

INSIGHT

September 2024 edition

THE ROAD TO A LOW CARBON FUTURE

PURSUING A VISION

GPCA Insight speaks to Fahad Al-Battar, CEO, SABIC Agri-Nutrients, about balancing the company's net-zero ambitions with profitability and growth

FEEDING THE WORLD

GPCA Insight speaks to Eng. Yasser Alabbasi, CEO, GPIC, about what the future holds for GPIC and the industry in the region



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WELCOME



Welcome to the September edition of our member publication *GPCA Insight*, your gateway to the latest updates and analysis from the chemical and petrochemical industry in the GCC and beyond.

With the 14th GPCA Agri-Nutrients Conference taking place in Riyadh, Saudi Arabia for the first time, we look forward to welcoming delegates from all corners of the region and the globe to share insights, network and strategize for a future that is more sustainable, prosperous and secure.

Taking place from 10-12 September 2024, the conference features a workshop on operational excellence, which offers insights into best practices, innovative approaches, and real-world examples of operational efficiency. It also plays host to the 3rd GPCA Innovation Competition, seeking to unveil the next best ideas in research and innovation that support a food-secure and climate-resilient planet.

We look forward to welcoming delegates to the inaugural GPCA Process Safety Conference taking place from 7-10 October 2024 at the King Abdullah Cultural Center, Al Jubail, Saudi Arabia, under the theme "Enabling Process Safety Leadership through Enriching Knowledge and Catalyzing Commitment". The event will feature a comprehensive program including two full-day technical workshops in addition to the first of its kind "Process Safety by Frontlines program" on Day 1. A technical session, executive and strategic discussions, and the inauguration of the exhibition will take place on 8-10 October 2024.

This edition of *Insight* features an insightful interview with Eng. Yasser Alabbasi, CEO, GPIC, who sheds more light on the future of agri-nutrients and their role in enabling food security. It also delves into important industry topics, including how the industry can work toward driving more resilient food systems, how agri-nutrients can support food security initiatives globally, the pace of decarbonization and its place in the agri-nutrient industry, the changing nature of regional nitrogen investment, how we could reach net-zero by 2050, and much more.

I hope you enjoy reading this edition filled with insights and fascinating perspectives and do get in touch with any comments or suggestions.

Dr. Abdulwahab Al-Sadoun

Secretary General

Gulf Petrochemicals and Chemicals Association

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18th Annual GPCA Forum to take place in Oman this December

The 18th Annual GPCA Forum, GPCA's flagship event, hosted by OQ, will take place for the first time in Oman Convention & Exhibition Centre, Muscat, Oman, from 2-5 December 2024. The forum will address the theme "Industry's Next Chapter: Driving Sustainable Advancement for Global Progress", attracting delegates from across the region and globally over four days of knowledge sharing, networking and collaboration.

The forum will open with Welcome remarks from Eng. Abdulrahman Al-Fageeh, CEO, SABIC, and Chairman, GPCA, followed by a Ministerial address from H.E. Salim bin Nasser bin Said Al Afi, Minister of Energy and Minerals, Oman on 2 December 2024.

H.E. Kamal bin Ahmed Mohammed, President of Electricity & Water Authority (EWA), Bahrain, and Chairman of Board of Directors, GPIC, will deliver a special address to the audience in the afternoon on Day 1.

Shaikh Nawaf S. Al-Sabah, CEO, Kuwait Petroleum Corporation, and Mulham Basheer Al-Jarf, Chairman, OQ, will participate in a Fireside chat on 3 December 2024, followed by a CEOs Plenary keynotes presented by Jim Fitterling, Chair & CEO, Dow, and Dr. Ilham Kadri, CEO, Syensqo.

Other esteemed speakers at this year's event include:

- Nadia Al Hajji, CEO, PIC
- Eng. Yasser Al Abbasi, CEO, GPIC
- Conrad Keijzer, CEO, Clariant
- François Jackow, CEO, Air Liquide
- Ed Sparks, CEO, W.R. Grace
- Robert Wilt, CEO, Ma'aden
- Ahmad Al-Khowaiter, EVP, Technology & Innovation, Aramco
- Thomas Maurisse, Senior VP, Refining & Chemicals, TotalEnergies
- Stefan Koch, Head – Chemical and Advanced Materials Industry, WEF

Now in its 18th edition, GPCA's flagship event will combine an array of new and improved features including the 2nd GPCA Solutions Xchange Program, taking place from 3-4 December, the 6th GPCA Legacy Award "Al Rowad", which will take place on 2 December, the 3rd edition of the GPCA Youth Forum being held from 2-5 December and much more. For the first time this year, the forum will host the inaugural GPCA Startup Nexus, a brand new GPCA initiative which aims to foster innovation and collaboration by bridging the gap between the start-up ecosystem and the chemical and petrochemical industry in the region.



GPCA Youth Forum returns for its 3rd edition at the Annual Forum

The GPCA Youth Forum has grown significantly since its inception, evolving into a premier platform for knowledge sharing, networking, and professional development. Over the past editions, it has successfully bridged the gap between emerging talent and industry veterans, providing a platform for young professionals and university students to engage, learn, and connect.

This year, the GPCA Youth Forum is returning for its 3rd edition, taking place from 2-5

December 2024, alongside the 18th Annual GPCA Forum, marking a significant milestone in GPCA's commitment to fostering the next generation of leaders in the chemical and petrochemical industry. Held under the theme "Youth Powering Tomorrow: Shaping a Sustainable Future", this year promises to be engaging featuring a comprehensive program designed to bridge the gap between experienced industry leaders and aspiring young professionals.





GPCA Legacy Award “Al-Rowad” (الرواد) enters its 6th edition to recognize one outstanding industry pioneer in the Arabian Gulf

Launched in 2017 to recognize the pioneers of the chemical industry in the Arabian Gulf region, this year the GPCA Legacy Initiative and GPCA Legacy Award “Al-Rowad” (الرواد) enters its 6th edition, honoring some of the industry's most esteemed individuals, who have made extraordinary contributions to foster and strengthen the chemical industry in one or more of the GCC states.

Set to take place on the sidelines of the 18th Annual GPCA Forum, the Award will be bestowed upon one highly acclaimed honoree for their dedication and contribution to fostering the downstream industry in their

country. The Award ceremony will take place on 2 December 2024 when the winner will be announced, and their legacy will be celebrated by delegates and dignitaries from across the region.

Throughout the Annual GPCA Forum, from 2-5 December, a specially curated Hall of Fame will be available at the forum's venue for delegates to visit, narrating the accomplishments and contributions of past Award honorees. Now in its 6th edition, the GPCA Legacy Award has been awarded to eight visionary leaders from across the GCC for their exemplary petrochemical legacy.



“GPCA Startup Nexus” to debut in December

For the first time, “GPCA Startup Nexus”, GPCA's brand new networking platform, will provide young start-up companies with a stage to present their unique and forward-looking technologies to a broad audience of experts and decision-makers from chemical companies and international investors.

On the sidelines of the 18th Annual GPCA Forum, 10 young growth companies from the circular economy and climate action technology fields will provide short Shark Tank-style presentations and take questions

from the audience. The aim is to create a network of mutual exchange with the opportunity to start collaborations and to stimulate investments.

Start-ups that are less than five-years old can apply for one of the coveted places in each of the two technology fields. The best five companies in each of the two categories will be selected by a GPCA Expert Panel, comprising senior industry veterans. The deadline to submit an application is 30 September 2024.





Agri-Innovation to come under the spotlight at GPCA Agri-Nutrients Conference

The role of agri-innovation to enable food security and help to meet climate targets will come under the spotlight at the 14th GPCA Agri-Nutrients Conference taking place for the first time at the JW Marriott Hotel in Riyadh, Saudi Arabia, from 10-12 September 2024. With the world's population likely to add nearly another billion people and incomes rising, total food consumption is expected to increase by more than 50% by 2030 and 70% by 2050.

Held under the theme "Agri-Innovation: Powering a Food-Secure & Climate-Smart Planet", the conference will discuss the latest technologies and innovations driving the efficient and smart use of agri-nutrients to help support food security globally, while at the same time lower CO₂ emissions and mitigate the climate impact of farming.

The event will begin on Day 1, 11 September, with opening remarks by Eng. Abdulrahman Al-Fageeh, CEO, SABIC, and Chairman, GPCA, and welcome remarks by Abdulrahman Al-Suwaidi, CEO, QAFCO, and Chairman, Agri-Nutrients Committee, GPCA. An Executive

leadership dialogue on the "Impact of energy transition on agri-nutrients businesses" will feature Fahad Al-Battar, CEO, SABIC Agri-Nutrients, Dr. Ahmed Said Al-Marhoubi, CEO, OMIFCO, and Hassan Al-Ali, EVP, Phosphate BU, Ma'aden. Dr. Tarifa A. Alzaabi, Director General, International Center for Biosaline Agriculture (ICBA), will deliver a keynote address on "Nourishing the planet, powering the future with sustainable agri-nutrients".

On Day 2, 12 September, Yasser Alabbasi, CEO, GPIC, will present the opening remarks, followed by Nicolas Denis, Partner | Global leader, McKinsey Center for Agriculture Transformation and Food Security, McKinsey & Company, who will deliver a keynote address on "The current state of food security and nutrition around the world" and Dr. Edwini Kessie, Director of the Agriculture and Commodities Division, World Trade Organization (WTO), who will present a keynote address on the "Global trade in agri-food products and the role of the WTO in ensuring removal of trade barriers".



GPCA to recognize young talent in agri-sustainability as part of 3rd Innovation Competition

GPCA will recognize outstanding talent among GCC university students in agri-nutrient sustainability as part of the 3rd GPCA Innovation Competition. Set to take place on the sidelines of the 14th GPCA Agri-Nutrients Conference from 10-12 September 2024 in Riyadh, Saudi Arabia, the prestigious competition will reward both undergraduate and postgraduate students from all universities, vocational and research institutes in Saudi Arabia, the UAE, Qatar, Kuwait, Bahrain and Oman.

For the first time since its inception, the competition is dedicated to rewarding outstanding projects and ideas in agri-nutrients research for a food-secure and climate-resilient planet. Students from

across the region can submit their entry in the "Race towards Agri-Sustainability".

To qualify for the competition, students must present an innovative solution to any of the following challenge: Circular Economy in Agriculture; Soil Health; Sustainable Resource Management; and Innovation and Emission Reduction in Agri-Nutrients Production. The GPCA Innovation Competition features two categories under chemical engineering, chemistry, and other related STEM fields in the GCC.

Winners will be announced in second and first place in both the undergraduate and postgraduate category during the 14th GPCA Agri-Nutrients Conference on 11 September in Riyadh, Saudi Arabia.





Inaugural GPCA Process Safety Conference to arrive in Al Jubail this October

Addressing the industry's heightened focus on process safety, GPCA is pleased to announce the inaugural edition of the Process Safety Conference, scheduled to take place from 7-10 October 2024 at the King Abdullah Cultural Center, Al Jubail, Saudi Arabia.

Held under the theme "Enabling Process Safety Leadership through Enriching Knowledge and Catalyzing Commitment", the inaugural event will feature a specially tailored program including two full-day technical workshops in addition to the first of its kind "Process Safety by Frontlines" program on Day 1. A series of technical sessions, executive and strategic discussions, and the inauguration of the exhibition-floor will take place from 8-10 October 2024.

In the Arabian Gulf, Responsible Care® has played a key role in reducing process safety

incidents over the past nine years. Among GPCA members, process safety events decreased by 40%, marking remarkable progress for the region.

This milestone is a testament to the unwavering commitment of the industry to save lives, protect the environment, and support local communities. To further demonstrate the industry's commitment toward process safety in 2021, GPCA launched the Gulf Process Safety Network (GPSN). Since then, the GPSN has stood as a structured platform that enables knowledge sharing and collaboration among GPCA member companies. The GPSN is at the heart of the inaugural GPCA Process Safety Conference, which has been designed to facilitate effective connections, practical insights sharing, and enabling excellence in process safety.



