA | 22 Years
 Ronnie Neal | USA | 30 Years
 Brahmaiah Neelagaru | USA | 20 Years
 Ron Neet | USA | 31 Years
 Dwight Neibling | USA | 22 Years
 David Neiburg | USA | 22 Years
 Timothy Neil | USA | 23 Years
 Raymond Nelson | Canada | 26 Years
 Donald Newell | USA | 21 Years
 Ken Newman | USA | 22 Years
 Frank Nicosia | USA | 24 Years
 Steven Nixon | USA | 25 Years
 Joseph Nowaczyk | USA | 27 Years
 Richard Nowak | USA | 43 Years
 Martin Nuetzel | USA | 39 Years
 Dennis O'Malley | USA | 22 Years
 R. James Oaks | USA | 25 Years
 Jason Oelke | USA | 22 Years
 Eric Oliver | USA | 23 Years
 David Ortega | USA | 21 Years
 Mark Orton | USA | 28 Years
 Matthew Ossi | USA | 26 Years
 Larry Oswald | USA | 26 Years
 David Owens | USA | 21 Years
 Terry Pahl | USA | 21 Years
 Michael Paik | USA | 36 Years
 Richard Panzeri | USA | 23 Years
 Ajit Patel | USA | 27 Years
 J. Vicente Pedraza | USA | 24 Years
 Kenneth Peet | USA | 39 Years
 Michael Persinger | USA | 21 Years
 Martin Petchul | USA | 24 Years
 Wayne Peterson | USA | 23 Years
 John Petze | USA | 34 Years
 Francis Peverly | USA | 29 Years
 James Phillips | USA | 36 Years
 William Pickett | USA | 20 Years
 Joseph Pietrzak | USA | 20 Years
 Michael Politi | USA | 27 Years
 Ronald Poole | USA | 34 Years
 Tom Poole | USA | 25 Years
 Judith Porter | USA | 27 Years
 Ronald Powell | USA | 22 Years
 Kevin Power | USA | 29 Years
 Joseph Price | USA | 21 Years
 Wilson Prichett | USA | 34 Years
 Jack Prince | USA | 23 Years
 Timothy Pugh | USA | 23 Years
 Mike Pumroy | USA | 21 Years
 John Puskar | USA | 35 Years
 Robert Quick | USA | 30 Years
 Paul Raabe | USA | 37 Years
 Manoj Raathor | USA | 27 Years
 William Randel | USA | 21 Years
 Linda Rasor | USA | 25 Years
 Rajasekara Reddy | USA | 38 Years

Mark Redmond | USA | 27 Years
Gary Reed | USA | 21 Years
Stuart Reeve | USA | 25 Years
Helen Reeve | Canada | 24 Years
John Reid | USA | 25 Years
Paul Reid | USA | 20 Years
Kannan Rengarajan | USA | 20 Years
David Reynolds | USA | 28 Years
Kenneth Rheault | USA | 32 Years
John Rice | USA | 31 Years
Joe Rice | USA | 21 Years
Robert Richards | USA | 26 Years
Frank Richards | USA | 25 Years
Jason Richards | USA | 24 Years
Clifford Richardson | USA | 23 Years
James Richmond | USA | 20 Years
Thomas Richtsmeier | USA | 35 Years
Richard Ricks | USA | 22 Years
James Ridge | USA | 27 Years
Thomas Rinner | USA | 24 Years
Robert Risley | USA | 28 Years
Geoffrey Robbins | USA | 25 Years
Ryan Roberts | USA | 24 Years
Thomas Roberts | USA | 22 Years
Richard Rogan | USA | 23 Years
James Rogers | USA | 41 Years
Michael Rogers | USA | 25 Years
Lezli Root | USA | 21 Years
Wayne Rosa | USA | 25 Years
Julio Rovi | USA | 21 Years
Greg Ruess | USA | 22 Years
Eric Ruffel | USA | 21 Years
Mark Russell | USA | 22 Years
Hemmat Safwat | Greece | 33 Years
Stephen Sain | USA | 31 Years
Brad Salamone | USA | 23 Years
Carl Salas | USA | 40 Years
Siegfried Sanders | USA | 31 Years
Joseph Sarlo | USA | 22 Years
Mark Sawitsky | USA | 22 Years
Mel Scheeler | USA | 37 Years
Thomas Schmidt | USA | 21 Years
William Schmidt | USA | 21 Years
Randy Schrecengost | USA | 33 Years
Steve Schultz | USA | 25 Years
Carl Schultz | USA | 21 Years
Lawrence Schuster | USA | 33 Years
Daniel Schwab | USA | 26 Years
Robert Scott | USA | 22 Years
Rory Seagert | USA | 23 Years
Allen Sehart | USA | 23 Years
Glenn Seigler | USA | 26 Years
Edward Sekmistrz | USA | 23 Years
Aurel Selezeanu | USA | 24 Years
Edward Senter | USA | 32 Years
Paul Seward | USA | 34 Years
Phil Sewell | USA | 24 Years
William Sgro | USA | 22 Years
Daniel Shabo | USA | 27 Years
Chandra Shah | USA | 21 Years
Leonard Shapiro | USA | 29 Years
Michal Shepard | USA | 21 Years
William Shepherd | USA | 21 Years
Lawrence Sherman | USA | 24 Years
Tatyana Shine | USA | 20 Years
Adam Shirvinski | USA | 20 Years
Kenneth Shively | USA | 21 Years
Kenneth Sidebottom | USA | 26 Years
Scott Silver | USA | 37 Years
Jeff Simerl | USA | 27 Years
Kirk Simoneaux | USA | 24 Years

