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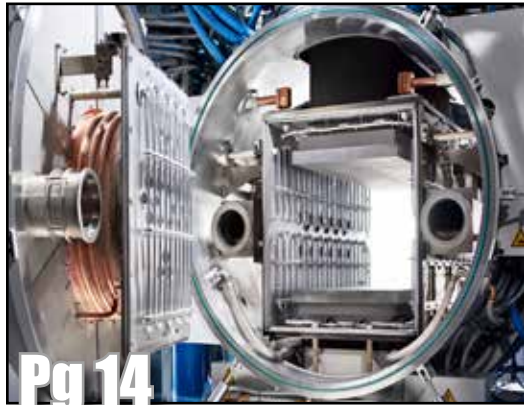
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Vol. 24 Issue 4

PRESIDENT

Glen Hobson
205-441-5591
glen@handfmedia.net

ASSOCIATE PUBLISHER

Steven Goodwin
205-624-2181
steve@handfmedia.net

ADMINISTRATIVE DIRECTOR

Steven Hobson
steven@handfmedia.net

EDITOR

Brandon Greenhill
brandon@handfmedia.net

CREATIVE/ WEB DIRECTOR

Jacklyn Greenhill
jacklyn@handfmedia.net

P.O. Box 1568 • Pelham, AL 35124
Phone: 205-441-5591 • Fax: 205-624-2181
www.theelectriccurrent.com
info@theelectriccurrent.com



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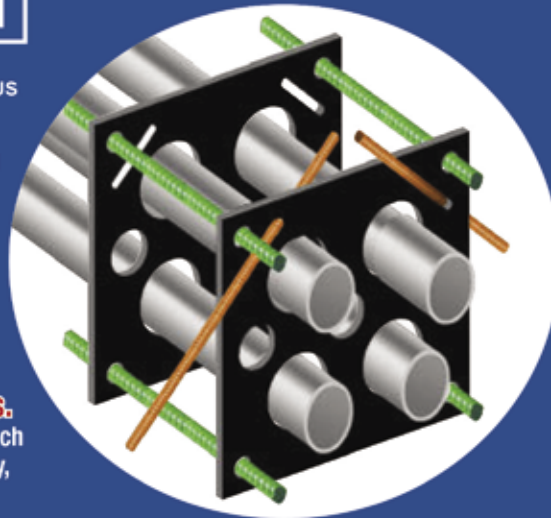
IP2



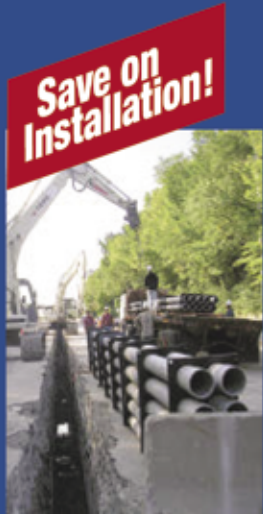
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Southern Power's South Cheyenne Solar Facility in Wyoming is now operational

Southern Power, a leading U.S. wholesale energy provider and subsidiary of Southern Company, today announced that the 150-megawatt (MW) South Cheyenne Solar Facility in Laramie County, Wyoming, is now operational.

This project, Southern Power's 30th solar facility, is Southern Power's first solar facility in Wyoming, and it contributes to the company's growing fleet of clean energy resources from California to Maine.

"We are thrilled to announce that South Cheyenne Solar has reached commercial operation, marking a significant milestone for our team and all who have worked tirelessly on this project, and we are equally excited to see our footprint expand with our first operational site in Wyoming," said Southern Power President Robin Boren. "This facility showcases our commitment to the development of solar energy and is an excellent addition to our growing renewable fleet."

The electricity and associated renewable energy credits generated by the facility will be sold under a 20-year power purchase agreement with Cheyenne Light, Fuel and Power, a subsidiary of Black Hills Energy. The energy will be used exclusively to provide renewable energy to a data center customer.

