Rockwell Automation

OPTIMIZING **GREEN HYDROGEN** PRODUCTION

Accelerate time-to-market by leveraging comprehensive project guidance, leading to enhanced return on investment.

BEGIN

Navigating opportunities

Unleashing the potential of a hydrogen-based economy

According to experts, green hydrogen (H_2) is poised to emerge as a sustainable substitute for natural gas, aligning with global initiatives for achieving net-zero emissions.

The H2 economy signifies a substantial shift in industrial production, electricity generation, transportation, and the broader societal response to climate change. A reduction in the costs of renewable energy, supportive policies from both governments and corporations, the establishment of regional hydrogen hubs, and a collective societal commitment to addressing climate issues create a favorable landscape for the swift expansion of the hydrogen economy. As the green hydrogen market gains momentum worldwide, the attraction to starting hydrogen production initiatives grows for many customers with existing energy production infrastructure.

In order to accommodate this growth, producers seek knowledgeable partners to help in the effective application of technology, guide project implementation, and adeptly manage associated risks.

Green Hydrogen could contribute **to more than 20%** of global emissions reduction by 2050.

Source: McKinsey & Company

BUSINESS CHALLENGES

- Optimum design (and scalability)
- Operational costs
- System performance / high energy losses
- Safety for people and assets
- Limited specialized workforce

What's the bottom line?

If you're a Green Hydrogen producer, your success depends on strategically managing resources, operational costs and system performance, while maintaining a safe environment for workers. **The right equipment configuration and management is critical to achieving your goals.**

Maximizing production impact: Key areas for advancing efficiency in the hydrogen economy

Optimum design and scalability: Efficiency on a grand scale
Achieving optimal design and scalability is pivotal for a successful hydrogen-based economy. It involves creating efficient systems on a small scale and ensuring seamless scalability for broader adoption. Balancing design intricacies and scalability is crucial for overall system efficiency.

System performance and energy losses: Enhancing efficiency
Addressing system performance and mitigating energy losses are crucial for the sustainability of a hydrogen-based economy. Ensuring minimal losses in energy conversion and storage systems is essential for maximizing overall efficiency. Ongoing research and development efforts are necessary to enhance performance and minimize energy losses, contributing to long-term viability.

Operational costs: Navigating financial viability
Overcoming operational costs is critical in establishing a hydrogen-based economy. Balancing the economic feasibility of production, storage, and distribution processes is essential for realizing benefits without undue financial burdens. Developing cost-effective solutions and exploring innovative financing models are key in addressing operational cost challenges.

Limited specialized workforce: Building expertise
The shortage of a specialized workforce poses a hurdle in the growth of a hydrogen-based economy. Developing a skilled workforce in hydrogen technologies is essential for smooth operation and expansion. Investment in education, training programs, and collaborative initiatives with educational institutions can address the challenge of a limited specialized workforce.

Safety for people and assets: Security in implementation
Ensuring safety for people and assets is paramount in developing a hydrogen-based economy. Addressing risks associated with storage, transportation, and usage is crucial for building public and industry confidence. Implementing robust safety protocols and investing in advanced risk mitigation technologies are essential steps.

Developing **cost-effective solutions** and **exploring innovative financing models** are key in addressing operational cost challenges.

Rockwell Automation's legacy for the future

A history of leadership

With more than a century of experience, Rockwell Automation is a global leader in digital transformation and industrial automation. We're uniquely positioned to meet the evolving needs of the hydrogen industry and particularly those looking to produce green hydrogen. Our strength lies in combining our extensive PartnerNetwork™ and global support to offer unparalleled insights from game-changing solutions designed to make your operations as safe, efficient and sustainable as they can be.