"Be The Change" attracts support of GCC schools to drive early education on plastic waste

"Be The Change", an initiative of GPCA and supported by Alliance To End Plastic Waste (AEPW), has attracted the support of 10 GCC schools to drive early education on plastic waste among students and young members of the region's community. "Be The Change" is an evolution of the Waste Free Environment Campaign, an award-winning CSR initiative led by GPCA from 2013-2020.

Drawing inspiration from this and the Clean4Change campaign by the Alliance to End Plastics Waste, "Be The Change" seeks to further the global mission of educating communities on the significance of waste management and the potential of a circular

economy. GPCA believes that the young generation holds the key to the region's future. With this in mind the primary aim of the campaign is to mobilize and 'edutain' young individuals in the GCC, while driving awareness about recycling and amplifying waste literacy. By integrating education with entertainment, GPCA aims to make the learning process engaging and memorable.

The movement has recently attracted the support of 10 schools based in the region and will continue to gain momentum by attracting new participants from across the GCC through targeted public outreach activities.





GPCA's Gulf SQAS program celebrates "a decade of driving excellence in logistics"

Launched in 2014, the Gulf Sustainability and Quality Assessment System (Gulf SQAS) has rapidly evolved into a cornerstone of the chemical industry's commitment to safety, security, and environmental stewardship.

Initiated by GPCA in the region, Gulf SQAS has undergone a remarkable journey, witnessing a staggering 950% increase in the number of assessments conducted over the past decade.

The visionary objectives of Gulf SQAS

At its core, Gulf SQAS aims to enhance the safety and environmental performance of logistics service providers (LSPs) across the region. By establishing a standardized assessment framework, the program seeks to:

- **Harmonize assessment processes:** Streamlining the evaluation of LSPs through a unified approach.
- **Enhance LSP performance:** Providing a clear roadmap for LSPs to improve their environmental, health, safety, security, and quality (EHSS&Q) practices.
- **Facilitate informed decision-making:** Empowering chemical companies to select LSPs based on reliable, comparable assessment data.
- **Promote continuous improvement:** Fostering a culture of excellence and innovation within the logistics sector.

A decade of impact

Over the past ten years, Gulf SQAS has emerged as an indispensable tool for driving positive change within the logistics industry. The program has empowered countless LSPs to identify areas for improvement, implement

best practices, and reduce risks. This collective effort has contributed significantly to enhancing the overall safety and sustainability of the chemical supply chain.

Key benefits of Gulf SQAS

- **Reduced assessment burden:** LSPs undergo a single comprehensive assessment, eliminating the need for multiple evaluations by different chemical companies.
- **Improved EHS&Q performance:** By identifying gaps and setting clear improvement targets, Gulf SQAS empowers LSPs to enhance their overall performance.
- **Enhanced risk management:** Comprehensive assessments help LSPs and chemical companies to better identify and mitigate potential risks.
- **Strengthened industry collaboration:** Gulf SQAS fosters a collaborative environment where LSPs and chemical companies work together to achieve common goals.

A comprehensive framework

Gulf SQAS encompasses four core modules: Core, Transport Services, Warehousing, and Tank Cleaning. Each module delves into specific aspects of logistics operations, ensuring a holistic assessment of LSP capabilities. Recognizing the growing importance of rail transportation in the chemical industry, GPCA is currently developing a fifth module dedicated to rail operations, further expanding the program's scope and impact.

As Gulf SQAS enters its second decade, the program is poised to continue its upward



trajectory. By building upon its successes and adapting to evolving industry challenges, GPCA remains committed to driving excellence in logistics and safeguarding the environment.

By celebrating this significant milestone, we acknowledge the collective efforts of all stakeholders involved in making Gulf SQAS a resounding success. The program's journey is a testament to the industry's unwavering dedication to safety, sustainability, and Responsible Care®.





GPCA releases new position paper examining a potential FTA between the GCC and Türkiye



"Potential GCC-Türkiye FTA: Impact Analysis on the Petrochemical Industry", GPCA's new position paper, examines the potential implications of a GCC-Türkiye Free Trade Agreement (FTA) on the petrochemical sector. The paper is now available to read on the GPCA website, offering timely insights into this important subject. The analysis delves into demand elasticity, trade indices, and global market dynamics, highlighting both challenges and opportunities for GCC-Türkiye trade.

The study underscores the significant role of the petrochemical industry in the economies

of the GCC and Türkiye and presents strategic recommendations for leveraging the FTA to enhance market access, foster economic collaboration, and promote sustainable growth within the sector.

GCC countries enjoy a significant surplus in chemical trade with Türkiye. In 2022, GCC chemical exports to Türkiye reached an all-time high of USD 5.6 billion, up from USD 2.4 billion in 2019. This represents an increase of approximately 133% over the three-year period.

According to GPCA research, GCC petrochemical exports to Türkiye could increase

by USD 179.2 million over the next year if tariffs were reduced by 3.2%. The elimination of tariffs could also enhance the competitiveness of GCC petrochemical products on the Turkish market.

An FTA would increase market access and economic collaboration, facilitate trade and reduce import costs. It would also allow GCC producers to diversify export destinations and product offerings within Türkiye.

However, tariff removal poses risks for GCC plastic converters, such as increased competition from Turkish converters and price pressures on GCC products.

Welcome to our new members





Gulf Process Safety Network celebrates its 3rd year with remarkable achievements

Since its launch in November 2021 during the 4th GPCA Responsible Care Conference, the Gulf Process Safety Network (GPSN) has demonstrated significant achievements, driving new initiatives and networking for the process safety community across the Arabian Gulf region. Comprising 26 experienced professionals, who represent 23 GPCA member companies, the GPSN aims to promote and support process safety excellence within the regional chemical and petrochemical industry through effective knowledge sharing and value-added networking.

Over the last three years, the GPSN has successfully fulfilled its purpose to establish and maintain a regional platform that enables and supports knowledge exchange and promotes

collaborative work among GPCA member companies in the field of process safety. The Network has been working closely together with its members and member companies to support the GPCA Responsible Care Committee by addressing regional process safety challenges, while improving the overall process safety culture by providing recommendations and driving initiatives, based on GPCA's three strategic pillars of Effective Networking, Thought Leadership and Advocacy.

The GPSN's focus on delivering valuable outcomes to GPCA's member companies and the wider chemical and petrochemical community in the region has been instrumental and evident in the initiatives it has undertaken over the last few years. Last but not least, the



Network has been successfully engaging in effective two-way liaison with its members and external stakeholders, pursuing a robust strategy of visibility and public engagement. GPCA extends its sincere thanks to the GPSN members for their invaluable work and commitment toward ensuring the fulfilment of its mandate, and instilling effective process safety networking across chemical and petrochemical producers in the region.

GPSN Membership - 1st cycle 2022-2024



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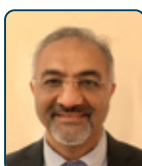


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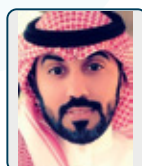
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Alsubaie
Ma'aden



Hisham Mohammed
Al-Hanfush
Farabi



Zyad Homud
Al-Shammari
APC



Advancing process safety through networking and collaboration

The GPSN kick-off meeting took place between 20-21 March 2022 at the Shangri-La Hotel Dubai, UAE, which officially marked the beginning of its journey, focusing on establishing GPSN's structure, strategy, offerings, and operational framework.

Under the effective networking pillar, the GPSN successfully delivered four focused process safety workshops during 2022-2023. The workshop content was tailored to address key regional process safety needs and challenges, creating a platform to promote knowledge sharing, focusing on learning from Process Safety Events (PSE), good practices and the latest digital solutions.

“Process Safety Excellence via SMART and VIBRANT Metrics”

The GPSN kick-off meeting in March was followed by the first GPSN process safety workshop held on 22-23 March under the theme “Process Safety Excellence via SMART and VIBRANT Metrics”. The workshop attracted 80 process safety professionals and provided a great opportunity for companies' EHSS&Q heads and safety experts to learn more about process safety performance monitoring metrics as well as share and recommend good practices, exchange learnings, challenges, and advanced applications with other participating professionals. The workshop program included awareness sessions on the leading practice on process safety metrics (API-754). Global and regional experts discussed the metrics' implementation best practices, key challenges, lessons learned, and their advanced applications.

“Structured Sharing, Towards Effective Learning”



GPCA organized the 2nd Process Safety Workshop, hosted by OQ, on 2-3 November 2022 at the Intercontinental Muscat Hotel, Oman, under the theme “Structured Sharing,



Towards Effective Learning”. Over 90 global and regional process safety experts attended and shared their expertise on how to adopt unique Learning From Incidents (LFI) management practices and exchanged knowledge on process safety at their facilities.

“Manage Risk, CHANGE It Right and START It Right”



The GPSN's 3rd Process Safety Workshop, hosted by TASNEE, was held successfully between 8-9 March 2023 at TASNEE Beach Camp, Al Jubail, Saudi Arabia, attracting 100 process safety and EHS&S experts from across the region. Held under the theme “Manage Risk, CHANGE It Right and START It Right!”, the workshop began with opening remarks by Abdullah Al-Qahtani, Chief Engineer Process Risk Management, SABIC and Chairman, Gulf Process Safety Network, GPCA. The third in a series of workshops organized by the GPSN, the workshop provided a platform for sharing best practices related to the effective Management Of Change (MOC) and Operational Readiness (OR).

“Be Safe, Not Sorry – Walk The Line!”



On 1-2 November 2023 GPCA organized the 4th Process Safety Workshop, which was managed by GPSN and hosted by GPIC in Bahrain. The workshop, themed “Be Safe, Not Sorry – Walk The Line!”, focused on the globally renowned “Walk The Line” program. Jerry Forest, the program's pioneer, delivered a comprehensive masterclass, guiding attendees on implementation methods and equipping them with essential tools to prevent line-up errors. The workshop also featured knowledge-sharing presentations from GPIC, SABIC, Ma'aden, OQ, S-Chem, and QAFCO, who discussed insights from past incidents and best management practices relevant to the workshop's theme. The workshop attracted 150 delegates from across the GCC.

Growing interest and active participation

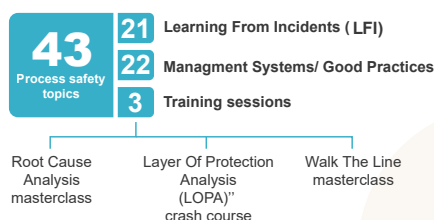
The growth in workshop attendance over the last two years, as illustrated in Figure 1, indicates the industry's growing interest and willingness to learn and share knowledge about learning from incidents, regulations, enablers and digital solutions, and advancements in process safety. As more industry professionals attend these important

Figure 1: Process safety workshop attendance growth (2023-2022)





Figure 2: Process safety topics covered



process safety gatherings, delegates benefit from a broader pool of expertise to draw upon, fostering a collaborative and dynamic environment for networking and the exchange of knowledge and experiences.

Enriching process safety knowledge

Within the workshops, the GPSN ensured to enrich the process safety knowledge in the region through dedicated technical learning opportunities.

Root Cause Analysis (RCA) masterclass

Another important feature among the GPSN offerings was the Root Cause Analysis (RCA) masterclass held during the 2nd GPCA Process Safety workshop and led by Yusif J Halawani, Root Cause Analysis Specialist, SABIC. The masterclass delivered a systematic approach to analyzing incidents, identifying all causes, and creating corrective action plans to address these causes and prevent reoccurrence. Discussions covered RCA program requirements, effectiveness, best practices and key points to remember. Human error, recommendations, and key learnings were highlighted, along with developing Learning From Incidents (LFI). The criteria for LFI development, internal and external communication, implementation, and effectiveness measurement were also discussed, providing participants with comprehensive tools to enhance their process safety practices.



