



ASYS
GROUP

2023
Year-End Closing

**BUSINESS
UNIT ENERGY**



ASYS Group – Energy

Turnkey Solutions for Fuel Cell Production

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INTRO

For almost two decades, the ASYS Group is successfully developing and building manufacturing solutions for the energy market. 2023 has been no exception to this continued success story. We were able to deliver full manufacturing solutions to our customers, helping them to produce innovative renewable energy products and thus making a significant difference towards worldwide energy sustainability. We have remained true to our philosophy as a turnkey solution provider. With modular machine solutions and concepts, we can put together individually configurable production lines, which can then be used to produce an entire product in a joint matrix network.

This year, we continued to focus particularly on one aspect of our philosophy: we develop innovative solutions exactly where our customers' pain remains the greatest. For example, with the XH4, we have developed and successfully established a screen-printing machine that turns one of the slowest process steps in

manufacturing of bipolar plates into one of the fastest and most scalable processes.

At the moment, we are focusing on further improving our turnkey solutions by the same approach. We also continue to do that for our solar metallization product line. There, we will work on further enhancing our production throughput as well as increasing flexibility for different product designs while maintaining the established excellent production yield of our machines.

Following this newsletter, you will stay up to date on our latest development and product releases for the energy market.

Further, we have prepared a new ASYS fuel cell booklet which summarizes all main aspects of our turnkey solution.



Dr.-Ing. Sebastian Tepner
Product Manager HYCON & ENERGY

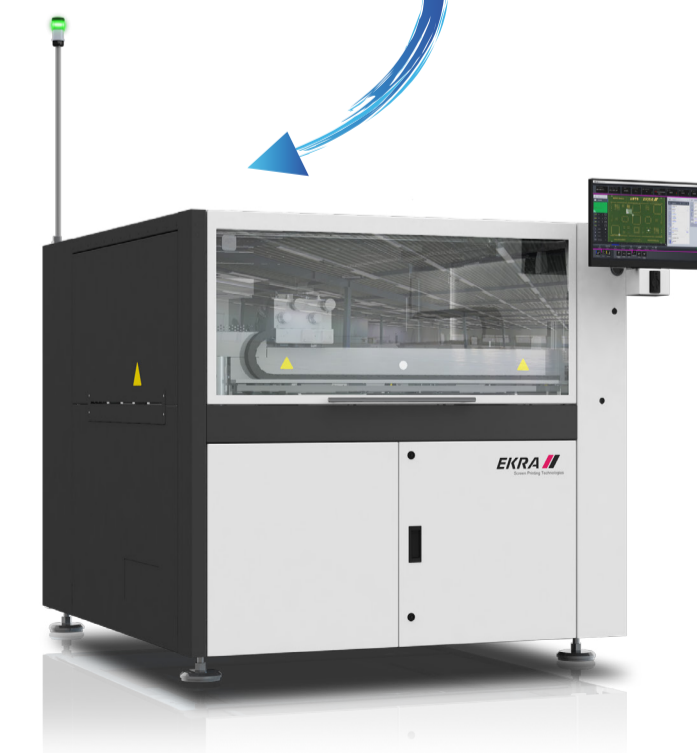
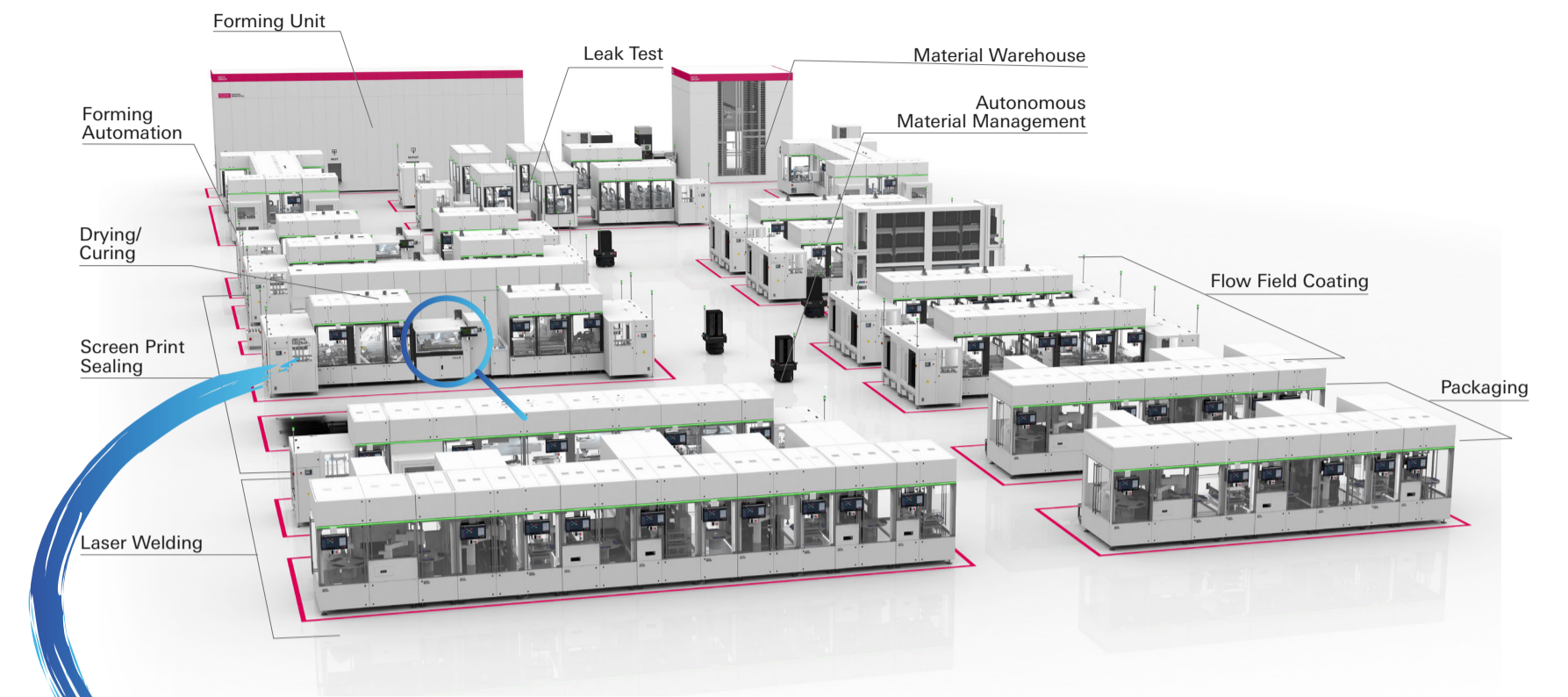
OUR PHILOSOPHY AS A TURNKEY SOLUTION PROVIDER