Mitch Simpler | USA | 29 Years
Joseph Sinclair | USA | 34 Years
Richard Skall | USA | 39 Years
Richard Skinner | USA | 21 Years
Mark Slabaugh | USA | 29 Years
Dave Smarsh | USA | 23 Years
Clyde Smith | USA | 35 Years
Richard Smith | USA | 32 Years
Richard Smith | USA | 31 Years
Thad Smith | USA | 28 Years
Todd Smith | USA | 24 Years
David Smith | USA | 24 Years
Phillip Smith | USA | 23 Years
Steven Smith | USA | 20 Years
Alexander Sokiranski | USA | 38 Years
Joseph Solomon | USA | 29 Years
Marc Songer | USA | 20 Years
John Sosoka | USA | 32 Years
Alfredo Sotolongo | USA | 41 Years
Gene Spires | USA | 25 Years
Barney Spratt | USA | 39 Years
Jeffrey Springer | USA | 30 Years
Marc St-Jean | Canada | 21 Years
Larry Stalica | USA | 23 Years
Kathleen Stanley | USA | 23 Years
James Stapleton | USA | 23 Years
Edwin Staunch | USA | 29 Years
Michael Stears | USA | 24 Years
John Sternitzke | USA | 23 Years
Lisa Stickler | USA | 22 Years
Norman Stickney | USA | 24 Years
Michael Stockard | USA | 29 Years
Kenneth Stone | USA | 22 Years
Steve Stookey | USA | 29 Years
James Strack | USA | 32 Years
Gary Strickland | USA | 34 Years
Robert Striff | USA | 20 Years
Jeffrey Stringfield | USA | 24 Years
Richard Stroh | USA | 23 Years
Keith Struble | USA | 26 Years
Robert Stryjewski | USA | 25 Years
Glenn Stubblefield | USA | 23 Years
Mark Stuebe | USA | 23 Years
Andrew Susemichel | USA | 42 Years
Cash Sutton | USA | 32 Years
Charles Sutton | USA | 23 Years
Donald Swick | USA | 27 Years
Lawrence Swisher | USA | 23 Years
Dean Switzer | USA | 21 Years
Leslie Taniyama | USA | 24 Years
Anthony Tartaglia | USA | 28 Years
Thomas Tate | USA | 26 Years
Robert Taylor | USA | 25 Years
Ralph Taylor | USA | 22 Years
Richard Teschner | USA | 31 Years
Harris Thanopoulos | USA | 23 Years
Daniel Thayer | USA | 27 Years
Ralph Thompson | USA | 23 Years
John Thompson | USA | 40 Years
Gary Throckmorton | USA | 25 Years
Robert Tidona | USA | 25 Years
R. Dean Tillison | USA | 39 Years
William Tinsley | USA | 22 Years
Stephen Tissiere | USA | 20 Years
Thomas To | USA | 25 Years
S. Thomas Tobias | USA | 39 Years
Greg Tomaro | USA | 23 Years
Robert Torre | USA | 25 Years
John Townsend | USA | 25 Years
Theodore Traum | USA | 37 Years
Dean Trigg | USA | 25 Years

