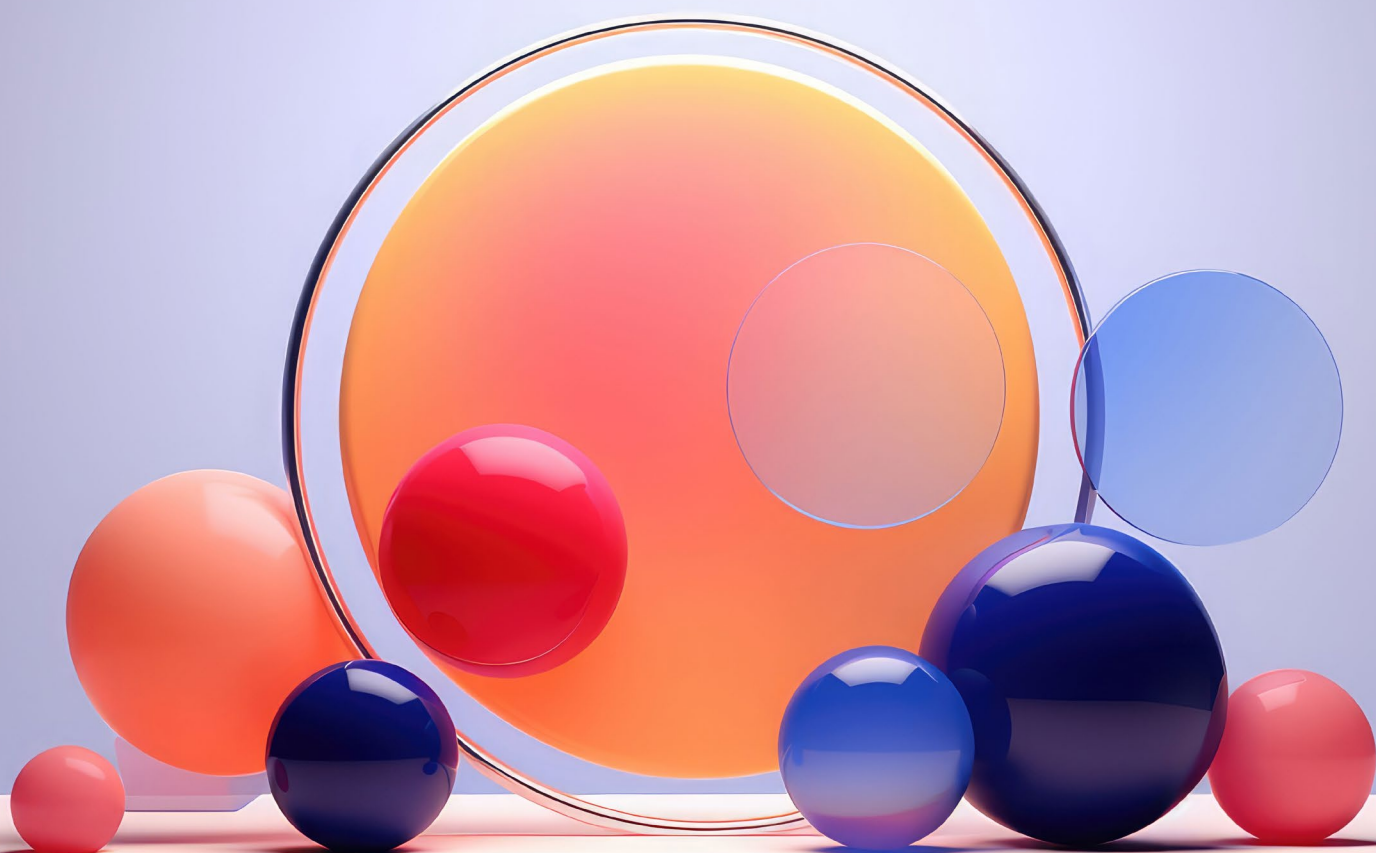


CHEMICALS THE NEW ERA



published in

TIME

CHEMICALS—THE NEW ERA

The environmental impact of chemical contamination and plastic waste is well-documented. The image of plastic on our shores is etched in our memories. Yet, the complexity of the issue is often overlooked. Why is there so much plastic polluting our oceans? Is this a problem of plastic waste or plastic production? Considering the chemicals industry contributes 5 percent of global greenhouse gas emissions, according to the International Energy Agency (IEA), what purpose does this industry really serve?

Over the past four months, I have had conversations with leaders from 75 top chemical companies and associations across the U.S., Europe and Asia to uncover the deep truth behind the role of chemicals in our lives. Every day, you and I use, see, touch, or taste dozens of products that originate from the chemicals industry. If chemicals were to disappear, our quality of life would suffer significantly.

While it is a large contributor to greenhouse gas emissions and is having to answer for the harmful chemicals present in our environment, the

chemicals industry will be crucial to the energy transition and the next phase of modernity.

In this feature, I aim to shed light on this \$6.2 trillion global industry (in 2023 according to Markets and Markets) that Lori J. Ryerkerk, chairman, CEO & president of Celanese, says needs to overcome public misconceptions. "Much like the agricultural industry, the ubiquity and essential nature of chemical products are often overlooked or misunderstood by the public. From medical supplies and vehicles to renewable energy infrastructure and everyday electronics, polymers and chemicals are indispensable," highlights Ryerkerk. Tracy Garrison, CEO of GEON Performance Solutions adds: "The challenge lies in educating the broader community about the industry's foundational contributions to modern conveniences and necessities."

This piece will showcase key innovations being developed by the industry and the challenges it faces while providing a toolbox for you to better address challenges you may personally encounter with chemicals in your daily lives.

IN THIS REPORT...



JIM FITTERLING |
CHAIR AND CEO,
DOW, INC.

By the end of this decade, our circular and renewable solutions business will represent ~25 percent of Dow's polyethylene capacity; this can deliver ~15 percent lower CO₂e emissions vs. traditional polymers.



MITCHELL TOOMEY |
VP SUSTAINABILITY &
RESPONSIBLE CARE,
**AMERICAN
CHEMISTRY COUNCIL**

Emerging technologies and digital tools like digital twins are essential for simulating scenarios to eliminate inefficiencies or incorporate non-fossil feedstocks.