Instructor:
Yusif J. Halawani
Senior RCA Specialist
SABIC

“Layer Of Protection Analysis (LOPA)” crash course

The “Layer Of Protection Analysis (LOPA)” course took place during the 3rd GPCA Process Safety Workshop and was led by Mohammad Nurkholik, Staff Engineer, Process Safety, SABIC. This course introduced attendees to this risk assessment tool, essential for evaluating the adequacy of protection layers in managing process risks. Participants gained insights on LOPA's role in risk assessment, its methodology, applications, limitations, and the critical aspects of risk targets and LOPA math. The session also highlighted key focus areas, including initiating events, frequency modifiers, and independent protection layers, complemented by a case study. Through this structured methodology, attendees learned to identify and evaluate potential hazards, enhancing their ability to apply this knowledge to improve process safety practices in their workplaces and industries. Key questions addressed included the adequacy of safety measures, the required number of independent protection layers, and the necessary risk reduction each layer should provide.



Instructor:
Mohammed Nurkholik
Staff Engineer, Process
Safety CoE
SABIC

“Walk The Line” masterclass

During GPCA's 4th Process Safety Workshop, a full-day masterclass was facilitated by Jerry Foster on “Walk The Line (WTL)” program. This

program is designed to prevent line-up errors in pipes and equipment, which are major contributors to process safety events. “Walk The Line” is a conduct of operations model that helps manufacturing plant operators ensure they understand where energy will flow with 100 % certainty, thereby avoiding line-up errors that might lead to process safety events. This model emphasizes consistent results through leadership, operational, and engineering disciplines.

Leaders create operational discipline tools and monitor results, operators use these tools to perform routine tasks correctly, and engineers optimize processes and recommend improvements. The model includes specific tools for operational continuity, open bleed management, line-up, and operational readiness, all designed to minimize errors and ensure safety during the transient operations of preparing equipment for maintenance and returning it to service.



Instructor:
Jerry Forest
Process Safety Consultant

Upcoming events

Building on the success and the positive impact of the Process Safety workshops, GPCA is organizing its inaugural Process Safety Conference through the GPSN under the theme “Enabling Process Safety Leadership: Enriching Knowledge, Catalyzing Commitment”.

The overarching objective of this conference is to provide an interactive platform for delegates, equipping them with the tools, insights, and collaborative opportunities needed to drive process safety within their organizations.

For more details, visit:

www.gpc.org.ae/conferences/psc/

or contact **Mohamed Seraj**
mohamed@gpc.org.ae.

CHEMISTRY THAT MATTERS™



PROCESS SAFETY IS ABOUT UNDERSTANDING HAZARDS AND RISKS,
MANAGING RISKS BY ENSURING
APPROPRIATE AND EFFECTIVE
LAYERS OF PROTECTION TO
PREVENT PROCESS SAFETY
INCIDENTS





Pursuing a vision

GPCA Insight speaks to **Fahad Al-Battar, CEO, SABIC Agri-Nutrients**, about balancing the company's net-zero ambitions with profitability and growth

As we enter the second half of the year, what are the key developments, risks and opportunities that will influence the GCC agri-nutrient industry in the region as well as globally?

The agri-nutrient value chain has been put under strain by recent developments. High inflation has squeezed the margins of end-manufacturers; geopolitical disputes have interfered with supply chains; weather conditions and changes have resulted in unfavorable crop productivity. And on top of that, fertilizer producers are expected to demonstrate their support for decarbonization.

Yet our industry remains resilient. Indeed, it might seize some business opportunities in the second half of the year. Farming seasons will bring back global demand activities at about the same time as fertilizer output recovers from the flurry of plant outages in the first half of the year. In addition, the expectations of economic recovery and an easing of interest rates should encourage both farmers and producers to invest in innovative and sustainable solutions.

Given the current global supply chain disruptions and geopolitical tensions, how is SABIC Agri-Nutrients adapting its strategies to ensure stability and growth in the agri-nutrient sector?

SABIC Agri-Nutrients has been able to deliver to its customers on time despite the ongoing supply chain disruptions and other international tensions. We trust the measures that made this possible will continue to mitigate the risk of business interruptions.

At SABIC Agri-Nutrients, you've remained focused on your energy transition pathway toward achieving carbon neutrality by 2050. How far have you advanced on your goal, and what are some of the key milestones in your journey so far?

SABIC Agri-Nutrients is evaluating multiple options—from new technology to new business models—that will lead it to carbon neutrality by 2050. All possible options are evaluated against the current and potential future market situations. Currently, global regulations and incentives are not supportive enough for some of the options, but that may change.

As for the key milestones, we are striving to deliver low-carbon ammonia and its derived fertilizers to our committed offtake customers. Indeed, we are aiming to become one of the world's leading low-carbon ammonia producers.

You've recently taken the reins as the company's CEO. What are your plans for the next five years and what are your key ambitions for the company?

The company's key ambition is to distinguish itself as Saudi Arabia's national champion for the agri-nutrient industry, while also becoming a global market-driven leader. For the next five years, we are aiming to expand our conventional and low-carbon product offerings to farmers, thus increasing food security and sustainability. In addition, we will also focus on improving our downstream value-chain integration in key geographic regions.



What is the role of collaboration and investment in technology and innovation in enabling a low carbon agri-nutrient industry?

Collaboration and investment in technology and innovation are essential for creating a low-carbon agri-nutrient industry. They promote sustainable practices, produce better products, reduce costs, improve efficiencies, and foster policy and market transformations. These efforts collectively help reduce the carbon footprint of the industry, while maintaining global food security.

What do you expect from this year's event and what is your message to delegates and industry peers?

I'm convinced that the agri-nutrient industry has the imagination, skills and determination to create a profitable business out of helping feed the world and dealing with climate change challenges at the same time. My message is thus that we need to be innovative and use this forum to learn from one another through the speakers' presentations and sessions, while also enjoying the networking opportunities.





Feeding the world

GPCA Insight speaks to **Eng. Yasser Alabbasi, CEO, GPIC, Bahrain** about his assessment of the agri-nutrient market currently and what the future holds for GPIC and the industry in the region

How do you assess the agri-nutrient market currently and in the short term after several years of volatility and price fluctuations?

In the ever-evolving landscape of our post-Covid world, volatility has become an everyday reality across all sectors. For the agri-nutrients market, the challenges have been augmented by supply disruptions, demand fluctuations, geopolitical tensions, and inflation raising input costs. The resulting swings in fertilizer prices have added to the tough conditions. While I am cautiously hopeful of a recovery emerging in our industry in the second half of the year as inflationary pressures ease and supply chains continue normalizing, geopolitical strains remain concerning.

What are some of the challenges that agri-nutrient producers in the GCC, including GPIC, have been facing?

The reality of the Gulf region's arid climate, water scarcity, and limited arable land have naturally challenged the entire regional agri-nutrients and food industry. The formidable conditions have restricted local food production and led to a high dependence on imports. During the recent pandemic, this dependence exposed the potential vulnerability of the GCC food systems to disruptions in global supply chains and logistics, with geopolitical tensions further aggravating the concerns. At the same time, the onset of Covid-19 proved to be a positive and potent catalyst. Recognizing the importance of increasing the GCC food sector's self-sufficiency, government policies have been enhanced to increase domestic food production, reduce food wastage, support research and development, and streamline logistics. Technology and more

recently artificial intelligence (AI) have given these developments further impetus. However, much still remains to be done such as increasing the productivity of local farmers, shortening food supply chains, and establishing a pan-GCC entity to oversee regional food security.

At GPIC, we are encouraged and excited about the ongoing transformation of the GCC food industry and look forward to supporting the expanding government endeavors. Yet these are tough times as we are facing our own share of challenges including the volatile prices for our products, intensifying competition from established global players, new and upcoming agri-nutrient capacities worldwide, and securing feedstock for potential expansion projects to enable us to overcome these hurdles.

What is GPIC's agri-nutrients growth strategy, and how do you plan to balance growth with sustainability targets?

Recently, GPIC redefined its corporate vision with the stated ambition to become a leader in chemicals and agri-nutrients that pursues excellence and sustainability. This strategic pivot has led to the development of the GPIC Growth Strategy 2040, which is centred on product diversification, strategic partnerships, and aligns our company strategy with Bahrain's ambitious goals of reducing Scope 1 and 2 emissions by 2035 and 2060, respectively. As part of this, we have launched a comprehensive growth strategy balanced by a decarbonization roadmap focusing on sustainable product development, circular economy principles, resource efficiency, carbon footprint reduction, stakeholder engagement, and transparency and reporting. We believe that this approach will enable the company to grow successfully and also remain committed to low-carbon



and sustainable operations that meet our stakeholders' expectations.

The energy transition and the need for emissions reduction are accelerating, adding pressure on the industry to find new solutions and innovate. How can the industry meet the dual challenge of contributing to food security, while at the same time minimizing its impact on the planet?

It is widely recognized that energy transition entails nothing short of radical change in all human activity. As a result, there is a growing debate on how to do this and most certainly, designing secure and sustainable food networks is at the forefront. Population growth and the increased demand for food as well as the growing sophistication of consumer preferences has complicated in what must be a multifaceted journey to make the global food system sustainable. All of us involved in the food supply chain including agri-nutrient producers like GPIC bear the responsibility of embedding sustainability at the heart of all that we do, beginning with sustainable farming practices and fertilizer production.

More than half of the reduction in the emissions produced by the global food system can potentially be achieved through adopting practices such as 'Precision Agriculture' and





'Nutrient Use Efficiency (NUE)'. Farmers can maximize the proportion of mineral nitrogen taken up by the plant through the implementation of the 4R Nutrient Stewardship: applying the Right nutrient source, at the Right rate, at the Right time, and in the Right place. This will enable farmers to reduce input while increasing crop yield. Other practices such as promoting soil health and utilizing advanced technologies like remote sensing, drones, and AI to monitor crop health, soil conditions, and fertilizer application will further augment the benefits.

Simultaneously, making fertilizer production a more sustainable process will also contribute toward reducing the emissions of the global food system. This includes shifting toward renewable and low-carbon feedstocks for fertilizer production; investing in energy-efficient production processes to lower the industry's carbon footprint; developing and promoting low-emission fertilizer formulations such as controlled release mechanisms or lower nitrous oxide emissions; implementing carbon capture and storage (CCS) technologies; implementing circular economy principles to minimize waste and maximize resource efficiency; developing systems to recycle and reuse fertilizer byproducts and waste materials; and taking responsibility for the entire lifecycle of fertilizer products, from production to disposal, to minimize the overall environmental impact.

What is the role of policy and regulation in helping to support a more food secure and climate smart planet, as is the theme of this year's GPCA Agri-Nutrient Conference? What more do you hope to see from policy-makers and regulators to

help support the stability and resilience of the industry and the state of food security in the region and globally?

Policy and regulation are essential tools for building a food-secure and climate-smart planet. They provide a compass to guide industries, farmers, and consumers on how to navigate responsibly, efficiently and sustainably. Examples of policy and regulation to achieve this include incentivizing sustainable practices through subsidies, tax breaks, and grants for sustainable practices like organic farming, precision agriculture, and renewable energy adoption; setting environmental standards including regulation on emission levels, water usage, and chemical inputs toward reducing the environmental impact of agriculture and food production; promoting robust food safety regulations to protect consumers and build trust in the global food system; promotion of fair trade policies to support small-scale farmers; and investing in research and development to accelerate new technologies and practices that improve food security and reduce emissions.

But policies and regulations are not enough. We also need to facilitate access to finance so farmers and agribusinesses have the financial support to invest in technologies and practices to make food systems more sustainable and enhance climate resilience. Through such investments, data and technology can be leveraged to augment decision-making in farming systems and thereby improve food system outcomes such as crop yields, profits, environmental sustainability and food security.

We must also strive to create more opportunities for women and young people to participate in the agricultural sector because this contributes

to positive economic, ecological and sociocultural changes in farming households and communities, and further enhances food security. Finally, raising awareness about the impact of food practices and choices on nature, sustainable eating habits, promoting sustainable diets, and the importance of reducing food waste through education and information programs is an integral part toward making our global system a sustainable one.