Douglas Tripp | Canada | 22 Years
Guerino Trovato | USA | 21 Years
Michael Trzesniowski | USA | 26 Years
Michael Trzesniowski | USA | 26 Years
Mark Tschirhart | USA | 21 Years
Robert Tugwell | USA | 32 Years
Vincent Tummarello | USA | 21 Years
Garland Turner | USA | 24 Years
Roger Turner | USA | 23 Years
William Turpish | USA | 36 Years
Emily Tuzson | USA | 22 Years
Timothy Unruh | USA | 25 Years
Frank Vadino | USA | 38 Years
Dann Vail | USA | 21 Years
Richard Vaillencourt | USA | 20 Years
James Valgean | USA | 36 Years
Keith Valiquette | USA | 22 Years
Matthew VanDeCreek | USA | 23 Years
Andrew VanderMeer | USA | 20 Years
Paul VanDuynes | USA | 29 Years
Thomas Varghese | USA | 25 Years
Kevin Venturini | USA | 25 Years
Sonny Vera Cruz | USA | 23 Years
Frank Verbeke | USA | 21 Years
Michael Vernon | USA | 34 Years
T. Nejat Veziroglu | USA | 27 Years
Leonardo Vidal | USA | 21 Years
Dennis Villanueva | USA | 21 Years
Nelson Vital | USA | 41 Years
Ralph Vivo | USA | 23 Years
Lawrence Vogt | USA | 42 Years
Jeffrey Wachob | USA | 23 Years
Richard Wall | USA | 26 Years
James Waltz | USA | 43 Years
Steven Ward | USA | 20 Years
Craig Warner | USA | 20 Years
Gregory Warren | USA | 28 Years
Randall Warren | USA | 26 Years
Glenn Watkins | USA | 23 Years
Jerry Watson | USA | 25 Years
Thomas Weber | USA | 20 Years
David Weiss | USA | 25 Years
Brian Weldy | USA | 25 Years
Stephen Wells | USA | 20 Years
Robert Werner | USA | 36 Years
Bradley Wheaton | USA | 29 Years
Frank White | USA | 24 Years
Boyd White | USA | 23 Years
Kendall White | USA | 23 Years
Randall Whorton | USA | 25 Years
Donna Wicks | USA | 23 Years
Stan Wiens | USA | 21 Years
Robert Wilken | USA | 26 Years
Verle Williams | USA | 36 Years
Michael Wilson | USA | 23 Years
Frank Windle | USA | 20 Years
Lori Winyard | USA | 23 Years
William Wojcik | USA | 21 Years
Samuel Wolfe | USA | 21 Years
Peter S.Y. Wong | Canada | 21 Years
Daniel Woolford | USA | 24 Years
David Wrightsman | USA | 27 Years
Fred Wurst | USA | 26 Years
Albert Yasbick | USA | 28 Years
Paul Young | USA | 26 Years
Jimmy Young | USA | 21 Years
Khaled Yousef | USA | 25 Years
Sherif Youssef | USA | 20 Years
Eugene Yparrea | USA | 37 Years
William Zavanelli | USA | 20 Years
Mark Zoeteman | USA | 21 Years

Hope for a Zero Carbon World

Global events
related to
energy and the
environment.

By Samer Adnan Zawaydeh, AEE Past President

Over the past 16 months the pandemic has overshadowed many great accomplishments. I want to take this opportunity to highlight opportunities and reasons for hope, especially those that impact our organization and our work as energy engineers. And it is our organization I'd like to be optimistic about first.



The Association of Energy Engineers is taking the leadership position in disseminating knowledge, training, and certification in the energy sector. It educates energy engineers, managers, and fresh graduates about the latest science and technological advancements in energy efficiency, energy management, renewable energy solutions, and the environment to ensure efficient use of resources, reduce operational cost, and work towards carbon neutrality. AEE's flexibility, planning, and implementation, supported by dedicated professionals worldwide, ensured the smooth transition to online platforms and enabled thousands of engineers to continue building their capacities despite COVID-19 disruptions.

We live in a time of rapidly changing conditions as we move towards Net Zero Carbon's targets by 2050/2060. Global unity in purpose empowers the passion of hopeful young energy engineers. Collaboration in science and technology, local development of resources, and designing processes using clean energy will ensure pollution control, better efficiency, and less waste. No nation can do it alone. It will be the engineers of tomorrow that will eventually lead this change. They will see a bright future by driving local economies, creating jobs, and ensuring sustainable growth.

NASA Mars Perseverance Robotic Rover

The rover accomplished giant steps for humankind in space exploration in February 2021. While the world is currently suffering from the pandemic, climate change, and the impacts of extreme weather conditions, NASA successfully landed the sixth spacecraft on Mars. I find it amazing that we can land a robot on a planet 126 million miles away from the earth using radio signals traveling at the speed of light for 11 minutes to communicate back and forth. Astonishingly, this was the third mission to reach Mars this month! Misbar Al Amal (Hope spaceship) from the United Arab Emirates and Tianwen-1 from China, reached Mars orbit on February 9, 2021.



V236-15.0 MW™ Turbine

Vestas® announced earlier this year the new offshore wind platform with a 15MW turbine, 115.5m blade, and a swept area of 43,000 m². This amazing engineering technology will empower the renewable energy sector and allow coastal cities to move more rapidly to clean energy generation. Subsequently, the offshore wind sector will have a larger share of the global energy mix.