FREDERIQUE VAN BAARLE |
PRESIDENT & CEO,
LANXESS CORPORATION

The challenges in 2023 were multifaceted, involving raw material and energy cost increases, a global reduction in demand, geopolitical instability, logistical challenges, and regulatory complexities.



The Global Chemicals Industry at Large

The global chemical industry is navigating a complex landscape, shaped by the aftermath of the COVID-19 pandemic, fluctuating economic conditions, and geopolitical conflicts.

United States: The Land of Incentives

The U.S.' chemicals industry has been bolstered by a domestic economic boom and strategic incentives as President Joe Biden looks to bring green and semiconductor industries back from China. The Inflation Reduction Act (IRA), which is directing \$400 billion toward clean energy, with a key goal of reducing the nation's carbon emissions by 2030, is now in its second year and is playing a crucial role in supporting industry growth. "CO₂ capture and sequestration technology is seen as both scalable and profitable, especially with recent enhancements in incentive programs like the IRA in the United States," emphasizes Mark Behrman, president & CEO of LSB Industries, when talking about the value add from the IRA.

However, not all industry leaders are entirely satisfied with the IRA's scope. Mark Nikolich, CEO of Braskem America, acknowledged the act's positive aspects but also highlighted its limitations. "While initiatives like the IRA in the U.S. represent a positive step, especially in funding sustainable projects, they are viewed as too narrow as they do not address circularity projects," he notes.

While the bipartisan nature of the IRA ensures its continued influence beyond the upcoming election, there will be continued calls for more inclusive incentives that address a wider range of sustainability issues.



\$639 Billion

generated annually by the U.S. chemicals industry



Less than 1%

Proportion of bioplastics in the overall global plastics market

INGREDIENTS AND PRODUCTS IN CHEMICALS INDUSTRY INCLUDE:



Personal care & cosmetics

items like shampoos and makeup, detergents, paints and coatings for laptops, food additives etc.



Specialty chemicals

high-value materials that serve many industries including semiconductor, pharma, agriculture and many more



Basic chemicals

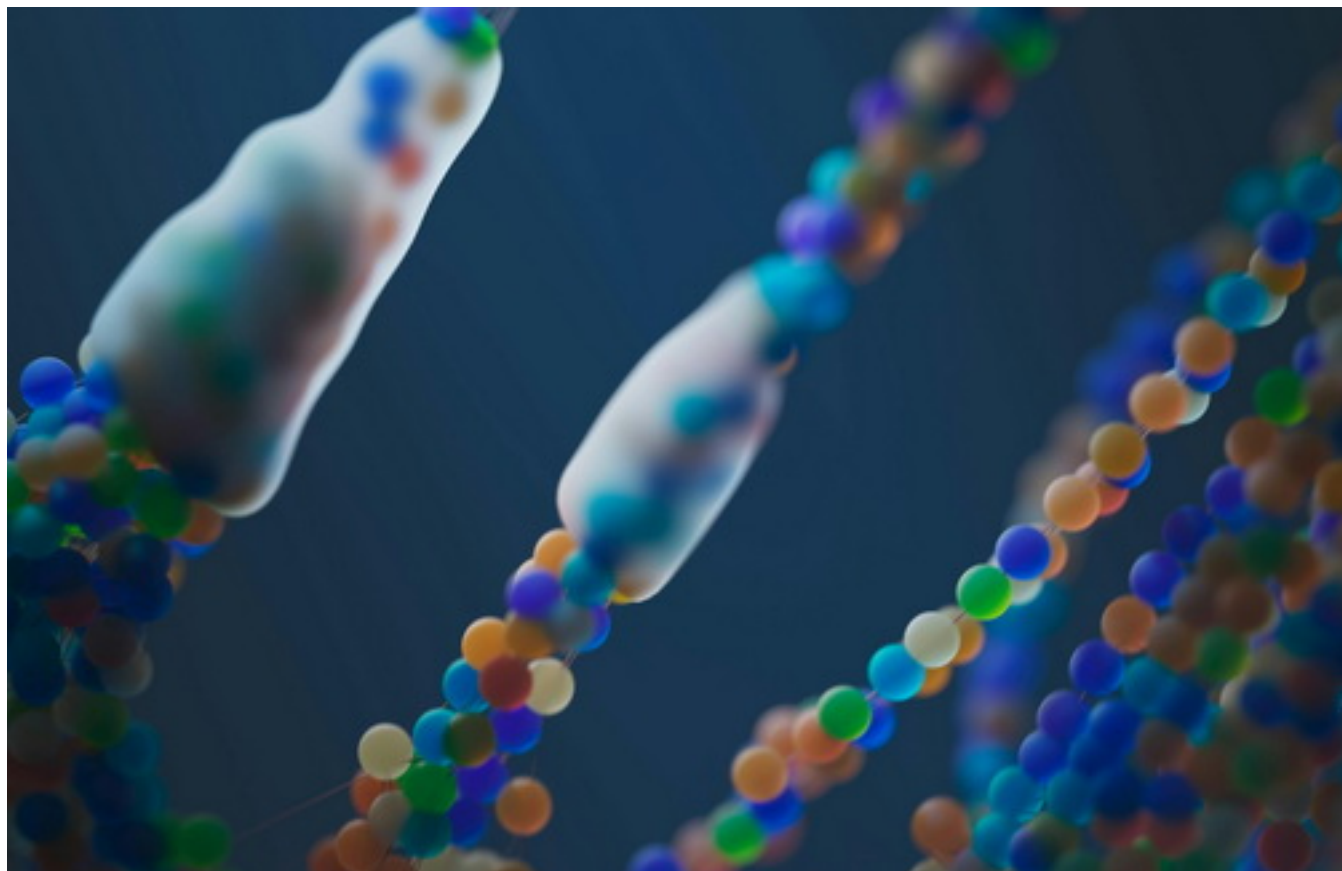
used in industry, construction and other industries



Polymers

are large molecules composed of repeating structural units called monomers, which are crucial to the industry

Sources: (The Business of Chemistry, By The Numbers; American Chemistry Council, 2023)
(World plastics production 2022; Plastics Europe, 2023)



Europe: Slow Push Back From the Edge

Europe has seen itself on a different trajectory. “2023 presented a ‘perfect storm’ for Covestro, accentuated by the geopolitical crisis and its domino effects on global demand and energy costs,” underlines Covestro’s Chief Commercial Officer Sucheta Govil. “The Ukraine-Russia conflict exacerbated these challenges, leading to a notable impact on our sales volumes, prices, and ultimately, a 20 percent decrease in sales to 14.4 billion from the previous year’s 18 billion. Despite these adversities, we take pride in our cash management and the steps we took to mitigate the downturn,” she notes.