You'll be delivering the Opening remarks on Day 2 at the GPCA Agri-Nutrient Conference. What do you expect from this year's gathering and what do you hope to achieve?

Environmental responsibility is top of mind across the globe. Therefore, in this year's conference I expect a strong focus on exploring sustainable practices for the agri-nutrient industry as well as discussions on carbon reduction strategies and how to adopt principles of a circular economy.

I am confident that the conference will provide rich insights for all of us as we collectively navigate through these very challenging times. By bringing together regional and global industry players, governments and research institutions, I am hopeful that through discourse, exchange of ideas and deeper collaboration, we will be able to forge a credible roadmap toward a more sustainable agri-nutrient industry. To further facilitate this, the GPCA Agri-Nutrients Committee is bringing an impressive group of speakers to this year's conference covering a broad spectrum of pertinent topics. I look forward to seeing you all very soon.



Policy and regulation are essential tools for building a food-secure and climate-smart planet.

Eng. Yasser Alabbasi
CEO, GPIC





Global fertilizer demand begins its recovery after a rocky two years

By Laura Cross, Director, Market Intelligence, International Fertilizer Association (IFA)

The fertilizer markets stabilized in 2023 and H1 2024 despite continued global disruption across commodity markets. Fertilizers remain exposed to global risks spanning geopolitics, conflict, economics and climate. Macroeconomic drivers remain highly influential as inflation and high interest rates have reduced borrowing power for producers and consumers alike. However, fertilizer affordability was much improved in H1 2024 compared to the previous 18 months.

High profile disruptions in global trade and shipping continued in early 2024, from changing export routes out of Russia and Belarus to events in the Red Sea and low water levels in the Panama Canal, all of which made it harder to ship fertilizers around the world. These issues have been mostly overcome, although risk and insurance costs remain major factors for traders to consider.

A year of potential political change is playing out in 2024, with almost 2 billion people in more than 70 countries due to vote in national elections (based on recent voter turnout). Many topics will be on the table in these elections, several of which will have implications for fertilizers, such as positions on foreign policy, food security, agricultural subsidies and decarbonization.

Fertilizer supply increased across the board in 2023, to varying degrees. Nitrogen production volumes broke away from recent trends to reach record levels in 2023, while phosphate and potash output partially

recovered from the challenging events of 2022.

Global ammonia output is estimated to have reached 185.6 Mt in 2023, up by 2% compared to 2022. Urea production is estimated to have increased significantly to reach 195.5 Mt in 2023, up by 6% compared to 2022.

Phosphoric acid production is estimated to have increased by 1% to 85 Mt in 2023 while total MAP+DAP production is estimated to have increased by 3% year-on-year to 64.3 Mt. Despite the partial recovery, global MAP+DAP output did not return to 2020 levels following three years of decline.

Global MOP production is estimated to have risen by 13% to 69.3 Mt in 2023. The Eastern Europe and Central Asia (EECA) region was the largest driver behind this recovery due to higher output from Belarus and Russia. Furthermore, MOP production in Laos grew by 67% in 2023 vs 2022, enough to offset a decline in Chinese domestic production.

Fertilizer consumption forecast

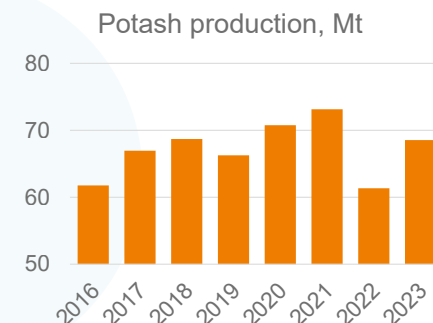
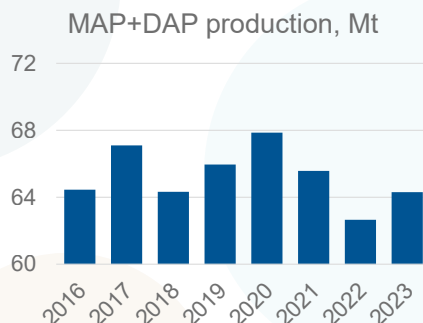
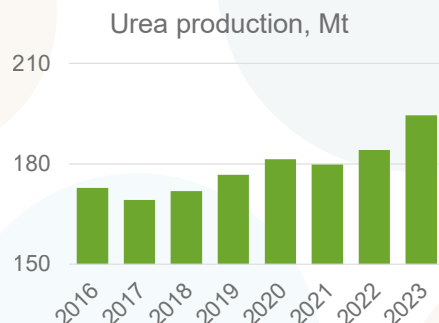
After declining for two consecutive years, global fertilizer use ($N + P_2O_5 + K_2O$) is forecast to increase by 4% in FY 2023 and by 3% in FY 2024. Consumption is forecast to reach 203.7 Mt nutrients in FY 2024, slightly above the previous record reached in FY 2020. This recovery can be primarily explained by improved affordability on the back of falling fertilizer prices since their peak in May 2022. Fertilizer affordability improved



considerably for grains (excluding rice) and oil crops in the second half of 2022 and in the first half of 2023, before stabilizing in the second half of the year. In the first quarter of 2024 the affordability of N and P_2O_5 fertilizers for grain production was poorer than in early 2023, but the affordability of K_2O fertilizers remained better, particularly for oil crops.

The fall and subsequent recovery in global fertilizer use has not been equally shared between the three major nutrients. K_2O use fell by 6.2 Mt (-15%) between FY 2020 and FY 2021, followed by P_2O_5 by 4.2 Mt (-9%) and N by 2.7 Mt (-2%). The recovery is expected to be driven by N increasing by 5.5 Mt (+5%), K_2O by 5.4 Mt (+16%), and P_2O_5 by 3.3 Mt (+7%).

Latin America and South Asia drive growth in N and P consumption



Source: IFA



As a result, by FY 2024, N consumption should be 2% above its FY 2020 level, whereas consumption of P_2O_5 and K_2O is expected to remain 2% lower.

Over the four years separating the two peaks in global fertilizer use, Latin America and East Asia are each expected to add over 2 Mt nutrients to their respective consumption. In contrast, West and Central Europe (WCE) and South Asia are forecast to contract their fertilizer use by 2 Mt and 1.1 Mt, respectively. Among smaller consuming regions, Africa is forecast to expand its fertilizer use by 0.5 Mt, but Oceania and EECA are expected to contract by 0.6 Mt and 0.4 Mt, respectively. North America and West Asia are forecast to increase consumption by less than 200 kt nutrients each.

K_2O drives the growth in Latin America and the decrease in South Asia, and N accounts for most of the consumption gains in East

Asia. In WCE consumption of all three nutrients is expected to decline.

Global fertilizer use is expected to continue expanding in the medium-term, but at a rate decreasing from 2.2% in FY 2025 to 1.5% in FY 2028. This is consistent with expectations of improved nutrient use efficiency and slowing growth in food production, reflecting slowing population growth.

Consumption of P_2O_5 and K_2O is expected to grow faster than N consumption over the medium-term. Between FY 2024 and FY 2028, consumption growth is forecast at 10% for K_2O compared to 8% for P_2O_5 and 6% for N.

Latin America and South Asia are expected to be the main engines of global growth in the medium term, adding between 3 and 4 Mt nutrients each between FY 2024 and FY 2028. East Asia is expected to expand by only 2% over these four years, but this translates into an additional 1.5 Mt nutrients

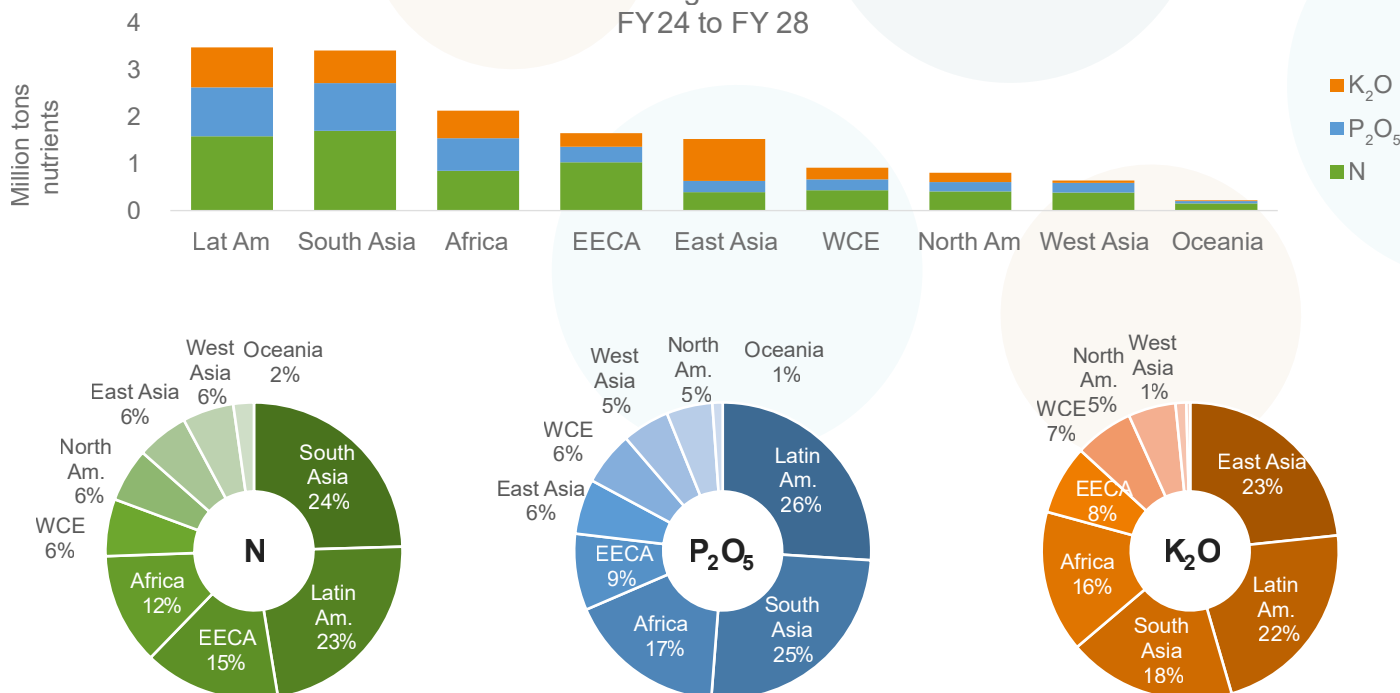
due to its large market size.

About half of the additional quantities of N and P_2O_5 consumed between FY 2024 and FY 2028 are expected to be represented by Latin American and South Asian countries. For K_2O , East Asia and Latin America are forecast to account for almost half of the additional quantities, with South Asia ranking third. Africa ranks third in terms of its overall contribution to additional quantities of fertilizers consumed between FY 2024 and FY 2028 (14%), behind Latin America (24%) and South Asia (23%). This is noteworthy given Africa's current small market share (4% in FY 2024).

This article features extracts from IFA's Medium-Term Fertilizer Outlook summary report, published in July 2024 and available in full at www.ifastat.org/market-outlooks.

Latin America and South Asia drive growth in N and P consumption

Absolute change in fertilizer use FY24 to FY 28



Source: IFA, May 2024



Fueling the future: UAE hydrogen sector growth opportunities

By **Suchitra Sriram**, Director and **Neeraj Mense**, Principal Consultant, Energy & Environment, Frost & Sullivan

The United Arab Emirates (UAE) has long been a key player in the global energy market, primarily due to its abundant oil and gas reserves. However, as the world transitions toward cleaner energy sources, the UAE strategically positions itself as a leader in the emerging hydrogen sector. This shift is not only aligned with global decarbonization efforts but also with the UAE's own ambitious sustainability goals. The rise of the hydrogen sector in the UAE is a testament to the country's commitment to diversifying its energy portfolio and reducing its carbon footprint.

