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Hydrogen Usage in the Chemicals & Polymers Industries

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Introduction

Hydrogen in Industry

In the industries of specialty chemicals, plastics, and polymers, h**ydrogen is a crucial but often overlooked input**; it plays a key role in hydrogenation, hydrotreating, and other chemical processes that improve material properties and ensure product quality.

Current Challenges

Yet, for decades, manufacturers have viewed hydrogen as just another consumable—sourced from large-scale producers, transported over long distances, and purchased without much consideration for hidden costs, risks, or environmental impact. **But this approach is rapidly becoming unsustainable.**

Changing Conditions

Market dynamics are shifting as regulatory frameworks tighten, carbon pricing mechanisms take hold, and supply chain vulnerabilities become more apparent. In India and Southeast Asia, where industrial growth is accelerating, these pressures are particularly pronounced. **Governments are implementing aggressive decarbonization targets, and multinational buyers are increasingly demanding emissions reductions from their suppliers**. Meanwhile, disruptions in global energy markets have highlighted the risks of depending on centralized grey hydrogen production and long-distance transport.

The Way Forward

For manufacturers in this sector, **the question is no longer just about cost—it's about resilience.**
What if, instead of relying on external suppliers, companies could generate their own hydrogen on-site, on-demand, and at a predictable cost?
This paper explores the case for decentralized hydrogen production in the specialty chemicals industry and why it is becoming a strategic necessity for businesses looking to stay competitive.

Hydrogen Use Cases in the Industry

Hydrogen Applications

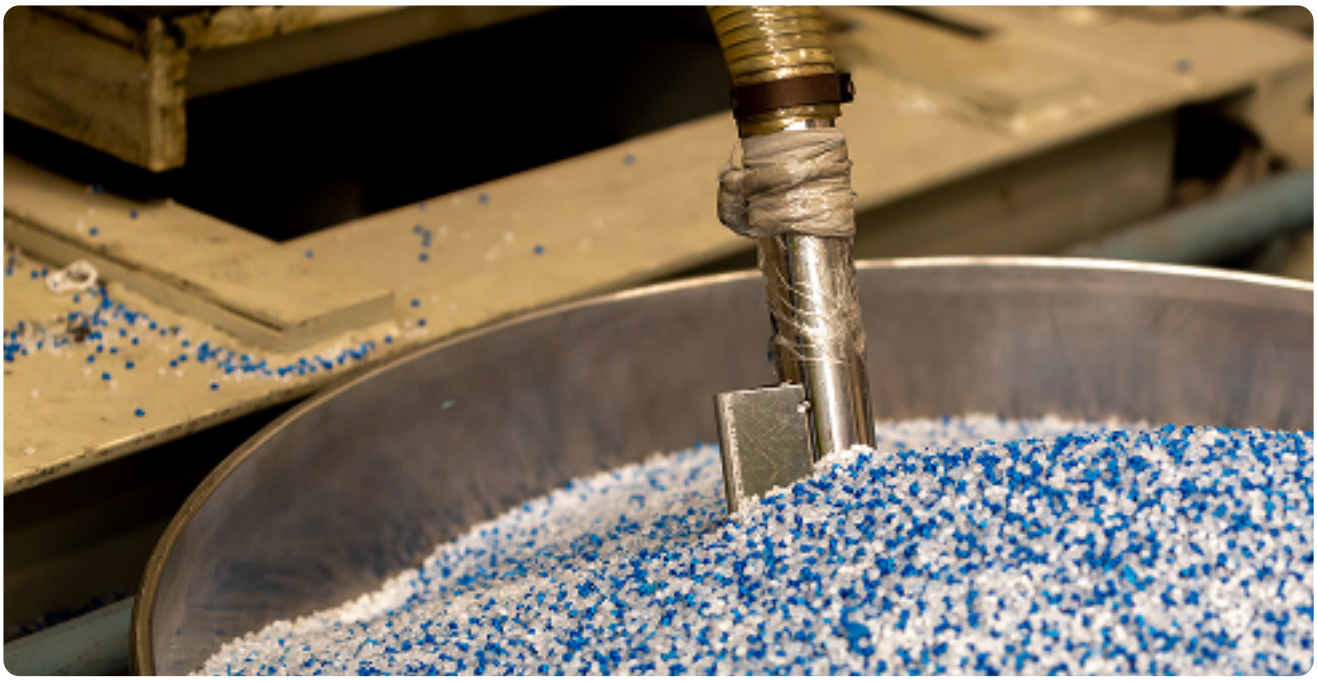
Hydrogen is an essential feedstock in the specialty chemicals, plastics, and polymers industry, supporting a range of critical processes.