While companies have weathered the almighty storm in Europe, and inflation and interest rates appear to be coming down, the European chemical industry does face upcoming challenges. Giuseppe Librandi, president and CEO of COIM, believes “stringent regulations and the ambitious but, in our view, poorly implemented Green Deal,” will affect the European chemical industry’s competitiveness moving forward. In the context of regulation, Sanjeev Rastogi, CEO of Arxada, underlines how certain markets like Switzerland, are becoming “highly attractive to customers seeking sustainable solutions,” due to their low scope three emissions.



New ships need to be built and alternative fuel sources used, but there is still a lot of debate and little consensus on what fuels are most appropriate. LNG, LPG, methanol, and ammonia are contenders but there’s a limit to the amount of ammonia available commercially currently that is not being used for fertilizer production.

GINA FYFFE |
CEO, **INTEGRA**



APAC: Growing Economies Still Creating Demand

The ripple effects of China’s economic deceleration have been felt across the APAC region, influencing market dynamics and trade flows. Neighboring countries that rely heavily on China for raw materials

THE IMPORTANCE OF LOCALIZATION



GEOFFREY CLOSE | CEO, **PRAYON**

Adaptability, a local yet global approach and family-like mindset are key components of Prayon success. Strategies are essential but the capacity to adjust swiftly is paramount.



ANNE MARIE INFILISE | PRESIDENT & CEO, **QUADRA**

With Canada’s strengths in critical minerals and mining, these sectors represent potential growth areas for Quadra, contributing to the broader energy transition movement.



OLIVIER RIGAUD | CEO, **CORBION**

Our geographical strategy prioritizes proximity to feedstock for cost and carbon emission reasons, especially for bulk bio-based chemicals. However, for more specialized products, like biomedical polymers for slow-release drug delivery, being closer to the consumer becomes crucial.



JOHN FORTSON | CEO, **INGEVITY**

South Carolina’s rich forestry resources and its position as a hub for pine trees provide a unique advantage for our chemistry-based operations.



SEAN KEOHANE | CEO, **CABOT**

Cabot’s global strategy leverages our pioneering heritage and a business model that emphasizes local production and leadership to meet regional demands effectively.

and chemical products are experiencing some cost fluctuations. However, APAC’s chemicals industry continues to be buoyed by growing middle classes and urbanization with Southeast Asia and India leading this. Growth in APAC’s chemicals industry will be 5.2 percent in 2024 compared to 3 percent worldwide, according to Atradius.

When it comes to sustainability, it is Singapore that is taking the boldest steps in the region. As a city-state with no natural feedstock



and little land, it is leveraging its strategic geographical location and ease of doing business to be a first mover in the energy transition.

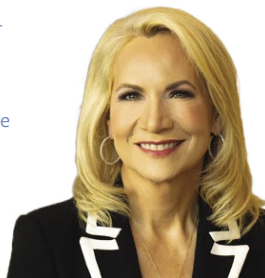
One of Singapore's most significant initiatives is the continued implementation of a carbon tax. Wey-Len Lim, executive vice president of the Singapore Economic Development Board, explains, "The carbon tax in Singapore was introduced not as a revenue-generating tool but as a price signal to encourage companies towards sustainable practices and energy transition."

The revenue generated from the carbon tax is reinvested, for example, through the Resource Efficiency Grant for Emissions, into the industry to support energy efficiency and emission reduction projects, directly contributing to the industry's sustainable transition.



This strategic focus on sustainability, coupled with our agility in meeting customer needs, exemplifies our proactive stance on environmental stewardship and our capacity to deliver tailor-made, sustainable solutions rapidly.

LORI J. RYERKERK |
CEO, CHAIR & PRESIDENT,
CELANESE



Why Not Just Create Sustainable Products?

In 2023, President Biden emphasized the need to replace 90 percent of plastics—which are predominantly made with fossil fuels—with biomaterials over the coming decades. With McKinsey predicting that bio-based processes could generate \$4 trillion in annual U.S. economic impact, it seems illogical that the industry would not shift toward creating bio-based plastics and chemicals today.

However, many challenges impede this transition. Albert Y. Chao, president and CEO of Westlake Corporation, explains, "There are some bio-based polymers, but they do not have all the properties that petroleum-based polymers have, and they are very expensive. While bio-based options are more sustainable, they often lack the durability required for certain applications and come at a significantly higher cost." Jeroen Verhoeven, VP of value

INFLATION REDUCTION ACT



\$369 Billion

for energy security and climate change initiatives



Driving investments in hydrogen production - increasing the 45Q tax credit for captured CO₂ to

\$85/metric ton

SINGAPORE: A FIRST MOVER



DANNY FOONG | GENERAL MANAGER OF HIGH PERFORMANCE POLYMERS, **ARKEMA SINGAPORE**:

Singapore's strategic position as a logistics hub significantly benefits our operations, especially given that our raw materials, like castor oil, are sourced mainly from India and our products are distributed globally.



LEE PAK SING | ASSISTANT MANAGING DIRECTOR, **ENTERPRISE SINGAPORE**

The industrialization of Southeast Asia has boosted demand for energy products, and this has attracted major players from the Middle East to set up operations in Singapore.



PROF PS LEE | EXECUTIVE DIRECTOR, **SINGAPORE ENERGY CONSORTIUM**

The unique collaborative environment in Singapore, involving research, industry, and government, is ideal for advancing our mission.