UAE's commitment to hydrogen energy

The UAE's interest in the hydrogen sector is driven by several factors. The nation recognizes the importance of reducing its dependency on fossil fuels and is keen on exploring alternative energy sources that can complement its existing energy infrastructure. Hydrogen, particularly green hydrogen produced using renewable energy, has emerged as a promising solution. To this effect, UAE's National Hydrogen Strategy (2050) aims to scale up hydrogen production in the country to achieve a production of 1.4 million tons per annum (mtpa) by 2031, 7.5 mtpa by 2040 and 15 mtpa by 2050. The country has already identified 10 enablers that will help attain the 2031 target of the National Hydrogen Strategy. UAE plans to develop at least two hydrogen production hubs called "Oasis" by 2031. The UAE's vast solar resources make it an ideal location for the production of green hydrogen, which can be used domestically or exported to global markets.

Furthermore, the UAE is aware of the growing international demand for clean energy. By investing in hydrogen, the country is securing its energy future and also positioning itself as a major exporter of hydrogen, particularly to regions like Europe and Asia, which are rapidly increasing their hydrogen consumption.

Strategic initiatives and investments

The UAE has launched several strategic initiatives and made significant investments to accelerate the development of its hydrogen sector. One of the most notable is the establishment of the Hydrogen

Leadership Roadmap, which outlines the country's plans to become a major player in the global hydrogen economy. This roadmap includes ambitious targets for hydrogen production and export, as well as investments in research and development to advance hydrogen technologies. Besides, the Abu Dhabi National Oil Company (ADNOC) has announced plans to invest in blue hydrogen (hydrogen produced from natural gas with carbon capture) production technologies, leveraging its extensive natural gas resources.

Additionally, the UAE has been fostering partnerships with international companies and governments to bolster its hydrogen capabilities. ADNOC has partnered with international firms such as Siemens and ENEOS to advance hydrogen technologies and integrate them into its energy portfolio. These collaborations are aimed at developing large-scale hydrogen production facilities, creating a robust supply chain, and ensuring the integration of hydrogen into various sectors - transportation, industry, and power generation.

Recent industry developments

The UAE's hydrogen sector has seen several key developments in recent years, signaling its rapid growth and increasing importance. Some of the most significant recent developments include:

- **Partnership with Siemens Energy and Mubadala:** In 2021, Siemens Energy and Mubadala announced a strategic partnership to develop green hydrogen production in the UAE. This collaboration aims to establish the UAE as a leading hub for green hydrogen in the Middle East.
- **Masdar and ENGIE's Green Hydrogen Project:** Masdar, a renewable energy company based in Abu Dhabi, has partnered with ENGIE, a French multinational utility company, to develop a green hydrogen production facility in the UAE. This project is expected to produce 200 MW of green hydrogen by 2025.
- **Hydrogen Alliance Launch:** The UAE launched the Abu Dhabi Hydrogen Alliance, a collaboration between ADNOC, Mubadala, and ADQ, to position the country as a major hydrogen exporter. This alliance



focuses on developing blue and green hydrogen projects and exploring export opportunities.

- **Dubai's Green Hydrogen Project:** Dubai Electricity and Water Authority (DEWA) has launched the first green hydrogen plant in the Middle East and North Africa (MENA) region. This pilot project, located at the Mohammed bin Rashid Al Maktoum Solar Park, aims to showcase the potential of green hydrogen in the UAE.

Abu Dhabi National Oil Company's (ADNOC) Hydrogen Ambitions:

ADNOC has set ambitious targets to produce and export hydrogen. The company is exploring various pathways, including blue hydrogen, which is produced from natural gas with carbon capture and storage (CCS).

Challenges and future prospects

While the rise of the hydrogen sector in the UAE is promising, it is not bereft of challenges. The high costs associated with hydrogen production, particularly green hydrogen, remain a significant barrier. Green hydrogen holds immense promise, but its potential remains largely untapped. While the technology offers multiple benefits, it is still in its early stages of development. To fully realize its potential,



a clear strategy and supportive policies are essential to incentivize hydrogen production, consumption, and trade. Currently, there is cautious optimism surrounding green hydrogen within the region. Stakeholders, particularly local industries and energy consumers, are still evaluating its value proposition. Globally, energy costs significantly impact the competitiveness of manufactured goods, and prioritizing sustainability mandates alone could have negative consequences. Additionally, the development of a comprehensive hydrogen infrastructure, including storage and distribution

networks, is still in its early stages.

However, the UAE's strong commitment to innovation and sustainability, combined with its strategic investments and partnerships, positions it well to overcome these challenges. The country's leadership in the hydrogen sector is expected to grow in the coming years, making it a key player in as a global energy leader.

Conclusion

The rise of the hydrogen sector in the UAE represents a strategic shift towards

a more sustainable and diversified energy landscape. As the UAE continues to invest in hydrogen production and infrastructure, it is poised to become a leader in the global hydrogen economy. This not only supports the UAE's sustainability goals but also enhances its role as a major energy exporter in a decarbonizing world. The hydrogen sector's growth in the UAE is a clear indication of the country's forward-thinking approach and its commitment to a sustainable energy future.



The UAE has been fostering partnerships with international companies and governments to bolster its hydrogen capabilities.

Suchitra Sriram, Director and Neeraj Mense,
Principal Consultant, Energy & Environment,
Frost & Sullivan





Evolving patterns in GCC nitrogen investment strategies

By Noora Mukhtar, Research Specialist, GPCA

As the global population is projected to reach 9.7 billion by 2050, the demand for food and agricultural products is intensifying, necessitating efficient and environmentally conscious nitrogen production. Additionally, the nitrogen industry is being influenced by broader global sustainability goals, including the push for alternative fuels (such as ammonia) by the International Maritime Organization (IMO) targets for reducing greenhouse gas (GHG) emissions from shipping. This presents a significant opportunity for the nitrogen industry to expand into new markets and applications. These evolving market dynamics, regulatory landscapes, and the emphasis on sustainability are driving transformative shifts in nitrogen investment strategies. They are reshaping the nitrogen industry's regional landscape, with implications for producers, consumers, and policymakers alike.

Shifting centers of production

Traditionally, nitrogen production, which constitutes over half of global fertilizer production, has been concentrated in regions with abundant natural gas reserves. These regions benefit from cost-effective

feedstock. However, the industry's center of gravity is gradually moving towards areas with lower production costs, favorable regulatory environments, and proximity to major consumption hubs. This shift aims to enhance operational efficiency, optimize costs, and reduce the environmental footprint.

Table 1 and Table 2 illustrate the global and regional trends in nitrogen production capacity from 2017 to 2027. The Gulf Cooperation Council (GCC) region, as a dominant part of West Asia, is expected to experience a positive increase in production capacity, reflecting strategic investments in nitrogen production. Compared to other regions such as Africa, East Europe and Central Asia, the GCC's sustained growth reflects a focus on leveraging natural gas resources, optimizing production efficiency, and solidifying its position in the global nitrogen market.

GCC's strategic expansion and investment in nitrogen production

The Arabian Gulf region, with its vast natural gas reserves and strategic location, is establishing state-of-the-art nitrogen production facilities.



For instance, Saudi Arabia, Qatar, and Oman ranked among the top fifteen leading fertilizer exporters in 2023. The GCC's fertilizer production capacity has grown significantly over the past decade, with a 4.86% Compound

Table 1: Urea production capacity share by region and growth forecast

Region	2017	2018	2019	2020	2021	2022	2023 F	2024 F	2025 F	2026 F	2027 F
West Europe	3.2%	3.3%	3.3%	3.3%	3.2%	3.1%	3.1%	3.0%	3.0%	3.0%	2.9%
Central Europe	2.3%	2.0%	2.0%	2.0%	1.9%	1.9%	1.9%	1.8%	1.8%	1.8%	1.8%
East Europe & Central Asia	7.6%	8.4%	9.1%	9.4%	9.2%	9.2%	10.0%	10.2%	10.7%	10.7%	11.4%
North America	7.4%	7.6%	7.8%	7.9%	7.7%	7.5%	7.5%	7.4%	7.4%	7.3%	7.2%
Latin America	3.7%	3.6%	3.6%	3.2%	3.5%	3.4%	3.4%	3.5%	3.5%	3.5%	3.4%
Africa	5.8%	5.9%	5.9%	6.2%	6.9%	7.3%	7.4%	7.3%	7.2%	7.8%	7.6%
West Asia	11.7%	11.9%	11.5%	12.0%	11.7%	11.3%	11.2%	11.3%	11.1%	11.0%	11.4%
South Asia	16.0%	16.2%	16.9%	16.9%	17.1%	18.3%	18.1%	18.0%	18.3%	18.2%	17.8%
East Asia	42.0%	40.7%	39.5%	38.9%	38.5%	37.7%	37.4%	37.4%	36.9%	36.6%	35.9%
Oceania	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.1%	0.1%	0.1%	0.1%	0.5%
TOTAL WORLD (ktp)	216,028	212,841	211,560	211,916	217,399	224,734	227,175	230,793	233,843	235,173	239,585

CAGR% (2017-2027)	
0.24%	→
-1.59%	↓
5.24%	↑
0.82%	→
0.26%	→
3.81%	↑
0.75%	→
2.12%	↑
-0.54%	↓
8.39%	↑
1.04%	↑

Table 2: Ammonia production capacity share by region and growth forecast

Region	2017	2018	2019	2020	2021	2022	2023 F	2024 F	2025 F	2026 F	2027 F
West Europe	5.2%	5.4%	5.4%	5.4%	5.4%	5.2%	4.9%	4.8%	4.7%	4.7%	4.8%
Central Europe	3.7%	3.3%	3.2%	3.2%	3.1%	3.0%	3.0%	3.0%	2.9%	2.9%	2.8%
East Europe & Central Asia	12.9%	13.6%	14.2%	14.5%	14.3%	14.2%	14.3%	14.3%	14.6%	14.5%	14.9%
North America	9.6%	10.1%	10.1%	10.2%	10.0%	9.8%	9.8%	10.2%	10.5%	10.5%	10.8%
Latin America	5.3%	5.4%	5.4%	4.9%	5.0%	4.9%	4.9%	4.9%	4.8%	4.8%	4.7%
Africa	5.0%	5.1%	5.1%	5.3%	5.6%	5.8%	6.0%	5.9%	5.8%	6.1%	6.0%
West Asia	8.8%	9.0%	8.8%	9.2%	9.1%	9.4%	9.4%	9.3%	9.1%	9.1%	9.4%
South Asia	9.7%	9.8%	10.2%	10.2%	10.4%	11.1%	11.1%	11.0%	11.2%	11.1%	10.9%
East Asia	38.7%	37.4%	36.6%	36.1%	36.0%	35.5%	35.6%	35.9%	35.6%	35.4%	34.7%
Oceania	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	0.8%	0.8%	0.8%	0.8%	1.0%
TOTAL WORLD (ktp)	227,064	223,457	222,978	221,963	225,727	231,984	231,644	235,789	239,646	240,217	245,302

CAGR% (2017-2027)	
-0.01%	→
-1.76%	↓
2.18%	↑
1.98%	↑
-0.55%	↓
2.56%	↑
1.38%	↑
1.98%	↑
-0.33%	↓
1.36%	↑
0.78%	↑

Source: GPCA analysis, IFASTAT, 2024

ktp = Kilo tons per annum



Annual Growth Rate (CAGR) between 2013 and 2023, scoring an additional 13.2 million tons (Figure 1).

The nitrogenous fertilizer segment occupies the larger bulk of the market, where the GCC nitrogen-based fertilizers (mainly urea and ammonia) account for 82.3% of the regions' fertilizer portfolio in 2023. The GCC fertilizer industry remains heavily export-oriented, shipping its products to 63 countries from across the globe. India, the USA and Singapore ranked the top three GCC nitrogen export destinations, accounting for 62% of the total nitrogen export value in 2022. Although capacity additions in agri-nutrients have been limited in the past couple of years, they played a pivotal role in boosting revenue within the regional petrochemical industry. Record-high prices for agri-nutrients were driven by a complex combination of various factors such as rising energy costs, supply and demand dynamics, and geopolitical factors.