Southern Power acquired South Cheyenne Solar Facility from Qcells USA Corp. (Qcells USA), in September 2023. Qcells USA provided full renewable value chain and turnkey services on the project including serving as the project developer, module manufacturer and engineering procurement construction (EPC) provider of the site, which created more than 200 jobs at peak construction.

With the addition of South Cheyenne, Southern Power's solar portfolio includes more than 2,740 MW of solar



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generation. Southern Power's solar facilities are a part of the company's 5,280 MW renewable fleet, which consists of 30 solar and 15 wind facilities operating or under construction.

This project aligns with Southern Power's overall business strategy of strengthening its wholesale business by acquiring and developing generating assets that are covered by long-term contracts with counterparties with strong credit support.

About Southern Power

Southern Power, a subsidiary of Southern Company, is a leading U.S. wholesale energy provider meeting the electricity needs of municipalities, electric cooperatives, investor-owned utilities and other energy customers. Southern Power and its subsidiaries, some of which are owned in part with various partners, own or operate 55 facilities operating or under development in 15 states with more than 12,840 MW of generating capacity in Alabama, California, Delaware, Georgia, Kansas, Maine, Nevada, New Mexico, North Carolina, Oklahoma, South Dakota, Texas, Washington, West Virginia and Wyoming.

About Southern Company

Southern Company (NYSE: SO) is a leading energy provider serving 9 million customers across the Southeast and beyond through its family of companies. Providing clean, safe, reliable and affordable energy with excellent service is our mission. The company has electric operating companies in three states, natural gas distribution companies in four states, a competitive generation company, a leading distributed energy distribution company with national capabilities, a fiber optics network and telecommunications services. Through an industry-leading commitment to innovation, resilience and sustainability, we are taking action to meet customers' and communities' needs while advancing our goal of net zero greenhouse gas emissions by 2050. Our uncompromising values ensure we put the needs of those we serve at the center of everything we do and are the key to our sustained success. We are transforming energy into economic, environmental and social progress for tomorrow. Our corporate culture and hiring practices have earned the company national awards and recognition from numerous organizations, including Forbes, The Military Times, DiversityInc, Black Enterprise, J.D. Power, Fortune, Human Rights Campaign and more. To learn more, visit www.southerncompany.com.

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Cybeats Announces Cyber Contract with U.S. Electrical Grid Provider

Cybeats Technologies Corp., a Company offering industry-leading cybersecurity software, is pleased to announce a SaaS ("software as a Service") agreement with one of the largest electrical infrastructure companies in the U.S.

Cybeats' new client provides electrical infrastructure and industrial control systems (ICS) technology that operates in a 'critical state', meaning the operating performance, including software, could affect the safety of citizens as well as national security interests. Cybeats has already secured four of the global top 10 ICS providers, but given the enhanced regulatory pressures on U.S. critical infrastructure, the ICS sector remains the largest market opportunity with the highest demand for Cybeats' technology. SBOM Studio¹ revolutionizes how companies handle vulnerabilities and provides automated solutions for enhanced management of product and organizational risk.

"The ICS sector presents an immense opportunity for our growth, driven by a surge in regulatory focus on software transparency through SBOM. Both industry regulators and companies now recognize the essential need to increase software transparency. SBOM Studio offers a comprehensive solution that addresses the industry's urgent cybersecurity challenges and operational demands," said Justin Leger, CEO, Cybeats.

Regulation & Requirements for Utility Providers

NERC CIP² (North American Electric Reliability Corporation Critical Infrastructure Protection) is a set of requirements and standards to enhance the reliability and security of the electric utility grid by identifying and protecting critical cyber assets that, if compromised or destroyed, would impact the operation of the grid. Violations can also lead to penalties, making it essential for applicable entities to implement effective security measures and compliance strategies.

ISA 62443³ standards provide a structured framework for addressing and mitigating security vulnerabilities in industrial automation and control systems (IACS). These standards are used globally and are applicable to multiple sectors, including manufacturing, power generation, water treatment, and other industries that rely heavily on automation and control systems. They aim to provide a common language and set of best practices to ensure that industrial systems are both secure and resilient against disruptions from cyber threats.