Social Cost of Carbon (SCC)

SCC will be the most critical number in the future. Simply put, it is the "Polluter Pays" principle. It is an estimate of the economic climate damages associated with the increase in one ton of CO₂. In a working paper published in Feb 2021, "The Social Cost of Carbon, Risk, Distribution, Market Failures: An Alternative Approach" by Nobel Laureate Joseph Stiglitz and Lord Nicholas Stern, the price would reach between 50-100 USD/ton CO₂ by 2030. Also, the report shows how many companies are setting out to achieve carbon neutrality.

Solar PV 182mm x 210mm Silicon Wafer

The SolarPV sector is pushed forward as the major manufacturers shift to larger size wafers. This size increase is just one of the many recent advancements that will provide consumers with higher efficiency PV modules at lower prices. In seven years, the space required for PV has halved, and the price has reduced by two-thirds. It is now more likely that end-users can rely on Solar to cover their annual energy needs.



Pollution

Industrial nations worldwide (EU, Japan, South Korea, and China) took up the challenge targeting transition into Net Zero carbon by 2050 -2060. This is an unprecedented commitment towards environmental protection to stop air, water, and soil pollution. Achieving these objectives requires mobilizing the economy and institutionalizing policies and regulations to enforce clean energy and reduce the GHG across the supply chains.



Impact of Extreme Weather

In February this year, a record cold snap across the USA broke over 2,000 records. Temperatures plummeted to about 40-50 degrees Fahrenheit below average, and over 70% of the country was covered in snow. Texas suffered the most with multiple failures in power generation across the state. Outages affected millions of households, leading to billions of dollars in losses, and numerous lives were lost. Freezing of pipes and pumps caused conventional power to fail. Solar PV didn't work without the Sun, and Wind energy didn't work because the blades froze.

Planning for Extreme Weather

What happened in Texas is a clear lesson for the need to prepare for more extreme weather scenarios across all countries in the world. Investing in infrastructure, preparation, policymaking, and human resources building to deal with extreme weather conditions will save lives and reduce economic impact.




Large-scale planning, up to the national level, is becoming increasingly important. It is forecast severe weather will increase during this decade. Therefore securing enough time to complete contingency plans will save lives and reduce economic impact. And as energy engineers, we can learn to use weather forecasting to synchronize adequate supply with demand.

Weather Forecasting

Hope for a **Zero Carbon** World

Sustainable Aviation Fuels (SAF)




Airline commits to 100% Sustainable Aviation Fuels (SAF) by 2030: SAF is a clean substitute for fossil jet fuels produced from sustainable resources such as waste oils from a biological origin, agricultural residues, or a non-fossil source. The announcement was made in January 2021 by Boeing Co. to ensure that all of its commercial aircraft will be capable and certified to operate entirely with SAF by 2030.

Walking



People must be encouraged to walk every day to complete their errands and share electric vehicles if they need to use transportation. Basic, daily exercise will have a positive impact on health, the economy, and the environment. It will make them healthier, reduce obesity and illness, reduce fossil fuel, reduce pollution, reduce car accidents, reduce money spend on fuel, reduce infrastructure development to accommodate more cars on the roads. And to drive people to walk more, urban city design must change.

Urban City Design



Modern urban areas have allowed us to allocated and manage resources more efficiently, reduce infrastructure and provide services to large populations. However, the services and transportation sectors grew organically and were not studied carefully. Urban planners now realize they must design living and working environments within a 2 km radius to shift populations from predominantly using vehicles for commuting and daily needs to a pedestrian lifestyle. In turn, this shift would create a massive number of jobs in small, local communities.

COVER STORY

THE LIVING BUILDING CHALLENGE

KENDED A BUILDING | ATLANTA, GA

Right in the heart of Atlanta, a building lives to defy energy experts' expectations by becoming the most efficient building in the Southeast and solve the Living Building Challenge. The *Kendeda Building for Innovative Sustainable Design* is located on Georgia Tech's campus as a multi-disciplinary building that gives back more to the environment than it takes.

According to Georgia Tech's website, "To be certified under the Living Building Challenge, projects must meet the following ambitious performance requirements – Petals – over a minimum of 12 months of continuous occupancy and operations: place, water, energy, materials, health & happiness, and beauty." This building was thought to be impossible in the humid south and other environmental challenges but has proved to be net positive over the past year.

The Living Building Challenge is a certification program to create sustainable and regenerative buildings that use the resources created only by the facility. Living Buildings not only produce more energy than they use, but they also treat and collect all water on site. The Kendeda Building has met the standards and is currently waiting for the Living Building Challenge Certificate.



Take an Inside Look



Issue 1, 2021

EFFICIENCY



Association of Energy Engineers

If you no longer wish to receive AEE mailings please contact info@aeecenter.org and mention code: EFF-121