Market dynamics, regulatory drivers, and sustainability imperatives

Market dynamics

With a global focus on ensuring food security for a rapidly growing population, the demand for fertilizers is expected to rise substantially. The global urea and ammonia demand are projected to reach 300 mtpa and 290 mtpa, respectively, by 2030. The surge in demand underscores the urgent need for reliable fertilizer suppliers, enabling GCC producers to meet increasing global demands, particularly in major agricultural markets.

Simultaneously, the debate over the use of nitrogen-based products for food security versus fuel is intensifying. The IMO targets net-zero GHG emissions by 2050, spurring

interest in ammonia as an alternative maritime fuel. Ammonia's potential as a zero-carbon fuel is compelling, but it competes directly with its role in agriculture. This dual demand presents a strategic challenge for GCC producers: should they prioritize meeting the urgent needs of global food security, or capitalize on the emerging market for clean maritime fuel? Balancing these priorities will be crucial in shaping the future of the GCC's nitrogen investment strategies, ensuring they meet both environmental goals and food supply needs.

Regulatory drivers

Geopolitical conflicts and the European Union's Carbon Border Adjustment Mechanism (CBAM) are influencing the nitrogen investment landscape. Traditionally, Europe has sourced fertilizers from major producers like Russia, but ongoing geopolitical conflicts have disrupted these supply chains. Additionally, the implementation of the European CBAM could make imports from certain regions more costly due to carbon pricing considerations. These factors, coupled with Europe's chemical industry downturn, may drive the region to diversify its fertilizer import sources further, opening up prospects for GCC producers.

In addition to CBAM, global regulatory frameworks such as Emissions Trading Schemes (ETS) are becoming increasingly relevant. These schemes impose limits on GHG and provide economic incentives for industries in the GCC to adopt cleaner technologies and improve environmental performance. These regulatory shifts are encouraging investments in sustainable practices and resource-efficient production methods within the GCC, aligning with global sustainability goals.

Sustainability imperatives

The global push toward sustainability and the race to achieve net-zero emissions are reshaping investment landscapes across industries. Environmental, Social, and Governance (ESG) criteria are increasingly influencing investment decisions, compelling companies to adopt sustainable practices. In the nitrogen industry, this shift is evident as producers strive to align with ESG goals and reduce their carbon footprints. Governments worldwide are implementing stringent environmental regulations and offering incentives to encourage cleaner production technologies and reduce GHG emissions. Investments in carbon capture and storage (CCS) technologies, as well as the utilization of renewable energy sources, are emerging in the region.

Transition to green ammonia

The transition to green ammonia is a critical development in the nitrogen industry. Despite the high capital investments of constructing new ammonia-urea plants, there has been a notable increase in investment in green ammonia projects. In the past two years, a significant number of green ammonia projects have been announced worldwide, although these projects tend to be on a smaller scale compared to traditional facilities.

This transition is critical as the nitrogen production process is highly energy-intensive, with energy costs accounting for 70-80% of ammonia production expenses. Innovative approaches, such as the integration of CCS technologies and the development of hydrogen-based ammonia production, are gaining traction reflecting the industry's commitment to sustainability and low-carbon technologies.

Evolution and future prospects of nitrogen investments in the GCC

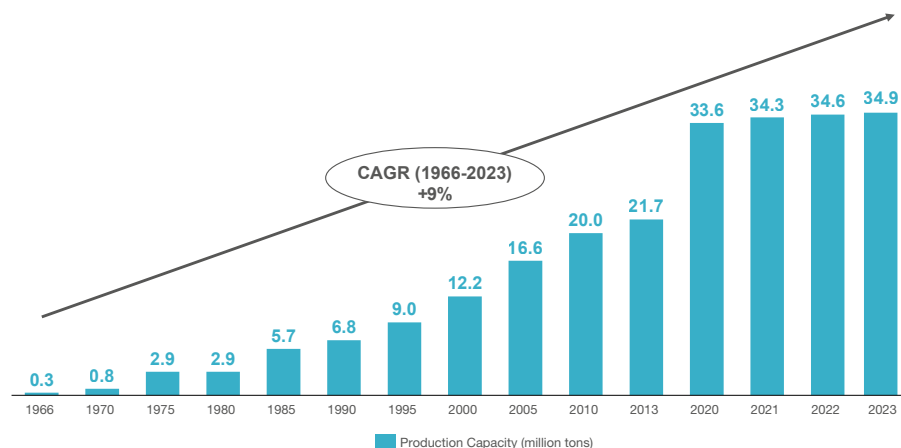
Historical achievements

The GCC's journey in nitrogen production began in the 1960s when countries started converting flared gas into valuable agri-nutrient products, marking the birth of the region's petrochemical industry. Since then, the GCC has continuously expanded its nitrogen production capacities, modernizing facilities and increasing efficiency (Figure 2).

Future prospects

Since these early efforts, the GCC countries have continuously expanded their nitrogen production capacities. Major investments have been made to modernize facilities and increase production efficiency. The ample investments in nitrogen capacity in

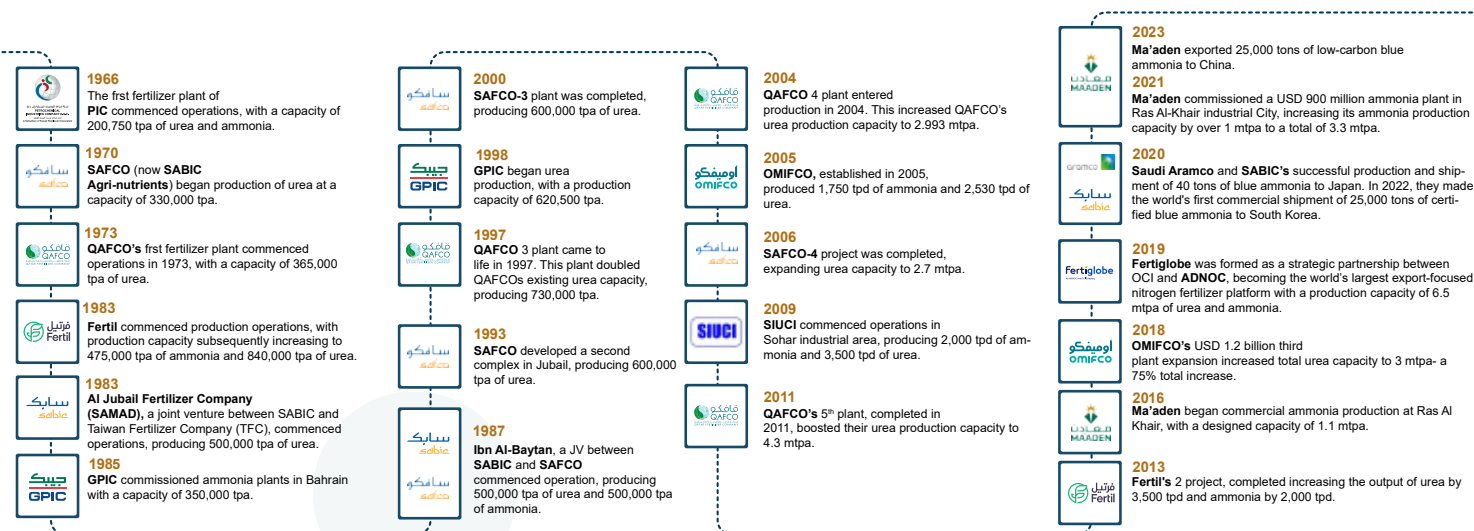
Figure 1: GCC agri-nutrient production capacity (million tons and % growth rate)



Source: GPCA analysis, 2024

Note: GPCA member companies only

Figure 2: Early developments and major milestones of the GCC nitrogen investment projects



Source: GPCA research, 2024

the GCC are part of a broader trend within the GCC countries to enhance their industrial capabilities and economic diversification efforts.

Regions with access to renewable energy sources, such as solar and wind, are gaining traction in attracting nitrogen investments. The integration of renewable energy into nitrogen production processes holds the promise of reducing GHG emissions and aligning with the industry's sustainability goals. For example, countries like Morocco, with its vast solar potential, and Chile, known for its abundant wind resources, are actively courting investments in green nitrogen production facilities. Morocco has announced plans to invest USD 7 billion in a green ammonia production facility, leveraging its renewable energy resources. While Chile, with an estimated investment of USD 2.5 billion, the project envisions the construction of a green hydrogen plant capable of producing 600,000 tons of green ammonia annually.

Similarly, the GCC countries are proactively pursuing green ammonia projects to diversify their energy mix and reduce their carbon footprint. Several GCC nations have unveiled ambitious plans to establish green ammonia facilities, capitalizing on their renewable energy endowments and commitment to environmental stewardship. Table 3 provides some examples of these upcoming investments.

Conclusion

The nitrogen fertilizer industry stands at a pivotal moment, marked by evolving investment patterns driven by sustainability and resilience. Leveraging its resource advantages and strategic initiatives, the GCC region is poised to play a critical role in the future of nitrogen production. Balancing economic viability with environmental stewardship will be key to the success of these investments.

To facilitate the transition in nitrogen investments, regional collaborations and

infrastructure development are gaining momentum. Investments in research and development are driving market growth, supported by GCC governments through subsidies, financial assistance, and technological advancements. These measures are fostering more favorable conditions for fertilizer adoption across the region.

The convergence of geopolitical shifts, regulatory changes, and sustainability imperatives is creating a dynamic landscape for nitrogen investments. The GCC region, with its strategic initiatives and investments in both traditional and green ammonia projects, is well-positioned to capitalize on these emerging opportunities and contribute to meeting global nitrogen demand while aligning with environmental goals.

This article was originally published in Vol 41 Issue 4 of "Fertilizer Focus", a publication by Argus Media.

Table 3: Upcoming announced GCC nitrogen-based agri-nutrients projects overview

Project name	Location	Investment (USD billion)	Completion year	Capacity (mtpa)
Fertiglobe, blue ammonia project at Ta'ziz industrial complex	Ruwais, UAE	2.0*	2025	1.0
KIZAD, green ammonia facility	Abu Dhabi, UAE	1.0	2026	0.2
QE and QAFCO's world largest blue ammonia project (Ammonia-7 Project)	Mesaieed Industrial City, Qatar	1.0	2026	1.2
OQ and DEME, HYPORT green ammonia plant	Duqm, Oman	NA	2026	0.33
Air Products, ACWA Power, and NEOM green hydrogen and ammonia plant	NEOM, Saudi Arabia	5.0	2026	1.2
Saudi Aramco & Sabic agri-nutrients, blue ammonia production	Saudi Arabia	NA	2030	11
ACME's green ammonia production facility	Duqm, Oman	3.5	NA	1.2
OQ as part of Salalah2 consortium, renewable ammonia plant	Salalah, Oman	1.0	NA	0.4

Source: GPCA research, 2024

Note: *Investment includes a chlor-alkali, ethylene dichloride and polyvinyl chloride plant, a blue ammonia plant and a methanol plant.



Greening the supply chain: The impact of EU CBAM on fertilizers, polymers, and organic chemicals

By **Tatiana Shuldyk**, Tax Director, PwC Middle East

Introduction

In a world where carbon pricing mechanisms are proliferating, with over 70 carbon taxes and emissions trading systems (ETS) in place globally, the landscape is shifting rapidly. The introduction of the European Union's Carbon Border Adjustment Mechanism (EU CBAM) marks a significant milestone in this evolution, with profound implications for organisations operating in key industries in the GCC, including fertilizers, hydrogen, polymers, and organic chemicals and other sectors.

The EU CBAM - the first mechanism of its kind - is designed to level the playing field by aligning the carbon costs of EU producers with those of imported goods. This pioneering initiative is likely to inspire similar measures in other regions, with the UK considering its own CBAM by 2027 and various other legislative proposals in the US aiming to address carbon emissions in international trade. Australia and Japan also announced that similar mechanisms are being considered.