Executive Order 14028⁴ bolsters U.S. cybersecurity through several key measures, including mandating the development of standards like the Software Bill of Materials (SBOM) for more transparent software supply chain security, aimed to

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2
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4
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enhance national security and address the evolving landscape of cyber threats. A recent U.S. President's Council of Advisors on Science and Technology (PCAST) briefing from February 2024 highlights the importance of Software Bills of Materials (SBOMs) for industrial controls and utility companies due to their key role in enhancing cyber-physical security. SBOMs provide essential transparency, enabling these companies to better identify and manage vulnerabilities, ensure compliance, and secure their supply chains.⁵

Read more about the power of SBOM and its role in build-

ing resilience in critical infrastructure on Cybeats' Blog, written by Dr. Georgina Shea, a renowned cyber expert, member of the PCAST Working Group, and advisor to Cybeats⁶.

Cybeats will be participating in the 2024 ISA OT cybersecurity Summit⁷ in London, UK, an event dedicated to safeguarding operational technology in sectors like energy, manufacturing, and building automation. It will feature the latest updates with ISA/IEC 62443 standards, and provide a platform for sharing insights about protection practices to enhance infrastructure and data security.



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About Cybeats

Cybeats is a cybersecurity company providing SBOM management and software supply chain intelligence technology, helping organizations to manage risk, meet compliance requirements, and secure their software from procurement to development and operation. Our platform gives customers comprehensive visibility and transparency into their software supply chain, enabling them to improve operational efficiency and increase revenue. Cybeats. Software Made Certain. Website: <https://cybeats.com>

¹ <https://www.cybeats.com/sbom-studio>

² <https://www.nerc.com/pa/Stand/Pages/ReliabilityStandards.aspx>

³ https://programs.isa.org/automationproday2024?utm_source=google_ads&utm_medium=ppc&utm_campaign=IAPD&utm_content=search&gad_source=1&gclid=CjwKCAjwxLKxBhA7EiwAXO0R0FLia6r93aXiuXaN4TNsV3Z8ON3ROxRFqkvi3QAycVWsEXIDu-scAxoCeMkQAvD_BwE

⁴ <https://www.whitehouse.gov/briefing-room/presidential-actions/2021/05/12/executive-order-on-improving-the-nations-cybersecurity/>

⁵ https://www.whitehouse.gov/wp-content/uploads/2024/02/PCAST_Cyber-Physical-Resilience-Report_Feb2024.pdf

⁶ <https://www.cybeats.com/blog/the-power-of-sboms-building-resilience-in-our-critical-infrastructure>

⁷ <https://otcybersummit.isa.org/>

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Diffusion Bonded Printed Circuit Heat Exchangers for Severe Environments

Compact printed circuit heat exchangers (PCHE), produced through a diffusion bonding process, surpass traditional alternatives in extreme temperature and pressure environments

Traditional plate or shell and tube heat exchangers have long been used in processing industries. Today, however, with many new applications involving high pressures, temperatures, and exposure to corrosive environments, more manufacturers are turning to compact printed circuit heat exchangers (PCHEs).

A PCHE is a multi-layer heat exchanger consisting of thin, flat metal plates into which fluid flow microchannels are chemically etched in each layer to form a complex flow pattern. The layers are then diffusion bonded together to create a dense heat exchanger with superior airflow and heat transfer properties.

When designed this way, a heat exchanger can be up to 85% smaller and lighter than traditional plate or shell and tube designs. In addition, PCHEs do not require excessive pipework, frames, or other asso-

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ciated structural elements, further reducing costs.