GINA FYFFE | CEO, **INTEGRA PETROCHEMICALS**

The trend towards localization and deglobalization is shaping different strategies across regions. China is focusing on self-sufficiency and higher-value projects, while Korea and Southeast Asia are undergoing economic transformations.

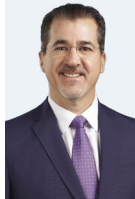


GREENER CHEMISTRY SOLUTIONS



SANJEEV RASTOGI | CEO, **ARXADA**

Microbial control technology plays a critical role in our daily lives, often without our awareness...Innovation is geared towards precision in defending against specific organisms without harming the surrounding environment, including humans, fish, and other non-target species.



GUILLERMO NOVO | CHAIR & CEO, **ASHLAND INC.**

One example of a sustainable, commercially available product is our transformed vegetable oil-based core ingredient which is used across the pharma, personal care, and coating sectors. It represents a new core ingredient around which we can design a myriad of products, such as biodegradable seed coatings, personal care products and more efficient pill coatings.



DONALD WISEMAN | CEO, **TEKNOR APEX COMPANY**

Our TekVentures Group was established precisely because predicting the future, especially in biopolymers and biology-based chemistries, is complex.



D. MICHAEL WILSON | PRESIDENT & CEO, **VIBRANTZ TECHNOLOGIES**

Our solution offers a dry, volumetrically dosed tinting system in recyclable packaging that eliminates the need for harmful chemicals.

chain development at Neste Renewable Polymers and Chemicals, adds: “The primary obstacle in moving towards a more sustainable chemical industry is the cost competitiveness of fossil-based feedstocks. The low price of these materials discourages the shift to more expensive, sustainable alternatives.”

The inherent qualities that make plastics valuable—durability, longevity and waterproofness—are the same qualities that complicate the creation of biodegradable or sustainable versions. For instance, low-density polyethylene (LDPE) used in single-use plastic bags or polyethylene terephthalate (PET) for food packaging are difficult to replicate sustainably due to their robust properties. Imagine a plastic bag disintegrating into the ocean without leaving a trace and that same bag needing to support the contents and potential leakage of your grocery shopping.

Renee Henze, chief sustainability officer at IFF, notes, “Further complicating the adoption of innovative technologies are the challenges of scaling up. Many promising solutions remain in the R&D phase, and scaling them to make a measurable impact requires significant capital and resources.”

Attaining commercial viability for most bio-based products takes time, and many companies are waiting for future regulation to provide the right conditions and price point for wider adoption. As Rahul Rasal, VP commercial at NatureWorks, puts it, “we believe an inflection point is near. Legislation is a significant factor driving this shift, with Europe, the U.S. and other countries leading the way.”

Anthony O'Donovan, president and CEO of Arkema Inc., mentions another significant barrier: “Overcoming market inertia is crucial. Customers are often reluctant to pay a premium for sustainable



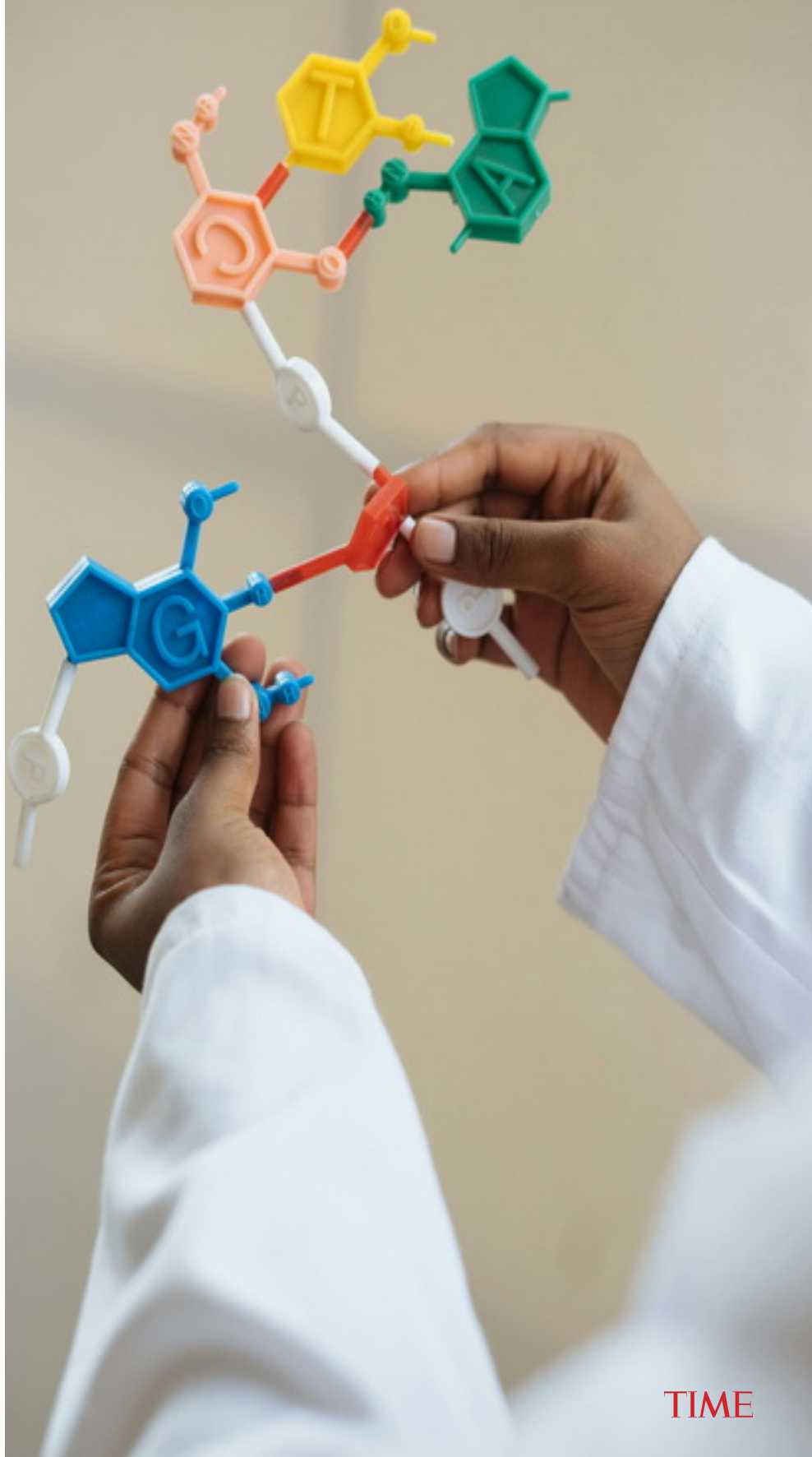
products despite their professed interest in sustainability. This economic reality makes it challenging to achieve economies of scale for new sustainable technologies.