Hydrogenation

One of its most widespread applications is in hydrogenation, a process used to modify the structure of organic compounds. For example, hydrogenation is essential in producing high-performance coatings, adhesives, and specialty resins. **Without hydrogen, many of these materials would lack the durability, flexibility, or resistance that industrial users require.**

Hydrotreating

Another key application is hydrotreating, where **hydrogen is used to remove impurities from feedstocks.** This is particularly important for ensuring the quality of base chemicals used in manufacturing high-performance polymers and plastics.
In addition, hydrogen plays a role in the production of specialty gas blends, which are used in controlled chemical reactions that demand high levels of purity and precision.



Current & Projected Demand for H_2

The demand for hydrogen in the specialty chemicals sectors is expected to grow steadily as industries expand and sustainability requirements tighten. While large-scale applications like ammonia and methanol production require massive hydrogen volumes, specialty chemical processes typically need smaller, steady supplies—making them well-suited for on-site production.

Current H_2 demand in the industry

The chemicals industry currently consumes approximately 3 million tonnes of hydrogen annually, with India and Southeast Asia accounting for a significant portion of this demand.*

Projected H_2 demand by 2030

The chemicals industry currently consumes approximately 3 million tonnes of hydrogen annually, with India and Southeast Asia accounting for a significant portion of this demand.*

CO_2 emissions impact

Every tonne of grey hydrogen used results in roughly 10 tonnes of CO_2 emissions. Given the industry's current reliance on grey hydrogen, total emissions from hydrogen usage in this sector amount to approximately 30 million tonnes of CO_2 per year.

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The Hidden Costs of Grey Hydrogen

Many companies assume that purchasing hydrogen from external suppliers is the most straightforward and cost-effective approach. However, the reality is that relying on grey hydrogen comes with significant hidden costs.

Carbon Costs

The first and most pressing concern is **carbon compliance**. As governments introduce stricter emissions regulations and carbon pricing schemes, **companies that rely on grey hydrogen may face increasing costs associated with carbon credits or penalties.** Large buyers in industries such as automotive and electronics are already evaluating their supply chains for sustainability compliance, which means that specialty chemical producers could come under pressure to decarbonize or risk losing business.

Supply Risks

Supply chain risks are another major consideration. Hydrogen is typically produced in centralized facilities and transported to end users, often over long distances. This creates vulnerabilities—rising transportation costs, geopolitical instability, and logistical disruptions can all impact supply reliability and cost. **Companies that depend on externally sourced hydrogen may find themselves exposed to unexpected price fluctuations and delivery delays.**

Safety Burden

Safety and infrastructure costs further add to the equation. **Transporting and storing hydrogen requires specialized infrastructure, including high-pressure tanks and safety monitoring systems.** For companies that rely on bulk hydrogen deliveries, these additional costs are often overlooked but can add significant complexity to operations.

Why On-Site, On-Demand Hydrogen is the Future

The challenges associated with grey hydrogen supply are pushing manufacturers toward a new solution: on-site, on-demand hydrogen production. By generating hydrogen as needed, companies can take control of their supply, eliminating transportation risks and reducing exposure to market volatility.

Just as importantly, producing hydrogen locally allows companies to transition away from fossil-based hydrogen and cut their carbon footprint without relying on expensive offsets.

With on-site production, costs become more predictable. Instead of fluctuating with market conditions, hydrogen costs are tied to electricity prices—an increasingly favorable dynamic as renewable energy sources such as solar and wind become more affordable. For manufacturers with existing renewable energy capacity, integrating electrolysis into their operations can create a self-sustaining hydrogen supply, further enhancing cost efficiency.

Operational flexibility is another advantage. Hydrogen production can be adjusted based on real-time demand, reducing waste and improving efficiency. This level of control is particularly valuable for manufacturers dealing with batch production processes or fluctuating order volumes.

The HYDGEN Advantage

Low CAPEX & OPEX:

Unlike PEM electrolysis, by using non-precious materials, AEM electrolysis reduces capital and operating costs while maintaining efficiency.

High operating flexibility

Unlike alkaline electrolysis, AEM systems can efficiently integrate with variable renewable energy sources such as solar, allowing companies to leverage their own power generation.