During the transitional phase of EU CBAM, from 1 October 2023 to 31 December 2025, importers to the EU - which, of course, include those from the GCC - are required to report the greenhouse gas (GHG) footprint of CBAM products, including fertilizers, on a quarterly basis. From 2026 onward, the stakes will rise as companies must purchase CBAM certificates to cover the carbon emissions embedded in the imported goods – a move that could significantly impact market prices, profit margins, as well as the demand for regular and low-carbon products.

Moreover, the EU Commission is considering extending the scope of CBAM to include polymers and organic chemicals, with a decision expected before 2026.

This expansion could later encompass petroleum products and other sectors, further increasing the pressure on industries to adapt to this new carbon-conscious landscape.

EU CBAM coverage: Products and emission scopes

EU CBAM is designed to target products with significant carbon footprints, and its current scope reflects this focus. As of now, CBAM applies to fertilizers, hydrogen, aluminum, steel and electricity. In the fertilizer sector

the following products are currently covered: urea, ammonia, nitric acid, and certain mixed fertilizer.

By 2026, the EU is expected to evaluate expanding CBAM to cover organic chemicals and polymers. Products under consideration include methanol, ethylene, ethylene dichloride, vinyl chloride monomer, HDPE, LDPE, normal alpha olefins, hexene and others.

By 2030, the product groups currently covered by the EU ETS could potentially fall under CBAM. This includes crude petroleum, petroleum products, and inorganic chemicals.

In terms of emissions covered, for fertilizers, EU CBAM covers both direct and indirect emissions, which broadly correspond to Scope 1, Scope 2, and some elements of Scope 3 (related to specific precursors). The emission boundaries, as well as the requirements to the EU CBAM GHG methodology, processes and risks and controls environment for EU CBAM purposes, have been set out in the CBAM regulations.

Additionally, while there is potential for CBAM to extend to transportation emissions in the future, the EU ETS has already begun covering emissions from shipping as of 2024, setting a precedent for broader carbon accountability.

EU CBAM costs starting 2026

The costs associated with EU CBAM from 2026 onward will hinge on several factors, including the choice between using actual emissions data versus default values, fluctuations in carbon prices within the EU ETS market, and whether additional precursors and/or transportation emissions are included under CBAM.



One key feature of the CBAM implementation is the gradually declining “discount” available from 2026 to 2034. This discount is designed to align CBAM obligations with the free EU ETS allowances, which will be phased out by 2034. This alignment aims to ensure that products produced within the EU and imported from third countries are treated equally under the carbon pricing regime.

While the “CBAM benchmarks” have yet to be published, they are expected to be based on a combination of the existing EU ETS benchmarks. The emissions subject to CBAM will be calculated using the below formula: Embedded emissions – (CBAM Benchmark × CBAM Factor).

Grey ammonia - illustrative calculation of potential CBAM costs

Year	CBAM factor	Carbon price scenario	Benchmark example	Calculations based on the actual emission intensity		Calculations based on the default emission intensity	
				Embedded emissions example	CBAM per ton of ammonia Euro	Default emissions example	CBAM per ton of ammonia Euro
2026	97.5%	80	1.57	2.2	53.5	2.82	103.1
2030	51.5%	100	1.57	2.2	139.1	2.82	201.1
2034	0.0%	140	1.57	2.2	308.0	2.82	394.8

¹ We note that CBAM benchmark and Default values for the Definitive periods are yet to be published. For illustration purposes only, we calculated the potential CBAM costs for ammonia based on the Update of benchmark values for the years 2021 – 2025 of phase 4 of the EU ETS, Default values for the transitional period of CBAM between 1 October 2023 and 31 December 2025, as well as scenarios of carbon price in the EU which may vary.



One significant factor influencing CBAM costs is the availability of quality data on the actual emission intensity, which should be calculated according to the CBAM methodology, supported by the required documentation and verified in compliance with CBAM requirements. If actual emissions data is unavailable (or deemed unreliable), default values for the definitive period will apply.

The European Commission plans to publish a separate set of default values for the definitive period, which are expected to be country-specific. These default values are also anticipated to include a top-up to further “stimulate” alignment with the CBAM methodology.

For producers of “cleaner” products with emissions lower than the default values, it is critical to ensure implementation of the CBAM methodology and have all the necessary documentation in place.

EU CBAM: Way forward

As of January 2026¹, the costs associated with EU CBAM will not only affect the EU market but also significantly influence producers of CBAM-covered goods. Depending on the carbon intensity of these goods, CBAM costs could become substantial, potentially comprising a significant portion of gross export revenue. Here are

some critical considerations for companies aiming to navigate this landscape effectively:

1. Robust methodology and IT systems.

For CBAM goods currently within scope, such as fertilizers, it's crucial to ensure that a comprehensive CBAM methodology, along with robust processes and control environments, is fully implemented before January 2025¹. The integration of advanced IT tools should also be considered to streamline compliance and reporting, making it easier to manage the complexities of CBAM.

2. Reconsidering trading structures.

Starting in 2026, only authorized CBAM declarants will be permitted to import CBAM products into the EU. Companies must carefully consider whether to appoint a third-party service provider or a group company as the authorized declarant. This decision will have significant implications for trading structures, including contractual relationships, financing, and the management of CBAM certificates, the prices of which will be closely aligned with the volatile EU ETS market.

3. Potential market impact.

The introduction of CBAM is likely to affect market dynamics, influencing the demand

and supply of both “regular” and “green” products. Companies must assess how CBAM will impact the competitiveness of their products against major competitors and its potential influence on profit margins. This assessment should include a consideration of how market positioning may shift as customers and partners increasingly prioritize low-carbon alternatives.

4. Decarbonization agenda.

CBAM costs should not be viewed in isolation but rather as a component of a broader organizational decarbonization strategy. Companies should explore how these costs align with existing and planned decarbonisation measures, ensuring that CBAM compliance contributes to the overall sustainability goals of the organization.

5. Leveraging green energy and CCS.

Companies that utilize “green” energy sources, such as renewable electricity, “green” hydrogen, or carbon capture and storage (CCS) technologies, need to pay special attention to CBAM's specific rules in these areas. Ensuring that decarbonization efforts are recognized under CBAM will be essential for minimizing costs and maximizing the environmental benefits of these investments.





Achieving net-zero: Pathways to decarbonization and sustainable future

By **Harish Jayaram**, VP – Business Development, **Hygenco Green Energies**, and **Akshay Mohan**, DGM - Business Development, **Hygenco Green Energies**

The goal of achieving net-zero has become a pivotal objective in the global battle against climate change. The UN's 2050 net-zero targets emphasize decarbonization as a vital component for cutting emissions and fostering sustainability across various industries.

Decarbonization plays a crucial role in preventing the worst effects of climate change and keeping global temperature rise below 1.5°C above pre-industrial levels, as set out in the Paris Agreement.

Increased rates of GHG emissions

Over the past two decades, the world has faced setbacks regarding Greenhouse Gas (GHG) emissions and climate change. Despite significant actions and growing awareness, GHG emissions have continued to rise, increasing by a minimum of 1.1%.

Pathways for decarbonization

Addressing the challenges of decarbonization requires a multifaceted approach. Some key solutions include:

1. Transition to renewable energy:

Shifting from fossil fuels to renewable energy sources like wind, solar, and hydroelectric power is crucial. These sources generate electricity with little to no CO₂ emissions.

2. Energy efficiency:

Enhancing energy efficiency in buildings, transportation, and industrial processes reduces the overall demand for energy and, consequently, CO₂ emissions.

3. Carbon Capture and Storage (CCS):

Technologies that capture CO₂ emissions

at their source and store them underground can significantly reduce the carbon footprint of fossil fuel use.

4. Electrification of transportation:

Promoting Electric Vehicles (EVs) and investing in public transportation can reduce emissions from the transportation sector.

5. Sustainable agriculture:

Implementing practices that reduce methane emissions, such as improved livestock management and rice production techniques, and promoting agroforestry.

6. Reforestation and afforestation:

Planting trees and restoring forests can absorb CO₂ from the atmosphere, helping to offset emissions.

7. Circular economy practices:

Reducing waste, recycling materials, and designing products for longer use can minimize the environmental impact of consumption and production.

Government's role in achieving net-zero

Governments play a critical role in driving the transition to a net-zero future. They can implement policies, regulations, and market-based mechanisms to encourage decarbonization. Some of the key initiatives include:

- **Carbon credits:** Carbon credits are permits that allow the holder to emit a certain amount of CO₂. Companies that exceed their emission limits can purchase credits from those that have reduced their emissions. This creates a financial incentive for companies to cut emissions.



- **Energy Saving Certificates (ESCs):** Issued to industries that reduce their energy consumption beyond certain targets, these certificates can be traded, providing a financial reward for energy efficiency.

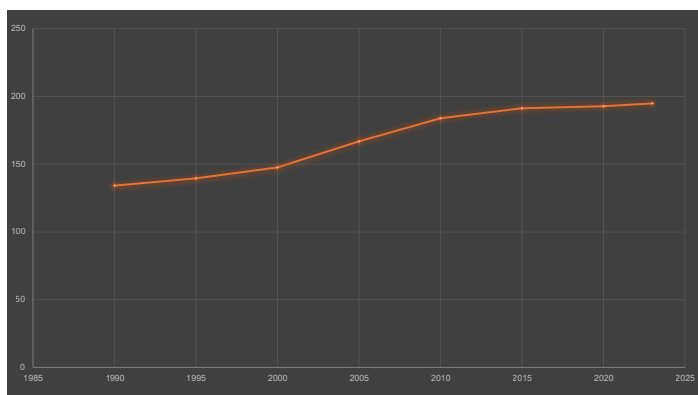
- **Internationally Transferred Mitigation Outcomes (ITMOs):** Under the Paris Agreement, countries can trade emission reductions to meet their national targets. This flexibility mechanism encourages global cooperation in reducing emissions.

- **Country-wise key initiatives by governments**

Global measures for achieving net-zero

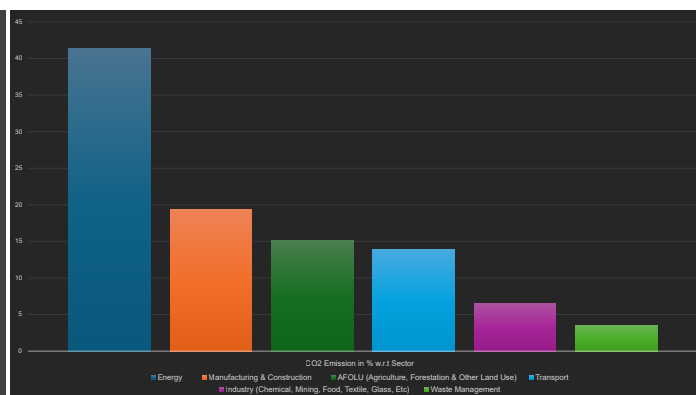
Countries across the globe are adopting

GHG emissions in billion tons with regards to time in years



Source: Our World in Data

Sector wise CO₂ emissions





ambitious measures to achieve net-zero emissions, with leading examples from Europe, Asia, and North America.

This collective effort highlights the importance of renewable energy, technological innovation, and policy support in the global transition toward sustainability.

Europe: pioneering decarbonization

Sweden and Norway are at the forefront of decarbonization in Europe. Sweden aims to achieve net-zero emissions by 2045, underpinned by policies that promote renewable energy, energy efficiency, and sustainable agricultural practices. The country has made significant investments in wind and solar power, along with advancements in battery storage technologies, to ensure a stable and green energy supply.

Norway, leveraging its extensive hydroelectric resources, has one of the highest shares of renewable energy in the world. The country's government has also introduced robust incentives for Electric Vehicle (EV) adoption, leading to a remarkable transformation in the transportation sector. Over half of all new cars sold in Norway are already electric.