Yet, there is progress. Almost every company I spoke to is already developing sustainable bio-based polymers. And many are reaching commercial viability. Ashland's vegetable oil-based core ingredient can be designed into a range of products such as biodegradable seed coatings and efficient pill coatings. Kalsec has developed a range of "natural antioxidants from rosemary to replace synthetic preservatives," highlights their CEO, Robert Wheeler, as an alternative to synthetic products common in the food industry. And thankfully for many coffee drinkers, like this reporter, Kuraray America is addressing the "coffee 2050 problem" by developing "biodegradable drip bag coffee filters made from plant-derived polylactic acid-based material," highlights Vance Darr, director of Health, Safety, Environmental and Security (HSES).

Pioneering the Future of Sustainability

Away from chemistry, chemical companies have even shifted their entire strategic direction to focus on the energy transition with divestments validating their actions. As an example, Johnson Matthey has divested assets to refocus the company toward clean air technologies, particularly automotive catalysts, and Indorama has acquired Oxitenio in South America to leverage "sustainable resources, such as corn and ethanol, and renewable energy sources," highlights Alastair Port, executive president, Indorama Ventures - Indovinva.

Circularity, carbon capture and processes to create more efficient and sustainable fuels are becoming more widespread within the industry. Air Liquide's Cryocap™ technology can capture over 99 percent of CO₂ emissions from key industrial processes. Mike Graff, chairman of American Air Liquide, explains, "This technology combines membranes and cryogenics to purify and liquefy CO₂ in a single unit, making it ready for sequestration or transport without the need for multiple steps." Despite its potential, widespread adoption of carbon sequestration faces hurdles. Graff notes, "The pace of carbon sequestration adoption is influenced by several factors, including technological readiness and the development of partnerships. The challenge lies in forming the right partnerships and securing permits." Effective sequestration requires collaboration between the chemical industry's expertise in carbon capture and the oil and gas sector's knowledge in subsurface geology.





Innovations in Sustainable Aviation Fuel

Sustainable aviation fuel (SAF) is another critical frontier in reducing carbon emissions. Kenneth Lim, general manager and refinery director at Neste Singapore, highlights that “currently, SAF supplies just 0.2 percent of the jet fuel demand, with projections to reach 1 to 2 percent by 2027. Although these figures fall short of the International Air Transport Association (IATA)’s net-zero carbon emissions by 2050, they reflect a growing market potential.”

Given the IATA’s aim is for SAF to be at 65 percent of overall aviation consumption, this demonstrates the huge opportunity at hand. Johnson Matthey is leveraging this through its Fischer-Tropsch process, which transforms various forms of feedstock, such as municipal waste or biomass, into synthetic crude oil, which is then converted into SAF. Johnson Matthey has also identified low-carbon hydrogen production. “Our project with BP, focusing on low-carbon hydrogen—often referred to as blue hydrogen—primarily uses natural gas as a feedstock,” says Johnson Matthey CEO Liam Condon.

Can We Truly End Plastic Waste?

Plastic pollution is one of the greatest environmental issues and most villainized stories of our time. The very reason why plastic has revolutionized countless industries and vastly improved our lives is what poses a severe threat to our biodiversity. At the recent Intergovernmental Negotiating Committee (INC-4), 28 countries introduced the “Bridge to Busan” declaration advocating for a comprehensive treaty on plastic production. And yet, we find ourselves at a critical crossroads: We rely on plastics, but often hesitate to invest in pricier, biodegradable alternatives. With plastic demand only growing, and with bio-based plastics needing time to penetrate, scale and become more cost-effective, should more focus be on how we manage plastic waste?

The Alliance to End Plastic Waste (AEPW) certainly thinks so. They have pledged \$1.5 billion by 2024 to tackle plastic pollution and boost recycling efforts. AEPW’s CEO and president, Jacob Duer, points out the primary challenge: “The massive scale of plastic pollution, particularly in parts of the world with inadequate waste management infrastructure. Our approach focuses on these high-leakage regions, prioritizing the development of basic waste management solutions. For instance, we run significant projects in countries like Indonesia and Vietnam, establishing essential infrastructure like household bins and collection systems.”

Duer, who transitioned from the UN to AEPW to drive impactful change, underlines the importance of industry involvement: “I realized that while policies are essential for progress, they are not sufficient without the active involvement of all stakeholders, especially the private sector.” The industry must play a pivotal role in the solution, focusing on standardizing design requirements to enhance recyclability and identifying specific chemicals and products of concern.

Frederic Schmuck, CEO at Alterra Energy, acknowledges the intricacies of plastic waste management. “The issue of plastic waste is complex and not solely an educational problem. While increased consumer awareness and participation are vital, as evidenced by higher separation and recycling rates in Europe compared to North America, the core challenge remains... the fragmented nature of waste management in the U.S., where many curbside pickups go to outdated single-stream facilities, highlights the need for investment in advanced sorting technologies to enhance recycling outcomes,” says Schmuck.

Ending plastic waste entirely might seem like a far-fetched goal, but better waste management, increased recycling efforts, and the development of sustainable alternatives will be essential in getting us some of the way there.



DONALD WISEMAN

CEO,
TEKNOR APEX
COMPANY



Teknor Apex Company, which is celebrating its 100th anniversary in 2024, is a leading materials company specializing in custom compounds and sustainable polymer solutions, while investing in validating multiple biology-based recycling technologies. Donald Wiseman recently succeeded Jonathan Fain as CEO, following Fain's 52-year tenure.