“A high-quality diffusion bonded PCHE can withstand very high pressures of hundreds of bars and extreme temperatures beyond 800°C. As a result, PCHEs are well suited for a wide range of demanding applications, including oil and gas, hydrogen vehicle fueling stations, and aerospace,” says Dr. Udo Broich, Managing Director of PVA Industrial Vacuum Systems GmbH, Wetztenberg, Germany. Dr. Broich, who wrote his doctorate thesis on joining technology, has focused on vacuum brazing and diffusion bonding for 25 years. PVA TePla AG is a global manufacturer of industrial furnaces and PulsPlasma nitriding systems.

Diffusion bonding versus brazing

For many years, diffusion bonding has been utilized to join high strength and refractory metals that are either difficult or impossible by other

means. The process involves applying high temperature and pressure to the bonding part in a high-vacuum hot press like those offered by PVA TePla; this causes the atoms on solid metallic surfaces to intersperse and join. The final piece will have little or no interface lines or striations if the materials are similar; the interface of one material blends into the other, and vice versa. The same result can also be achieved with dissimilar materials with the right equipment, material preparation, and process.

The key to the process is utilizing diffusion bonding to join the layers over other alternatives, such as vacuum brazing. Although brazing is widely used for joining metals under normal conditions, it can be insufficient in high temperature, pressure, or corrosion situations. Brazing is a joining process in which two or more metal items are joined together by melting and flowing a filler

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metal into the joint. The filler metal flows into the gap between the layers through capillary action.

With a proper choice of filler material and process parameters, brazing can also create high strengths and thermal resistant joints. However, as the filler metal always has a different chemical composition from the bonding part materials, the properties of brazed components usually cannot reach that of a solid part., according to Dr. Broich.

“In the case of brazing a PCHE, engineers must consider another issue: during brazing, molten filler metal can penetrate the microchannels and solidify, blocking the channels required for air-flow. This can render the PCHE quite ineffective,” says Dr. Broich. “Since diffusion bonding requires no filler metal and is a solid-state joining process, the microchannels remain intact.”

“When the layers of a PCHE are diffusion bonded, the final product retains the parent material’s mechanical, chemical, and thermal properties. Given the high strength and integrity of the material, PCHEs can withstand very severe operational conditions,” explains Dr. Broich.

A significant advantage of diffusion bonded PCHEs is that it significantly reduces the size of the heat exchanger.

“PCHEs have about 85% less mass and volume of traditional heat exchangers, while the microchannels provide a large surface area for heat exchange,” says Dr. Broich. “Achieving the same heat transfer rate with a standard [plate, or shell and tube] heat exchanger] design requires much more mass and volume.”

Growing Markets for Diffusion Bonded PCHEs

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Due to the inherent advantages of diffusion bonded PCHEs, many industries are adopting this evolving technology to improve heat transfer in various applications.

Oil and Gas

The compact, efficient heat transfer capabilities of PCHEs are ideal for many oil and gas applications, including preheaters, superheaters, gas compression coolers, high-temperature recuperators, and liquefied natural gas (LNG) exchangers.

For example, in offshore LNG production, natural gas is converted to a liquid for safe transport or storage when pipelines are not available. LNG takes up only a fraction of the space in its liquid form, but the natural gas must be cooled to approximately -260°F as part of the process, generating heat. A PCHE is a practical, compact solution for small footprint areas like onboard ships.

Hydrogen Fueling Stations

PCHEs are a requirement in hydrogen vehicle fuel-

ing stations. Stored hydrogen must be pre-cooled to approximately -40°C before being transferred into the vehicle's tank. This cooling process prevents potential damage from the excessive temperature that can damage tanks during filling.

"To fill a tank, pressurized hydrogen is dispensed at roughly 1,000 bars; this process generates excessive heat," says Dr. Broich. "Because it is critical that the temperature not exceed the critical limits of the tank, hydrogen is pre-cooled to about -40°C . The PCHE in the fueling station's cooling loop must withstand 1,000 or more bars of pressure and temperatures as low as -50°C . The compact design of PCHEs also eases integration with the hydrogen dispenser casing."