Compact design with built-in purification

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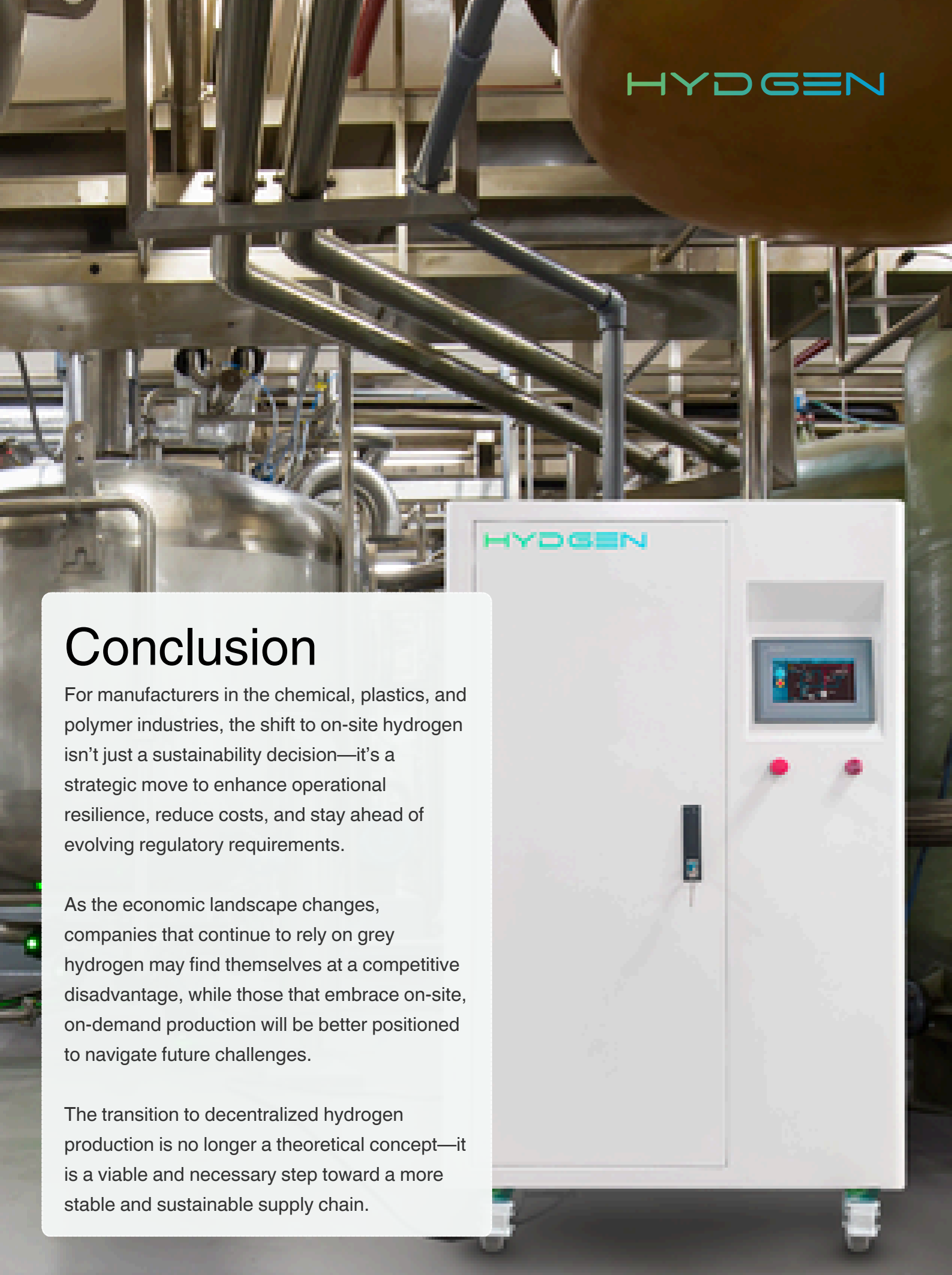

Conclusion

For manufacturers in the chemical, plastics, and polymer industries, the shift to on-site hydrogen isn't just a sustainability decision—it's a strategic move to enhance operational resilience, reduce costs, and stay ahead of evolving regulatory requirements.

As the economic landscape changes, companies that continue to rely on grey hydrogen may find themselves at a competitive disadvantage, while those that embrace on-site, on-demand production will be better positioned to navigate future challenges.

The transition to decentralized hydrogen production is no longer a theoretical concept—it is a viable and necessary step toward a more stable and sustainable supply chain.

Transform Your Production with HYDGEN

For more details on implementation and feasibility, please contact our team to explore how on-site hydrogen can work for your specific processes.

Contact Us Today:
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