Our matrix based turnkey solution (here for high-volume manufacturing of PEM bipolar plates) combines a large number of individual manufacturing processes. We optimize the factory concept not only with respect to these individual process cycle times but also utilize synergies with smart material logistics and software solutions like our PULSE PRO concept. The Figure on the right perfectly illustrates our philosophy. The modular approach allows us to scale individual process solutions towards the overall factory output target. We always start with the individual process or task by developing a scalable solution on machine level. Following this, the automation and supporting processes such as cleaning, drying and inspection tasks are combined to a full autonomous production line. These individual production lines are then duplicated and combined to a full turnkey solution on factory level. This approach not only works for entry-level to high volume scenarios but also allows for smooth scaling of already existing production setups.

From
factory
level

Throuh
process
line
level

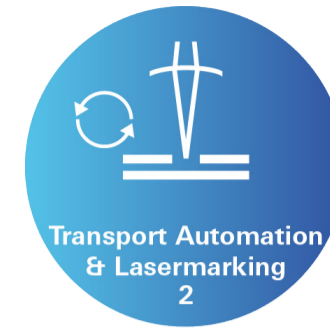
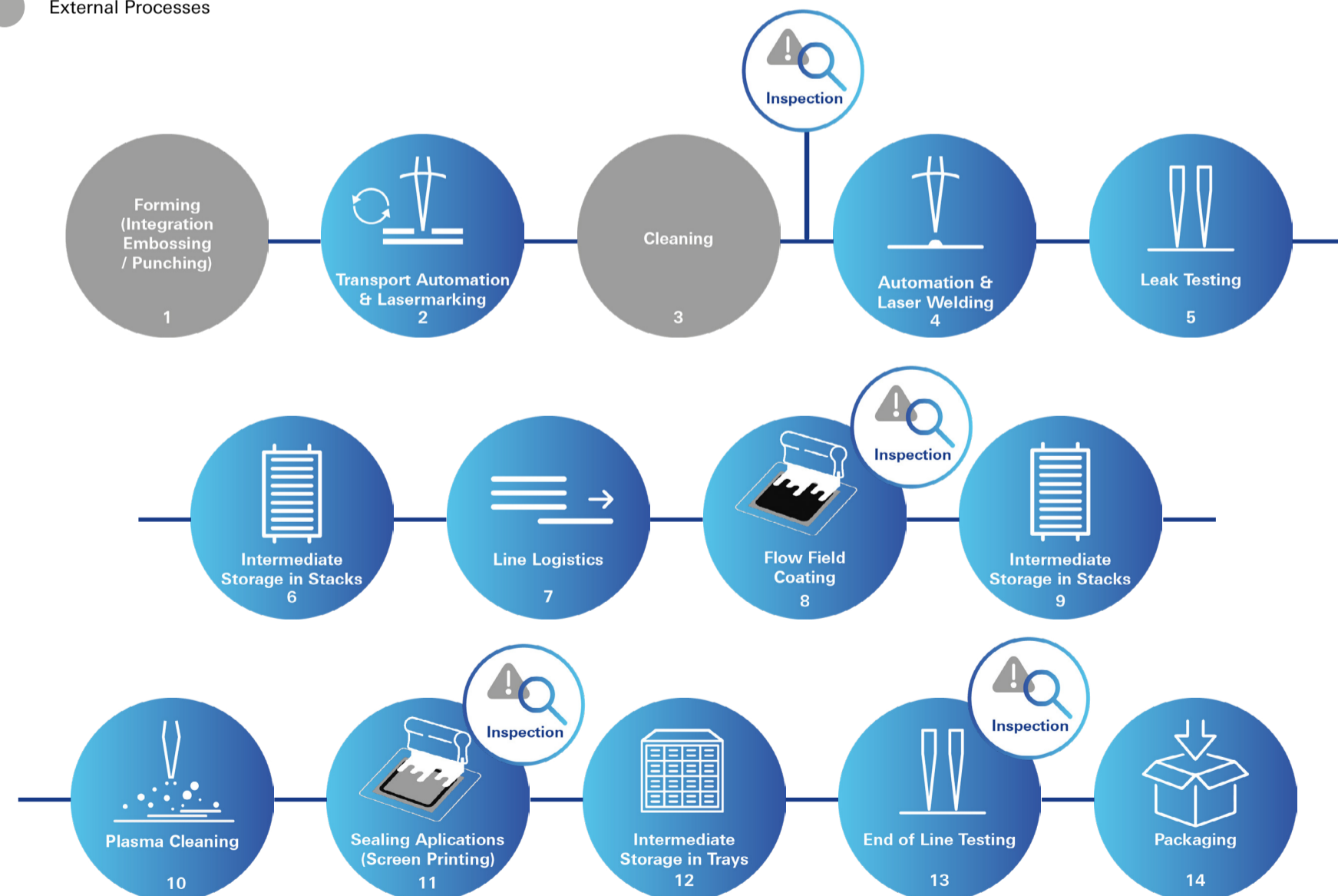
To
machine
level



FROM FACTORY TO MACHINE LEVEL

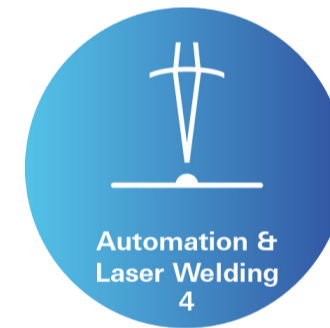
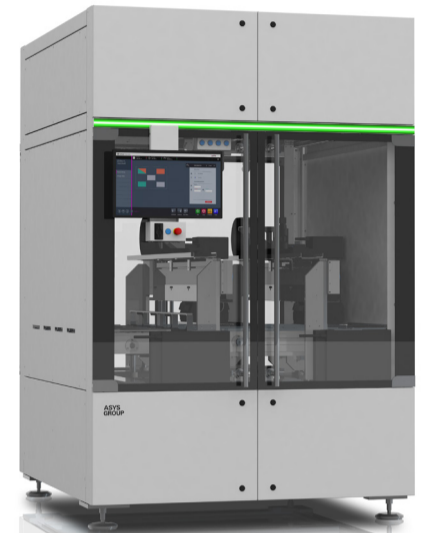
The process steps, starting from precise laser marking through efficient laser welding to the innovative process technology, not only represent the highest quality but also outstanding efficiency in production. The XH4 printing system sets new standards in screen printing, while our end-of-line tests ensure sufficient reliability and performance of bipolar plates. In addition, our logistics solutions, including material storage and the use autonomous mobile robots (AMRs) contribute to the seamless efficiency of our operations. The flow chart on the bottom illustrates our full turnkey solution for high-volume manufacturing of bipolar plates.