As a plastics manufacturer, Teknor Apex operates in a segment that can be villainized and misunderstood. What are the current challenges and opportunities for Teknor Apex in the plastics industry?

Our aim is to shift the narrative by highlighting our commitment to sustainability and circularity. We've been focusing on ensuring that new plastics do not end up in landfills or oceans and are instead repurposed into high-end applications. Our efforts extend to reducing our carbon footprint and exploring innovative solutions such as enzymatic recycling and bioplastics. Despite the challenges, we see this as a long-term journey to maintain our leadership and commitment to sustainability.

Privately held companies can often have a longer-term mindset than those listed. How does Teknor Apex's status as a privately held company impact its strategic decisions?

Being a privately held company with a strong balance sheet allows us to allocate resources towards long-term investments through our TekVentures group. This flexibility enables us to partner with inventors and develop minimum viable products without the pressure of meeting short-term financial targets. Our focus remains on making meaningful investments that align with our vision for the future, underpinned by a commitment to doing the right thing, which has been the cornerstone of our success and was emphasized during my transition into the CEO role by our investors.

The chemicals industry has often sided away from high-risk ventures. What value does having a ventures team bring for Teknor Apex?

Having a ventures team is quite unique for a company of our size and reflects our commitment to innovation and sustainability. While R&D spend in the chemical industry is traditionally modest, we believe it's crucial to make substantial bets on the future. This strategy involves partnering with scientists and startups to explore new avenues, such as green chemistry. Our focus on reinventing the company aligns with our long-term vision to not just survive but thrive by adapting our product lines and market approaches to the evolving global landscape.

Teknor Apex's blog aims to humanize plastics by linking them to their real-world applications. What are you doing to address the negative perceptions of plastics?

We are actively working to change the narrative around plastics by highlighting their essential role in various applications and their sustainability potential. Our efforts include addressing misconceptions about the environmental impact of polymers and promoting the benefits of recycling and circularity. Despite the challenges posed by regulatory changes and the cost implications of developing environmentally friendly plastics, our focus remains on innovation and improving recyclability to tackle the issue of single-use plastics and enhance food preservation and transfer solutions.



Nexus aims to complement mechanical recycling through advanced processes by managing many of today's plastic formats, such as films, flexible packaging and foams, which often end in landfills. This approach addresses the limitations of current recycling methods, improving the overall recycling ecosystem.

JODIE MORGAN |
CEO, NEXUS CIRCULAR



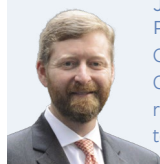
Advanced Recycling Technologies: Innovation Enhances Recycling Rates

As we wrestle with the plastic waste crisis, exploring every potential solution is critical. Advanced recycling technologies like pyrolysis—a process that breaks down materials using heat (400°C–800°C) in the absence of oxygen, preventing combustion—offer new hope, promising significant benefits but also presenting notable challenges. How can these innovations fit into a broader mission to reduce plastic waste and reliance on fossil fuels? Jodie Morgan, CEO of Nexus Circular, believes advanced recycling technologies are poised to become the norm, with an increasing recognition of their necessity as plastic use grows. “This growth in plastic, unfortunately, will likely lead to more visible environmental pollution, which in turn will drive the push for effective recycling solutions.”

Morgan highlights the limitations of traditional mechanical recycling, particularly for certain plastics and food-safe materials. Morgan's vision for Nexus Circular includes processing 5 billion pounds of post-use plastic by 2030. “We believe that we can reach the point of decoupling manufacturing from extraction and reducing the dependence on new fossil-based resources by ensuring that the plastic resources that we already have above ground stay in play.”

Simon Critten, SVP and strategic market lead energy North America at Mott MacDonald, points out a crucial market shift: “Historically, recycled materials were sold at a discount, but now they can achieve parity or even a premium over virgin materials. This pricing shift encourages compa-

IS ADVANCED RECYCLING THE FUTURE?



JOHN LOUDERMILK |
PRESIDENT AND CEO, BIRLA CARBON

Our partnership with Cirttec to commercialize Sustainable Carbonaceous Material under the brand name Continua™ represents a significant innovation, focusing on pyrolysis to recycle tires back into usable materials.



RANDY POGUE | PRESIDENT & CEO, AMSTY

Whilst bio-based options reduce reliance on petrochemicals, they do not fundamentally change the need for effective waste management and recycling systems.



MARCO CODOGNOLA | CEO, ITALYUM

We advocate for a balanced view where both generic and specific recycling methods like pyrolysis and our tailored solutions coexist to enhance overall recycling yields.

nies to integrate advanced recycling into their operations, maintaining material quality and meeting stringent environmental standards.” This change represents a pivotal moment for the industry, aligning economic incentives with environmental benefits.

Despite the optimism surrounding advanced recycling, it faces its fair share of criticism. Concerns include the energy and resources required for processes like pyrolysis, which may offset environmental benefits. Additionally, integrating these technologies into existing systems can be complex and costly. Frederic Schmuck underlines the complementary nature of advanced recycling. “Our approach complements existing mechanical recycling methods by enhancing the recycling rates and tackling plastics that are currently deemed nonrecyclable.”

By blending the strengths of mechanical and advanced recycling, substantial strides can be made to not only reduce plastic pollution but the reliance on fossil fuels. As some of my interviewees confirmed, including Morgan, we have already dug up all the fossil fuels needed for future plastic demand. Just recycle it.



WATER IN 2024



DAVID NICHOLSON |
PRESIDENT & CEO, **PVS CHEMICALS**

Regulatory standards, especially regarding water quality, continue to tighten at local, state, and national levels. This trend presents growth opportunities for PVS Chemicals, as our base chemistry solutions are instrumental in removing pollutants from water.



RENATO MUNOZ OSSES |
MANAGING DIRECTOR, **WATERISLIFE**

We are in a context where billions of dollars are invested in water projects around the world, but we still have 2 billion people without access to safe drinking water.



MARK GARRETT |
GROUP CEO, **ARCHROMA**

We've recently introduced systems that can cut water usage by up to 50 percent.