Aluminum Heat Sink Applications: Electric Vehicle and Aerospace

Aluminum heat sinks are popular for the thermal management of many critical devices where weight is a factor, including automotive and aerospace. Aluminum heat sinks are also commonly



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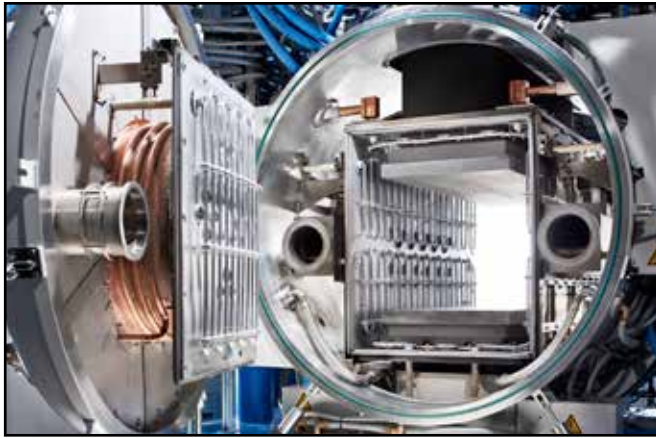


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remains a joining technology using filler metals based on an aluminum-silicon eutectic alloy. However, these alloys have a melting point of 580°C, very close to the melting point of the base material, thus providing only a tiny process window to achieve high-quality bonds,” says Dr. Broich.

He notes that PVA TePla has developed a diffusion bonding process to successfully join high alloyed aluminum materials like 6061 over the years.

Optimizing Furnace Design for Diffusion Bonding
There are various approaches to furnace design and process implementation for diffusion bonding of PCHes. Advances in high vacuum furnace hot presses allow superior pressure control and rapid cooling systems that improve bonding, increase yields, and significantly decrease cycle time.

Manufacturers such as PVA TePla offer multi-cylinder systems with large pressing plates that ac-

used with electric batteries.

The most common aluminum alloys used in heat sinks and exchangers are the 6000 series alloys. However, magnesium and silicon are the primary alloying elements and are difficult to join with methods such as brazing.

“In many heat sink applications, brazing flux is often prohibited. Therefore, vacuum brazing

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commodate various parts. The largest, the company's MOV 843 HP, can process substrates as large as 950mm (37.4") x 1300mm (51.18"), which is quite a large area for diffusion bonding. The pressing force is 8,000 kN. Research is underway to increase this geometrical limitation as well.

The integrated press provides remarkably consistent pressure across the entire surface by controlling and synchronizing each cylinder. The MOV also comes with built-in pressure transducers along the bottom of the pressing plate. The individual hydraulic cylinders can be adjusted in the software to achieve uniformity even over large areas based on sensor feedback.

Dr. Broich points out that high-bonding strength is critical for applications involving PCHEs in extreme settings.

"It requires a high-strength design [when a high vacuum hot press is needed] of the pressing unit [pressing rams and platens] to transfer 800 or 1000 tons at 1,000°C or even higher temperatures," says Dr. Broich.

In addition, the pressing unit should have a design that minimizes the mass within the hot zone while achieving uniform force distribution throughout the working space and pressing platen, according to Dr. Broich.

"The design of a diffusion bonding machine should enable the shortest cycle times possible while saving energy by reducing its thermal mass; this is very important to productivity and cost-effectiveness," he points out.

To produce a high-quality diffusion bonded PCHE, working with an expert partner like PVA TePla can