- ASYS Processes
- External Processes



TRANSPORT AUTOMATION & LASERMARKING

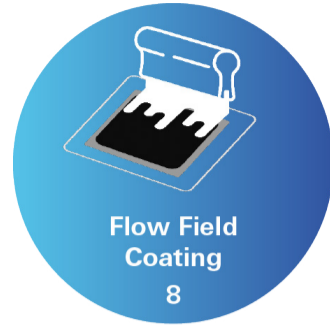
To ensure seamless traceability of the bipolar plates, we offer the POLYPHOS MK Laser Marking with proven fiber laser technology. Individual plates are automatically transported from the forming process and then divided into four lanes where they are laser-marked and code-verified by two laser heads and advanced digital galvo scanners in only 4 seconds per lane.



AUTOMATION & LASER WELDING

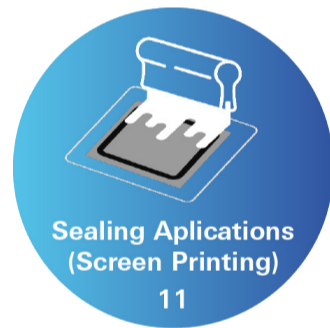
Bipolar plates for PEM fuel cells play a pivotal role in the efficient operation of stacks. They facilitate gas distribution, heat dissipation, and electrical conductivity. Metallic bipolar plates made of thin stainless steel enable reactant gases to flow over electrode surfaces where the electrochemical reaction occurs. The resulting heat is dissipated by a coolant between the plates. Effective sealing through inline remote welding with galvo scanners and fiber lasers is crucial to prevent gas mixing and leakage.





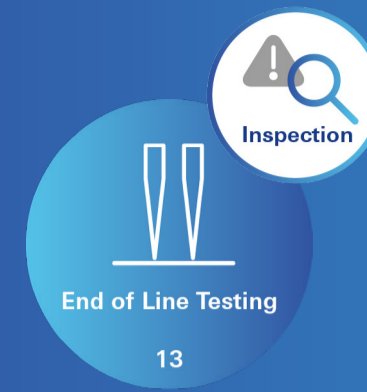
FLOW FIELD COATING

To enhance the electrical contact with the Membrane Electrode Assembly (MEA), bipolar plates are typically coated. Our innovative rotational coating system continuously applies a defined special material film onto the raised areas of the flow field bipolar plate. The coated part is then dried by our undergoes a high-speed drying system (IR-based) before it is finally and is inspected for defects. Our solution allows for coating, drying, and inspection in a cycle times of less than 4 seconds.



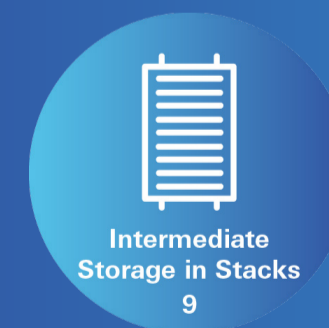
SCREEN PRINTING OF THE SEALING STRUCTURE

Our industry leading, patented XH4 printing system is used for applying the sealing structure onto the bipolar plate. The printer comes in a fully autonomous printing line, including cleaning and our AI based wet print inspection.



END OF LINE TESTING

The final inspection before packaging is crucial to ensure sufficient performance and durability of all bipolar plates. Our end-of-line testing line includes a leak test to check for complete sealing in order to prevent dangerous mixtures of hydrogen and oxygen. Further, we offer our AI based EOL inspection checking for any defect and unwanted deformation of the plate.



MATERIAL STOCKING / LOGISTICS

The ASYS Group addresses the challenge of managing a high volume of manufacturing materials, such as bipolar plates, and at varying cycle times through storage solutions like the Smart Buffer or Material Warehouse. These systems can be directly installed in the production environment, offering full automation for loading, and unloading. In fully automated production, autonomous mobile robots (AMRs) handle the entire material transport, including bipolar plates. The concepts work perfectly for high-volume manufacturing of bipolar plates.