AL BENINATI |
CEO & PRESIDENT, **PQ CORPORATION**

Silicate-based products, including precipitated silicas and gels, are increasingly used in sustainability-focused applications such as water purification.

And due to their high solubility, they do not degrade and can lead to widespread contamination. Michael Kozak, business unit president - environmental & infrastructure at Minerals Technologies Inc., explains: "These compounds are notorious for their persistence and ability to spread quickly through groundwater, increasing the risk of exposure and potential harm to human health. The ubiquity of PFAS is alarming due to their proven adverse effects on human health, leading to significant regulatory attention worldwide, including stringent limits on PFAS levels in drinking water."

Understanding water quality is not just a task for regulators; it is something we all need to be aware of. Melissa Aquino, senior VP of the water quality segment at Veralto, offers practical advice: "I recommend that individuals take the time to read and understand their local water quality reports, which are sent out by municipalities. These reports detail the contaminants tested for and their levels in the water supply. It is important for everyone, especially families, to be informed about what is in their water and understand the measures being taken to ensure its safety. At home, I engage my children in this learning process, showing them how water testing works using simple kits that even children can use."

Aquino also touches on the complexities of regulating water contaminants: "The intention behind setting such low regulatory limits for contaminants like PFAS is to exert pressure on the system to eliminate harmful chemicals. However, another challenge is the practicality of dealing with these contaminants once captured—whether in filters or granulated activated carbon, they still need disposal."

Water management is more important than ever before. As the impact and awareness of contamination grows, so will the need to take action. We can take action ourselves with increased awareness of what may be in our water.

Dealing With Water Contamination: A Crisis Demanding Immediate Action

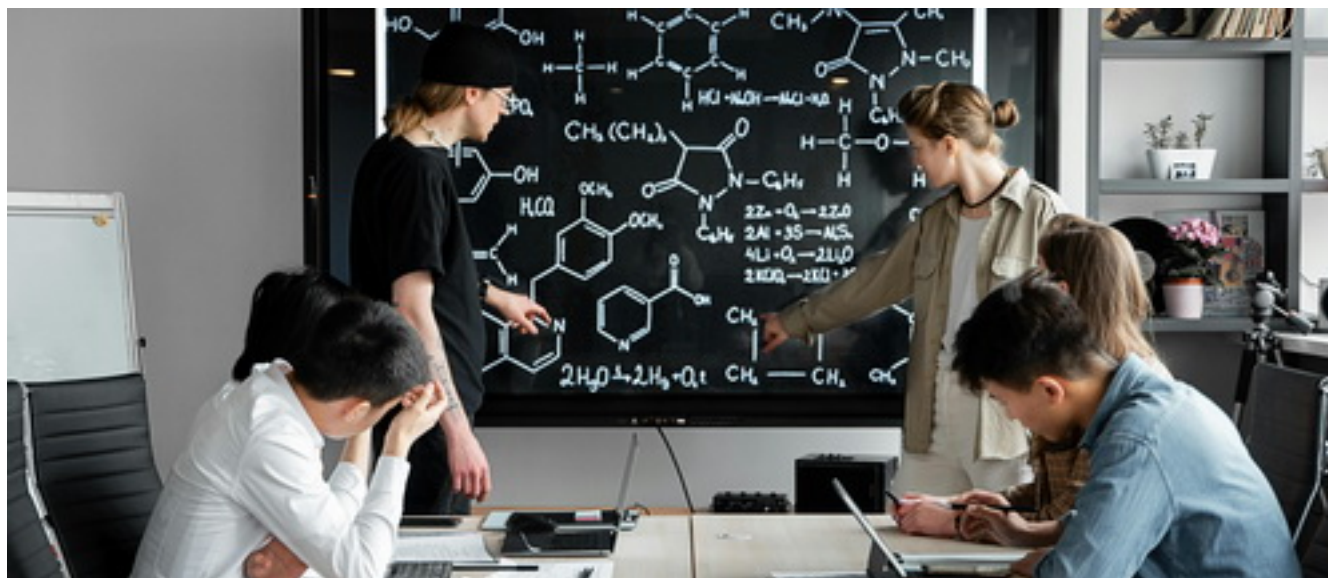
From reducing water and energy usage to ensuring access to safe drinking water and tackling pervasive pollutants, having a robust water management strategy is a must for all chemical companies.

The most pressing issue right now within this space is water contamination and the increased prevalence of perfluoroalkyl substances (PFAS) in our water. There are now over 13,000 PFAS compounds, according to Minerals Technologies Inc., which originate from many sources including industrial waste and consumer products like nonstick cookware or cleaning products.



DOUGLAS T. DIETRICH |
CHAIRMAN OF THE BOARD & CEO,
MINERALS TECHNOLOGIES INC.

Our environmental business, particularly our ability to address water contamination and support the supply of clean water, represents a significant growth opportunity and a way to contribute positively to global challenges.





Green Shoots in Distribution & Logistics

Both the distribution and logistics sectors within the chemicals industry are having to make sustainability a number one priority. “Today, sustainability is a crucial aspect of our operations, influencing our strategies and partnerships across the industry,” notes Anne Marie Infilise, president and CEO of Quadra. Distributors are incorporating sustainability frameworks as a norm. That includes Univar’s, which includes six characteristics: “Natural or bio-based, carbon footprinting, safer substitutes, circular materials, social impact, and environmental accreditation,” highlights Liam McCarroll, global director of sustainability, Univar Solutions.

Across logistics in the chemicals space, sustainability and safety are the most important topics of conversation. Joe Hinrichs, president and CEO of CSX Transportation, underlines this by stating: “Safety is our paramount concern. Incidents like the East Palestine, Ohio, derailment highlight the critical importance of safety for rail. This focus is not just about compliance or avoiding negative attention—it’s about the profound responsibility we carry every day.”