Asia: embracing green fuel and hydrogen

Asia is also making significant strides toward decarbonization, with countries like South Korea, Japan, and India leading the charge. South Korea has developed certifications to validate the use of green hydrogen and green ammonia, both of which are pivotal in reducing carbon emissions from industrial processes and power generation.

Japan, known for its technological innovations, is investing heavily in the development of Sustainable Aviation Fuel (SAF) to decarbonize its aviation sector. This is critical for Japan, as an island nation that heavily relies on air travel. The country's focus on SAF, along with hydrogen fuel cells for vehicles and industrial applications, underscores its commitment to reducing GHG emissions.

In the Middle East, countries like the United Arab Emirates (UAE) are not far behind. The UAE has been rapidly expanding its renewable

Country	Key initiatives (policies, certifications, deals)
Sweden	Climate Policy Framework, Renewable Energy Directive, Fossil-Free Sweden Initiative
Norway	Norwegian EV Incentive Program, Hydropower Certification, Climate Neutral Norway 2050
South Korea	Hydrogen Economy Roadmap, Green Hydrogen Certification, Renewable Energy 3020 Plan
Japan	Green Growth Strategy, Sustainable Aviation Fuel (SAF) Initiative, Hydrogen Strategy
India	National Biofuel Policy, Ethanol Blending Program, National Hydrogen Mission, Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM)
United States	Inflation Reduction Act (IRA), Clean Energy Standard, 45Q Carbon Capture Tax Credit
United Arab Emirates (UAE)	Masdar City Initiative, Abu Dhabi Sustainability Week, National Energy Strategy 2050

energy capacity, particularly in solar power, while also exploring the potential of green hydrogen to decarbonize its economy.

India is also taking bold steps toward achieving net-zero. The Indian government has launched several initiatives promoting the use of green fuel, with a strong focus on ethanol blending in road transport. India is actively expanding its ethanol blending program to reduce the carbon intensity of its transportation sector.

Additionally, India is making significant investments in green hydrogen production. Hygenco Green Energies, an Indian company, has set a benchmark by commissioning and successfully operating India's first green hydrogen plant for Jindal Stainless Limited in the Hisar district of Haryana State in India. This plant represents a significant milestone in India's journey toward a hydrogen-based economy, contributing to both energy security and emissions reduction.

North America: driving innovation with policy support

In North America, the United States is leading the way through policy-driven innovation. The Inflation Reduction Act (IRA) is a landmark legislation that drives significant investments in green fuel technologies.

The U.S. government is also heavily investing in research and development to advance the production and use of green hydrogen. This aligns with global efforts to decarbonize hard-to-abate sectors, such as heavy industry and long-haul transportation.

Conclusion

Achieving net-zero globally is vital to combating climate change, requiring collective action across industries and firm leadership from governments worldwide. Transitioning to renewable energy, enhancing efficiency, scaling green hydrogen, and utilizing carbon markets are crucial strategies. As large economies like the US, China, India, and the EU spearhead efforts, their actions set a global precedent. Developing countries also play a critical role in this transition, balancing economic growth with sustainability. Coordinated global efforts are essential to secure a sustainable, resilient future for all nations.



Agri-nutrients: pathways to a sustainable future

By **Andrea Valentini**, VP, Business Development, Agri-nutrients, Argus Media

The nitrogen fertilizer industry is an energy-intensive sector that is faced with increasing pressure to decarbonize. It is also considered a “hard-to-abate” sector, putting it in the same league as steelmaking, cement, other chemical processes, shipping, and aviation. This is a significant challenge, given that the sector’s share of total Greenhouse Gas (GHG) emissions is estimated at between 3 and 4 % of the world’s total. This is particularly relevant in the context of the overall carbon footprint of the agricultural sector, which is estimated at 11-15% of all GHGs, which total food system emissions account for a whopping 25% of total emissions. This challenge certainly resonates with Middle Eastern fertilizer producers since they are key suppliers of the most carbon intensive finished fertilizer product, responsible for 30 % of the seaborne urea market (based on GCC exports only).

It is also true that meeting this challenge requires a balanced approach in order to avoid counterproductive consequences. In recent years, the industry has come under fire for its environmental footprint not just from environmental groups, but crucially from regulators in key regions such as the European Union, where calls for an outright reduction in fertilizer application has been translated in region-wide targets (e.g. the EU Farm-to-Fork strategy).

In this context, it is always useful to note that inorganic fertilizers are estimated to enable around half of all agricultural output globally. Therefore, while reducing the carbon footprint of fertilizer use is certainly desirable,

their use remains crucial to ensuring food security. When Sri Lanka imposed a ban on inorganic fertilizers in 2021, it quickly triggered a collapse in crop yields, higher food prices, and a greater dependency on food imports. Furthermore, the efficient use of finite land resources requires a careful management of agricultural yields to minimize land-use change which would lead to further carbon emissions.

We do know that the fertilizer industry, and in particular the nitrogen fertilizer industry, is proactively looking to reduce its carbon footprint and improve its sustainability.

It has two major challenges: to reduce the greenhouse gas emissions associated with ammonia production, which amount to around 1.5-2% of all human-caused net GHGs according to multiple sources, and to reduce further emissions associated with actual mineral fertilizer use (in the form of CO₂, but more importantly nitrous oxides), which account for a further 2% of global emissions according to a study published by IFA and Systemiq in 2022.

The solutions that are being considered to address Scope 1, 2, and 3 emissions in the fertilizer industry can be broadly summarized in the below categories.

Currently, a lot of the industry efforts seem to be concentrated on reducing the carbon footprint of ammonia production. The interest in low or zero-carbon ammonia supply is in part (or primarily) driven by the promise of a theoretical future boom in demand for ammonia



for novel applications, such as marine fuels, power generation, and as a hydrogen carrier. However, focusing solely on this solution leads to some issues specific to the fertilizer industry, such as the challenge of using low-carbon ammonia for the production of urea, which currently accounts for over 50% of all nitrogen application globally. Since the CO₂ embedded in urea is fully released into the atmosphere upon application, the only way to produce a carbon-neutral urea molecule would be to use a biogenic source of CO₂ (e.g. biomass) or direct air capture, with obvious cost and supply challenges.

There are several products that could be decarbonized with low-carbon ammonia as a raw material, such as nitrates, but also ammonium phosphates and synthetic ammonium sulphate. AN/CAN in particular offer the opportunity to produce a fully carbon-free fertilizer product, but the challenge is that nitrates production and consumption are concentrated in Europe (as shown in Chart 1 below), while they are heavily regulated elsewhere due to the risk of explosions associated with AN in particular.

Nitrates’ suitability for the reduction of Scope 1 emissions and the geographical scope of their application is a good match for Europe’s goal to decarbonize not just its domestic fertilizer industry, but to force the decarbonization of all imported nitrogen fertilizers as well. The European Union has put in place a number of industry-specific measures to drive the decarbonization of the sector, ranging from the EU’s Renewable Energy Directive (REDIII)

Emissions reduction in the fertilizer industry (scope/measures)	Potential measure	Sustainable/low-carbon product type
Production (Scope 1, 2)	Reduce the carbon footprint of production, primarily of nitrogen	Zero or low carbon ammonia-based fertilizers
	Use/commercialize by-products and waste products which contain plant nutrients	Organic and organo-mineral fertilizers
Application (Scope 3)	Norwegian EV Incentive Program, Hydropower Certification, Climate Neutral Norway 2050	- Fertilizers containing secondary nutrients and micronutrients (S, Zn, Ca, Fe etc) - Water soluble fertilizers - Complementary and related products – biostimulants, microbials etc
	Reduce scope 3 emissions from nitrogen application, improve NUE	Enhanced efficiency fertilizers (coatings, inhibitors, etc.)

Source: Argus Media



to the Carbon Border Adjustment Mechanism (CBAM), and the aforementioned Farm-to-Fork strategy.

The considerations above however limit the scope of application of low-carbon ammonia both product- and region-wise, and could potentially create a challenge for the Middle Eastern nitrogen fertilizer industry given that it is almost exclusively urea-based, and heavily export-oriented. The silver lining is that currently Middle Eastern producers mostly supply urea to a number of countries that (speculatively) are unlikely to implement far-reaching, industry-specific emissions regulations affecting the fertilizer industry anytime soon, based on the trade matrix presented in Chart 2 below. We could speculate however that some of the current destination markets, such as the US and Australia will gradually adopt measures to incentivise either the use of low-carbon fertilizers, but also the use of enhanced-efficiency fertilizers.

The Middle East region's nitrogen fertilizer industry does have several options to offer a

more sustainable product portfolio, in addition to reducing production emissions, such as nitrogen products containing micronutrients, but also enhanced-efficiency urea. These solutions would tackle application (Scope 3) emissions rather than production emissions. In this category we find for instance stabilized urea. The usage of inhibitors to produce a more efficient urea product has clear demand potential driven by regulations, especially in the EU, where in some countries like Germany and Poland local regulators have mandated the use of inhibitors with urea. The main issue however is that inhibitors are typically applied at destination ports or further down the value chain, due to the fact that these compounds break down over time and will no longer be effective. This poses a technical challenge for export-oriented producers in the Middle East (unless inhibitors are introduced during the urea production as part of the granule, which might pose other technical challenges).

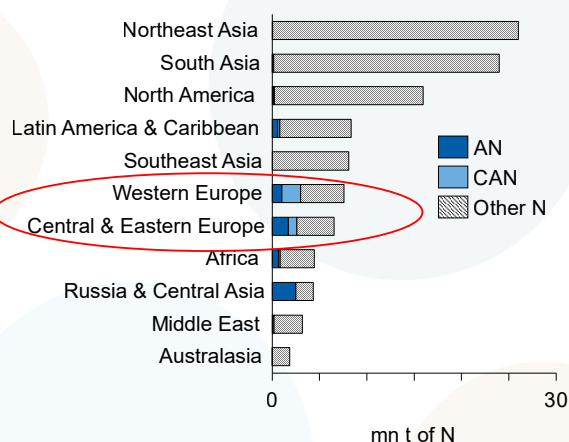
Coated urea (controlled/slow-release) is also attracting growing interest as well as awareness about their potential role in limiting

the environmental impact of nitrogen fertilizers. This solution could provide an ideal seaborne, premium product for Middle Eastern urea producers, but it is not without issues. In particular, polymer-coated urea prospects are limited by potential environmental regulations that will target the polymer residue left by these products. Biodegradable options, although potentially a game changer, are not currently viable on an economic scale.

In summary, the challenge posed by the decarbonization of the fertilizer industry, in particular nitrogen fertilizers, is very complex. Fertilizer producers in the Middle East will likely be forced to adopt a mix of solutions to adapt to a rapidly changing regulatory environment in an increasing number of markets, and also to capture potential market premiums. Although it is possible that several target markets for regional producers will not follow Europe's drastic decarbonization approach, it would be a prudent commercial strategy to anticipate similar changes in many other markets over the medium to long term.

Chart 1 - N consumption by region

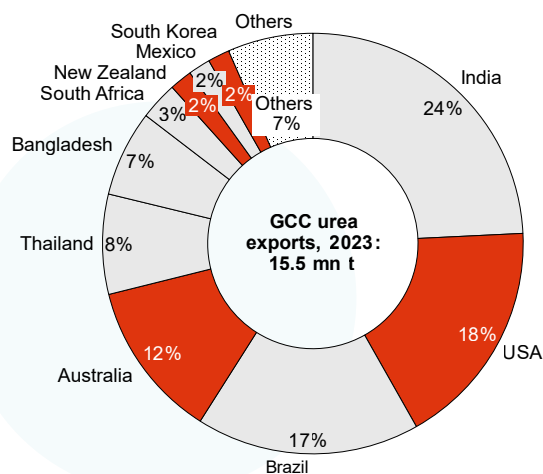
Nitrates demand vs. total N demand



Source: Argus Media

Chart 2 - Urea exports from GCC

Urea exports from GCC producers, by destination



Risk of fertilizers emissions regulations

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