Digital excellence for green hydrogen optimization

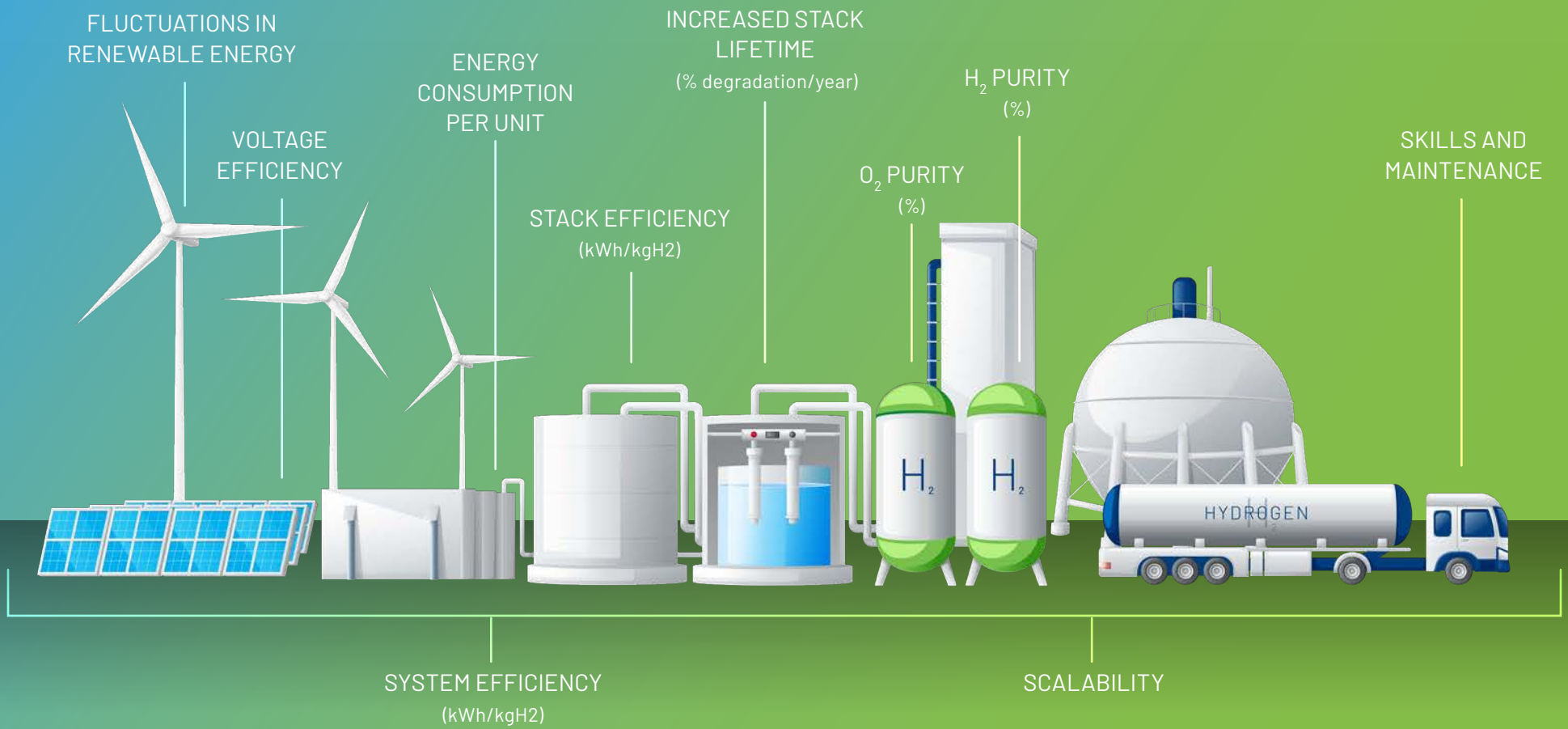
When it comes to production through advanced automation and digital solutions. Our portfolio encompasses a wide array of automation, control, and information solutions, including real-time data collection, predictive maintenance, and seamless integration of renewable energy sources, addressing the diverse requirements of the green hydrogen value chain.

Partnership that makes a difference

Rockwell Automation's global support teams and PartnerNetwork™ help to ensure that customers receive top-tier support wherever they operate.

Our commitment to providing robust, scalable, and globally supported solutions makes Rockwell Automation an ideal partner to help green hydrogen producers aiming for sustainable, efficient, and profitable operations.

Green Hydrogen Performance Challenges – Application



DESIGN **DEVELOP** **OPERATE** **OPTIMIZE**

SCALE

How Rockwell Automation brings value

Support at every stage of your hydrogen project lifecycle

Rockwell Automation delivers unparalleled value by providing comprehensive support at every stage of your H2 project lifecycle. From initial planning to implementation and ongoing operations, our expertise ensures seamless and efficient execution, maximizing the success of your hydrogen projects.