The emphasis on safety is complemented by a push toward more sustainable logistics operations. Randy Strutz, president of Quality Carriers, outlines the challenges and opportunities: “Initially, there is the continuous push to enhance the efficiency of existing technologies, such as diesel trucks. Despite advancements, there are limits to how far efficiencies can extend without impacting other operational aspects like payload capacities. The aspiration for a shift towards electric vehicles (EVs) as a more sustainable option faces practicality issues, including significant payload reduction due to the heavy weight of batteries, potentially necessitating an increase in the number of trucks on the road to maintain current freight volumes.”

The path forward will likely involve a blend of incremental improvements and more innovative changes, ensuring that the chemicals industry’s logistics and distribution sectors continue to advance toward a more sustainable future.

The Next Leap in Chemicals

The chemicals industry has been, at times, slow to truly innovate. But since I last reported on this industry in 2018, I have seen a shift in approach from many chemical companies. Breakthrough technologies are now being integrated much faster into company processes, chief digital officers are being hired and the AI revolution is being taken seriously.

Digital Twinning: Optimizing Processes and Decarbonization

Dr. Wai Kiong Ng, acting executive director at the Institute of Sustainability for Chemicals, Energy, and Environment (ISCE²) at A*STAR, is a strong advocate for digital twinning in the context of the industry. “Digital twinning allows us to optimize and plan processes before conducting physical tests,” he says. This method integrates different companies across the value chain and is crucial for decarbonization through process control and standards adherence. It is an approach that Mayank Patel, industry strategy director for chemicals at Siemens, has also taken note of, along with generative AI. “We have been integrating generative AI and digital twinning to enhance process modeling and operational efficiency,” Patel highlights.

These technologies create detailed, dynamic models that simulate various operational scenarios, optimizing processes without extensive manual input. Siemens is leveraging partnerships with tech giants like Microsoft and NVIDIA to further enhance these capabilities, particularly looking to aid new entrants in green ammonia production.

Driving the AI Revolution Through Chemistry

Specialty chemical companies are also posturing to align themselves with the industries of tomorrow. The semiconductor industry, crucial for advancements in various technologies including AI, is one of them. Eric Johnson, CEO of JSR Corporation, mentions how through chemistry: “We enable manufacturing precision and quality at unprecedented levels.” Focusing on imaging and processing for semiconductor manufacturing at the nanometer level, JSR Corporation ensures that its products meet extreme quality and

reliability standards. This precision is vital for the progression of computing, AI, 5G and autonomous vehicles.

The chemicals industry is also playing a significant role in supporting the AI revolution through advanced cooling solutions. Matthew Joyce, senior VP - lubricants & specialties at HF Sinclair, notes, "This initiative involves innovative cooling solutions that involve immersing servers in specially designed fluids to dissipate heat more effectively, thus reducing the massive energy consumption typically associated with cooling systems. Data centers, as they operate today, consume vast amounts of energy and water, which is the industry's dirty little secret."

Enhancing Oil Recovery With Nanotechnology

Even as the world shifts to cleaner energy, the demand for oil and gas remains significant. Ofek Levy, founder and CEO of Valor International, focuses on "maximizing efficiency and sustainability in oil production," he explains. By using renewable raw materials and innovative chemistry, Valor enhances well stimulation and production. Levy highlights their work with enhanced oil recovery (EOR) techniques and nanotechnology to clear organic deposits inside wells, improving extraction rates and reducing environmental harm.

These innovators leveraging digital twinning, AI, nanotechnology, predictive maintenance and enhanced oil recovery techniques are pioneering technologies to not only improve operational performance but also contribute to a more sustainable and responsible industrial landscape. As these advancements continue to evolve, they will play a crucial role in shaping a cleaner, more efficient future for the chemicals sector.

In Three Years' Time...

Throughout my journey with industry leaders, I would often finish interviews by asking: "Where will you be in three years?" Responses would often paint a picture of optimism, which makes sense given the vast opportunity being offered by the energy transition.

I asked Mark Nikolic, CEO of Braskem America, based in Philadelphia, how he imagined a Philadelphia Eagles game at Lincoln Financial Field. "By 2027, we envision a world where sustainability efforts are fully realized and integrated into everyday experiences, including at the Eagles game. We aim to have sustainable materials, like bio-EVA and bio-based polyethylene, utilized in sports equipment, apparel and infrastructure, creating a tangible connection between consumers and sustainable practices," Nikolic said.

Guillermo Novo, CEO of Ashland, shared a similarly optimistic outlook. "Three years from now, our goal is to have reshaped the public's perception from merely chemicals to a broader focus on materials, especially as we embrace more natural and sustainable products," he says.

The chemicals industry is at a critical juncture, facing significant environmental challenges while holding the potential for transformative innovations. My journey over the past four months has shown me that while advancements in carbon capture, bio-based polymers and sustainable aviation fuels are promising, the road ahead is fraught with obstacles—high costs, scalability issues, and market resistance. But I am optimistic that this industry will play its hugely significant role in the energy transition.

As we look forward, the vision of integrating sustainable practices not only into the day-to-day of the industry but our lives is necessary. This is not a time for passive optimism but for decisive action. The chemicals industry needs to continue accelerating its commitment to sustainability, and we, as consumers, must demand and support these changes. Our future depends on this collective effort.

THE FUTURE OF CHEMICALS



REBECCA LIEBERT |
PRESIDENT & CEO, **LUBRIZOL**

Data collection and analysis are critical in designing sustainable solutions. For example, analyzing data from fleet cars worldwide, we can improve the sustainability of our lubricants, allowing for extended use before needing an oil change.



MICHAEL GREEN |
SEGMENT BUSINESS SERVICES MANAGER,
AKZONOBEL AEROSPACE

Aerofleet Coatings Management is essentially a fleet monitoring and predictive maintenance program designed to help maximize the life of aircraft paint jobs using data-driven insights.



BRAD BUDDE |
CHIEF DIGITAL OFFICER, **PPG**

AI integration is a significant part of our strategy to enhance operational efficiency and product quality. In our automotive paint facilities, we've reduced the production cycles for paint batches significantly, from eight cycles down to two.



RAEF SULLY | CEO, **LILAC SOLUTIONS**

Our technology is particularly transformative in that it unlocks potential in groundwater reserves previously deemed uneconomical due to low lithium concentrations.