HIGH-LIGHTS 2023



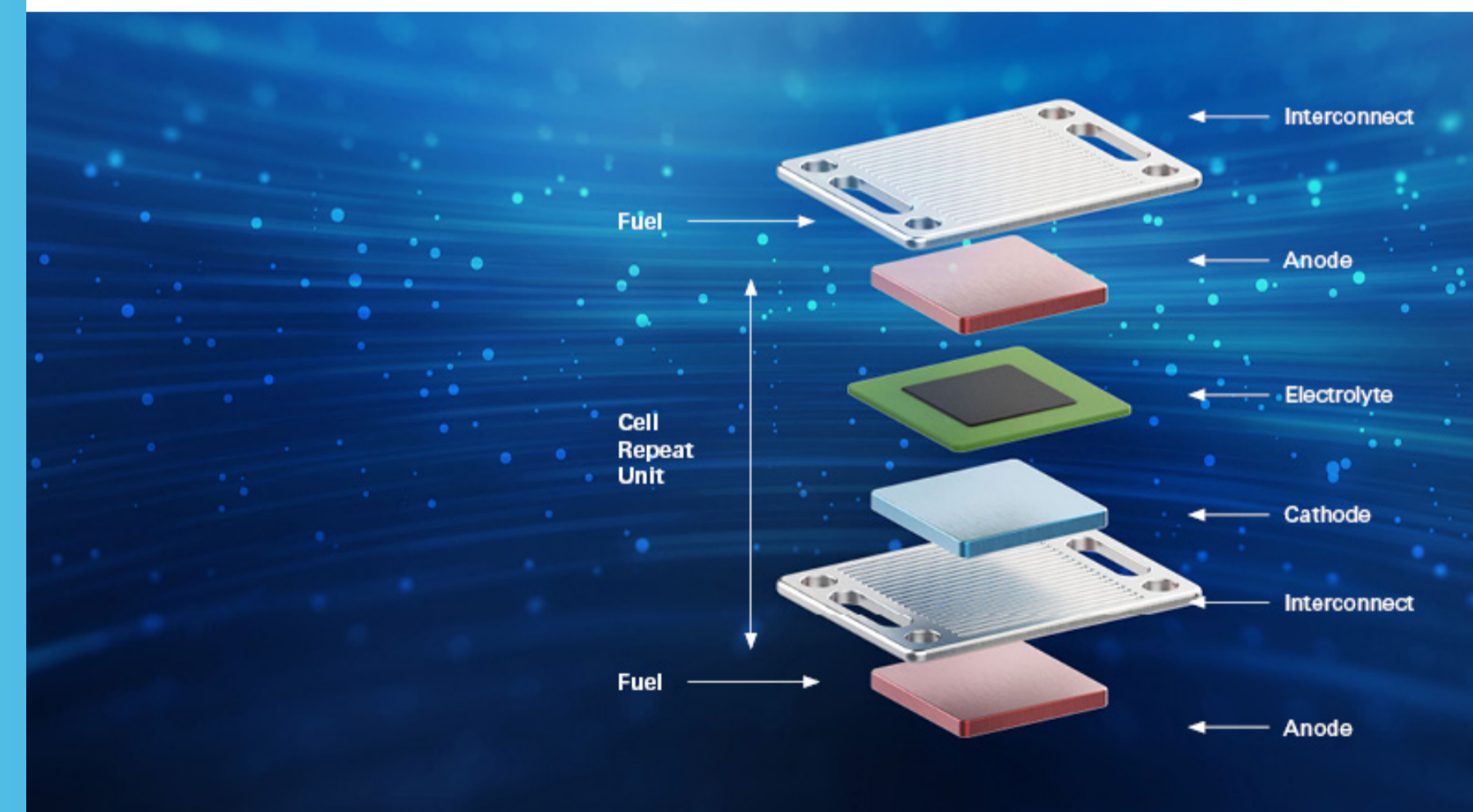
OUTLOOK



NEXT NEWSLETTER ISSUE

SOFC/SOEC Technology and Our Innovative Matrix-Based Turnkey Solution

In our upcoming newsletter, we shine a spotlight on an incredibly exciting topic: advanced SOFC/SOEC technology. Discover how this innovative technology is revolutionizing our industry and the groundbreaking developments we are spearheading in this field.



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