Connected. Agile. Powerful.

When you choose Rockwell Automation for green hydrogen production optimization, you can achieve consistent functionality, connected operations, and the agility you need to control and track diverse and evolving processes.

What can you expect? Comprehensive worker and resource integration and new levels of intelligence that help manage quality, enable continuous improvement, and boost productivity.

Rockwell Automation Solutions : **Plantwide Automation**

- ENERGY MANAGEMENT
- ANALYTICS (SPECIFIC TO H2 DASHBOARDS & PERFORMANCE MONITORING)
- ASSET PERFORMANCE MANAGEMENT
- CONTROL SYSTEM
- SAFETY SYSTEM
- MCC/DRIVES
- CYBERSECURITY
- SERVICES

Partnerships

- POWER CONVERSION
- PROCESS INSTRUMENTS
- CONNECTED WORKFORCE

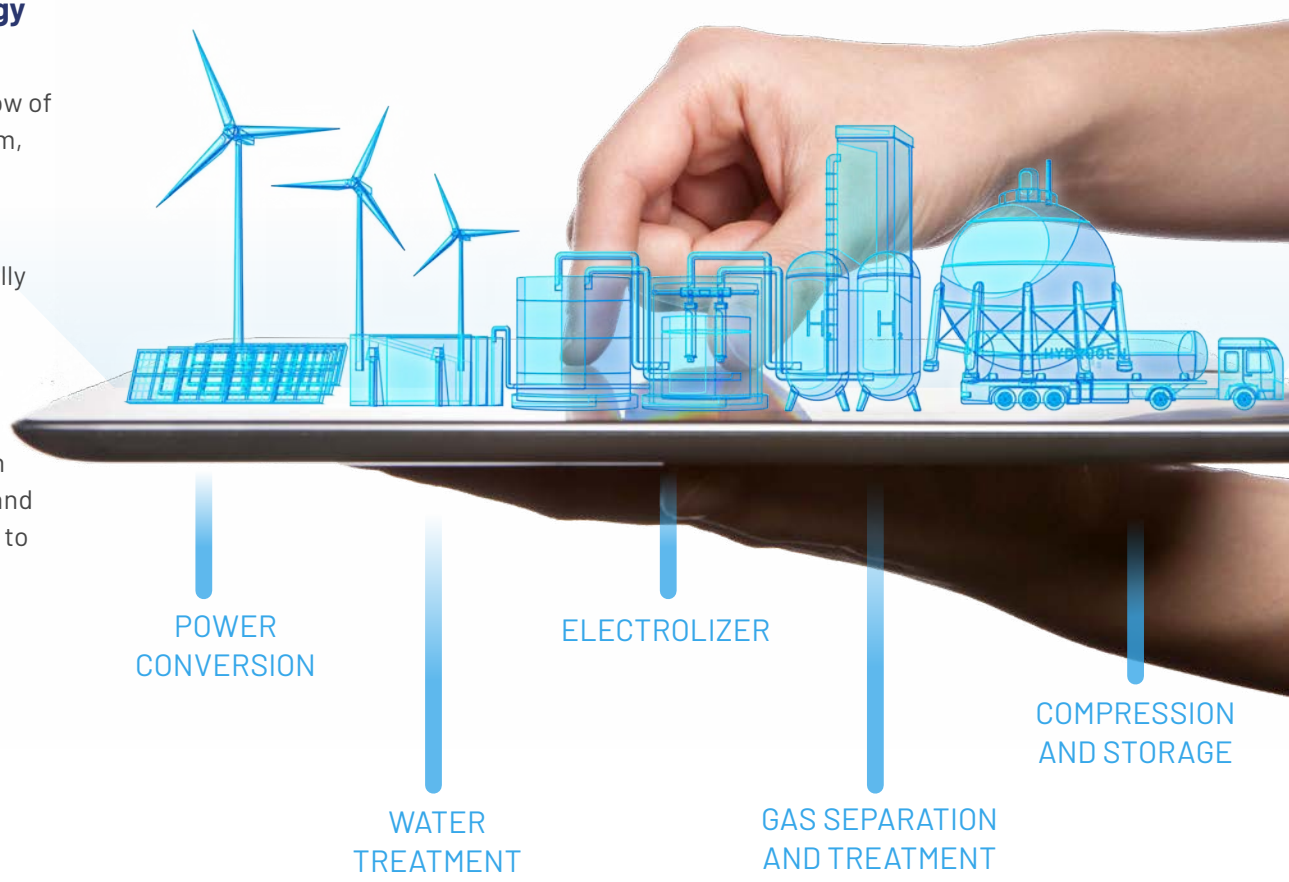
Leveraging digital technologies

Early adopters of digital transformation methodology are surging ahead in productivity and innovation.