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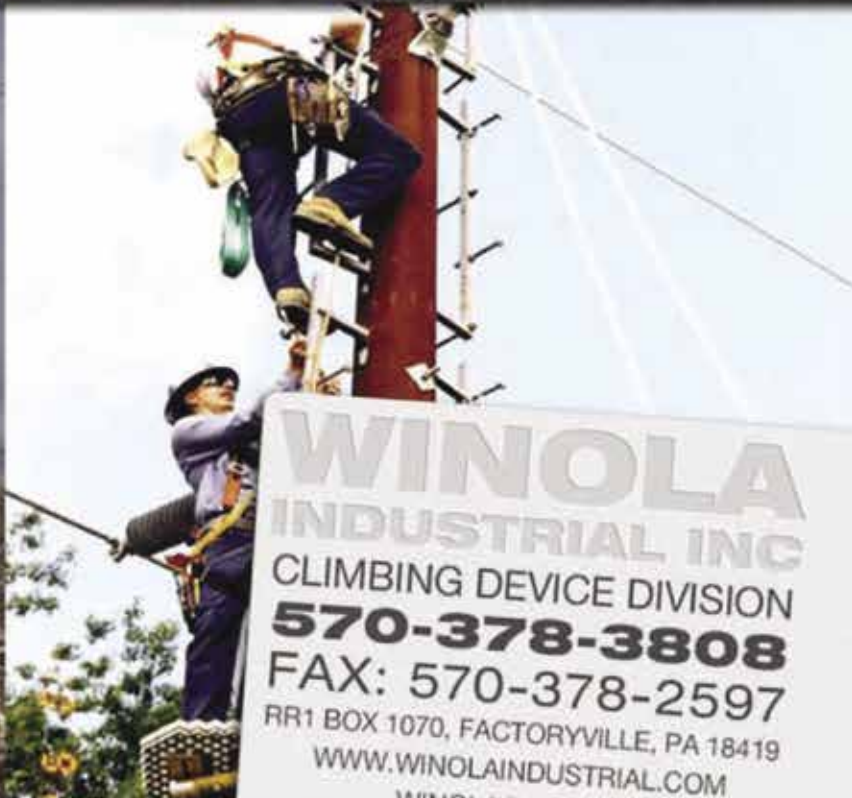
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be essential for manufacturers that require process and technology support.

“Most of our customers are not familiar with this technology. We support them with basic process technical knowledge so they can correctly use the machine to produce a high-quality diffusion bonded PCHE,” says Dr. Broich.

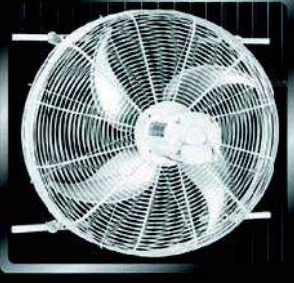
Due to the rapidly expanding need for this precision technology in the U.S., PVA TePla is opening a diffusion bonding technology center in Corona, California. This summer, a full-scale industrial furnace that matches the capabilities offered in Germany will be available. PVA TePla will be able to demonstrate the machine’s bonding capabilities, run R&D samples, and provide processing services.

“In both the U.S. and Germany, we can demonstrate the quality of the bonds before a customer decides to invest in a machine. We handle most of the elements of process development to prove the technology and assist in scaling up to production volumes. Alternatively, we can provide full-scale contract processing for customers if they outsource production,” says Dr. Broich.

For more information, contact PVA TePla America at 951-371-2500 or 800-527-5667 or visit www.pvateplaamerica.com



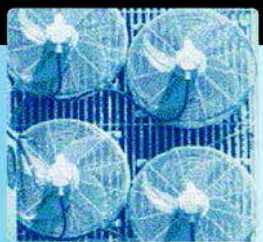
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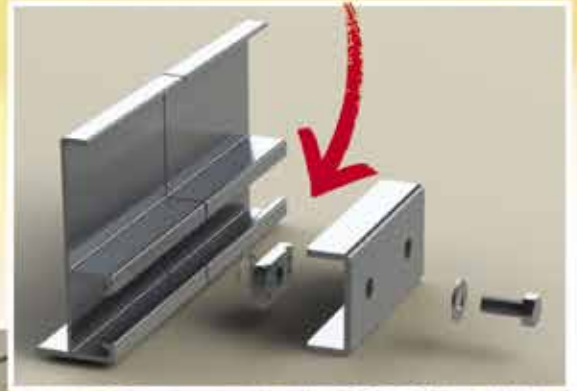
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