How? Embracing digital transformation enables a seamless flow of data throughout an organization. From plant floor to boardroom, a Connected Enterprise® is better equipped to address challenges and fully leverage the potential of their assets.

In a world where disruption is the new normal, becoming digitally enabled is the key to helping to establish your business or boost its growth, achieving operational excellence while solidifying resiliency. By connecting facets of your business, these technologies can help you accelerate innovation, maximize workforce productivity and optimize operations with improved organizational agility. Digital transformation unites and integrates information technology and operational technology to provide a foundation for your hydrogen production success.

Get projects right from the start with **an optimized design** – be confident that your system configuration offers the best ROI.



Optimize production

Process and power form the bedrock of hydrogen production, ensuring optimal, reliable, and secure operations. An integrated system, sourced from a single vendor, oversees, controls, and powers operations seamlessly from supply to storage.

Plant-wide automation

Our approach to plant-wide automation is based on the PlantPAx® distributed control system. It connects critical areas of hydrogen production for optimizing production. And when integrated with smart devices, such as PowerFlex® (Variable Speed Drives), PowerMonitor™ (Energy Monitoring) and Process instruments—it adds another level of connectivity to drive out more efficiency through reduced integration costs and easier access to performance enhancing data.

Process safety is a critical requirement for Hydrogen production. With a history of being a market leader in safety, Rockwell has a breadth of capabilities second to none. From safety consulting to safety technology and safety services, we have everything you need to keep your hydrogen operations up and running while helping to reduce risks.

Read the full story

Integrated process control solution, leveraged a world-class facility in the United States, **expedited completion** in just

11 months,

compared to an industry standard of 48 months.

Results Achieved

Decision-making empowered by Advanced Analytics

When producing green hydrogen, production analytics is a must. It provides critical visibility to help maintain a reliable output that's efficient and sustainable.

Analytics

Dealing with huge amounts of operational data at high-speeds can leave hydrogen operators with too much information and little context. Having the right tools to contextualize and provide actionable insights can make all the difference in process efficiency and improving end-to-end performance.

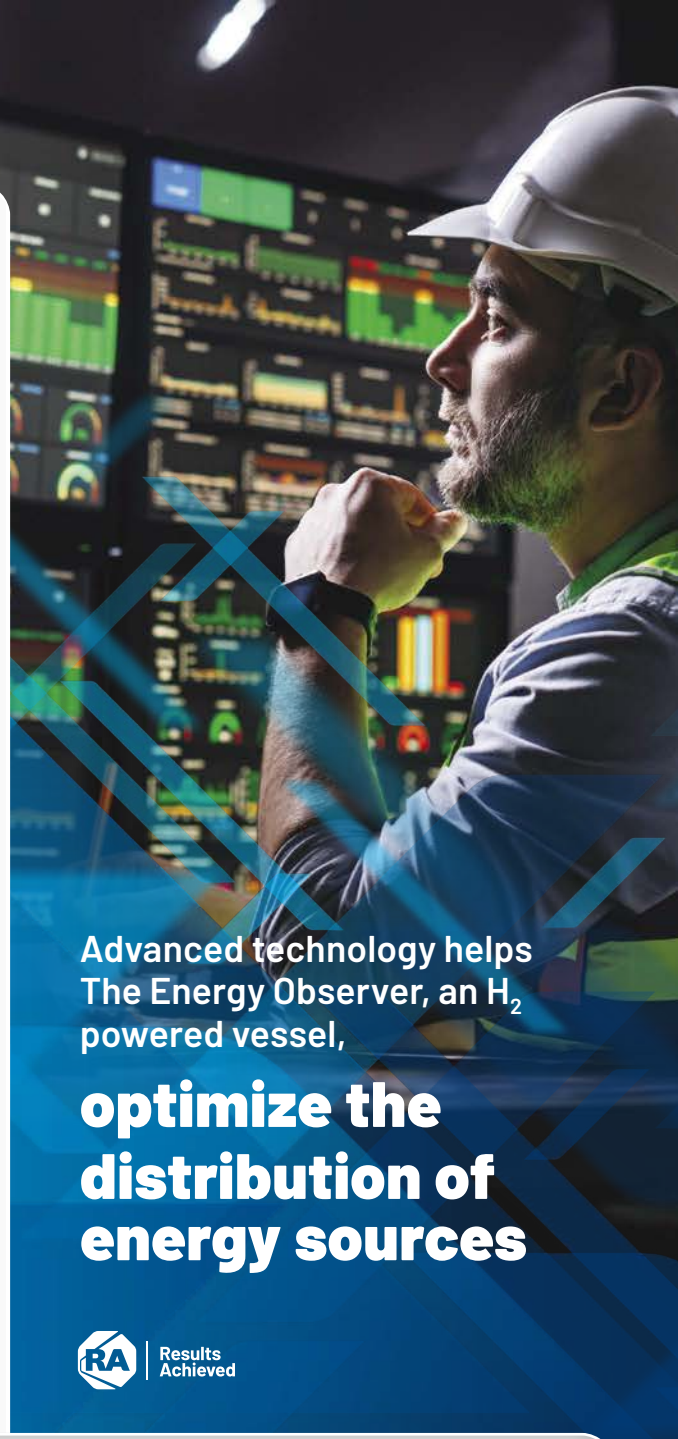
FactoryTalk® DataMosaix™ enables controlled access to relevant and contextualized data. The solution is about breaking down data silos and optimizing how industrial data is used across the organization. It delivers simple access to complex industrial data to solve tough problems that drive transformational outcomes in productivity, quality and sustainability.

FactoryTalk® Analytics™ allows for a high-volume of information generated at the edge that can deliver insights to the right person or system with low latency – dramatically cutting down evaluation and planning time.

FactoryTalk® Analytics™ Pavilion8® Model Predictive Control (MPC) is an intelligence layer on top of automation systems that continuously helps plants achieve cost reductions, decrease emissions, enable consistent quality and production increases—using accurate, highest fidelity process models.

Cybersecurity

Modern Green Hydrogen production requires modern cybersecurity. As the world leader in industrial automation, Rockwell Automation knows how to secure industrial systems for organizations of all sizes across all industries. We deliver unrivaled capability in OT cybersecurity through specialized in-house cyber knowledge coupled with world-class partnerships.



Advanced technology helps The Energy Observer, an H_2 powered vessel,

optimize the distribution of energy sources

Results Achieved

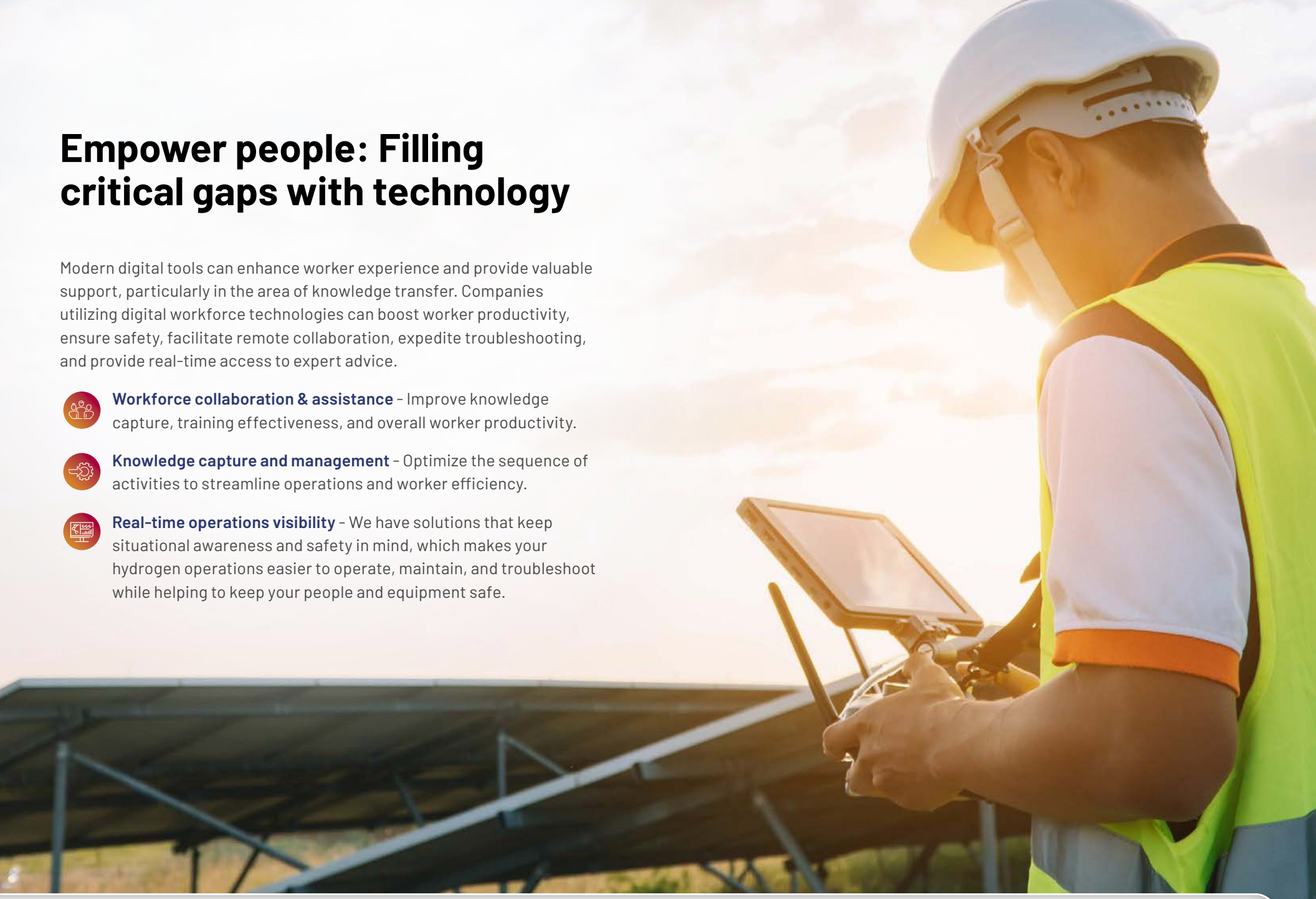
Empower people: Filling critical gaps with technology

Modern digital tools can enhance worker experience and provide valuable support, particularly in the area of knowledge transfer. Companies utilizing digital workforce technologies can boost worker productivity, ensure safety, facilitate remote collaboration, expedite troubleshooting, and provide real-time access to expert advice.

Workforce collaboration & assistance - Improve knowledge capture, training effectiveness, and overall worker productivity.

Knowledge capture and management - Optimize the sequence of activities to streamline operations and worker efficiency.

Real-time operations visibility - We have solutions that keep situational awareness and safety in mind, which makes your hydrogen operations easier to operate, maintain, and troubleshoot while helping to keep your people and equipment safe.



Sustainable energy production and water management

Keeping hydrogen production green faces several operational challenges regarding use of resources, such as unpredictability of renewable energy sources and water purity.

Renewables

Optimizing renewable energy sources offers opportunities for higher energy yields and more consistent power. Control technologies for renewable systems and integration of distributed energy resources (DERs) / microgrids are a few of the ways that automation can get the best performance out of renewable systems.

Energy management

As energy costs continue to increase globally it helps an organization understand where, when and how it uses energy to establish the necessary scope of its energy savings efforts and define key metrics. Monitor and analyze consumption, demand, intensity, and costs with FactoryTalk® Energy Manager™. Discover cost savings opportunities while boosting productivity.

Water management

Creating one kilogram of hydrogen requires at least 9 liters of water; however, industrial processes like filtration and vapor loss can add to this amount by 33% – managing usage with automated systems and analytics can decrease overall water needs for an operation and improve hydrogen's eco-friendly status as compared to other fuel sources.

Read the full story

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Publication CHEM-BR003A-EN-P - March 2024