CLIMATE ANALYTICS

Decarbonising the chemical industry in Albania, Bosnia and Herzegovina and Serbia

December 2025

Author

Dr Kim Coetzee

Contributors

Ani Ahmetaj (REC, Albania), Melina Kalem (REIC, Bosnia and Herzegovina) and Ksenija Todorović (RERI, Serbia)

Reviewers

Dr Abhinav Bhaskar, Claudio Forner

About Climate Analytics

Climate Analytics is a global climate science and policy institute. Our mission is to deliver cutting-edge science, analysis and support to accelerate climate action and keep warming below 1.5°C.

Acknowledgments

The authors would like to thank the industry experts who participated in the interview process and contributed their perspective to this report.

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How to cite: Climate Analytics (2025). Decarbonising chemical industry in Albania, Bosnia and Herzegovina and Serbia

Supported by

This project is part of the European Climate Initiative (EUKI). EUKI is a project financing instrument by the German Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety (BMUKN). The EUKI competition for project ideas is implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. It is the overarching goal of the EUKI to foster climate cooperation within the European Union (EU) in order to mitigate greenhouse gas emissions.

Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety

European Climate Initiative EUKI

The EU's Carbon Border Adjustment Mechanism (CBAM) will come into full effect in January 2026. The CBAM ensures that the carbon price of imports to the EU is equivalent to the carbon price of domestically produced products, thereby maintaining fair competition as EU companies transition to low carbon production. By placing a tax on the carbon content of imports the CBAM is expected to reduce carbon leakage and support EU decarbonisation while potentially incentivising producers outside of the EU to decarbonise and to improve the competitiveness of their products on the EU market.

This report is part of a four-part series analysing the impact and opportunities of CBAM for Albania, Bosnia and Herzegovina and Serbia and what this means for their emissions-intensive electricity, steel, cement, and chemicals sectors.

Chemical industry products underpin virtually every aspect of modern economies, providing essential materials or inputs for agriculture, manufacturing, infrastructure, healthcare and consumer goods. These industries are also responsible for 6% of global emissions. The sector's emissions profile is further complicated by its role in downstream applications. Chemical products often generate additional emissions when they are used and disposed of, contributing to Scope 3 emissions.

The direct impact of CBAM on Albania's chemical exports will be limited initially due to the sector's small size and limited in-scope exports. However, as CBAM expands to cover more chemical products, even small-volume exporters like Albania will eventually be affected. While Bosnia and Herzegovina has developed strategies for just transition in several of its carbon-intensive industries, including energy, steel, and cement, the chemical industry is not yet a primary focus. Serbia's more complex chemical industry has a high carbon intensity due to the dominance of coal in national electricity generation mix and has undergone a number of changes since 1990.

Globally, there are five main technologies for decarbonising the chemical industry:

- Electrification of heat and processes – replacing fossil combustion for heating with electric boilers, heat pumps, or plasma/electrochemical systems.
- Use of renewable feedstocks – including bio-based inputs (e.g., bioethanol, lignin-derived tonics), CO_2-derived intermediates, and waste plastics as circular carbon sources
- Energy efficiency and digitalisation – process optimisation, waste heat recovery, and AI-based operational controls
- Hydrogen as a fuel and feedstock – replacing fossil hydrogen used in ammonia, methanol, and refinery processes with green hydrogen produced via renewable electrolysis

- Carbon capture, utilisation and storage (CCS) – capturing CO_2 from high-purity streams for reuse or sequestration.

The core challenges of decarbonising the chemicals industry include:

- Dependence on fossil carbon as feedstock: This 'embedded carbon' is difficult to substitute with renewable or recycled alternatives at scale

- High-temperature process energy requirements: Electrification, while promising, is only viable for processes needing temperatures of below 150°C, and many require 800-1000°C.

- Capital intensity and long project lifespans: chemical production facilities typically operate for lifespans of 30–50 years. Retrofitting for electric heating, carbon capture, or green hydrogen, demands significant investment and long-term regulatory certainty – as well as potential disruptions to complex supply chains and employment.

- Product and process diversity: The sector produces over 70,000 products with diverse process requirements, making a "one-size-fits-all" decarbonisation strategy unlikely

- Technology readiness and infrastructure: green hydrogen and capture, utilisation, and storage (CCS) are not ready to be integrated into chemical industry at scale.

In Albania, Bosnia and Herzegovina, and Serbia - countries with transitional energy systems and developing industrial bases - the chemicals sector, though small, could be strategically and economically important for their economies. Moving away from their continued reliance on fossil fuels as energy source and feedstock would allow for fewer barriers to their exports to the EU market.

This report is part of a four-part series analysing the impact and opportunities of CBAM for Albania, Bosnia and Herzegovina and Serbia and what this means for their emissions-intensive **electricity, steel, cement**, and **chemicals** sectors. This report explores the impact of the CBAM on the three countries' chemical sectors (specifically in-scope fertiliser components) and what approaches they can take to decarbonise and mitigate the financial impacts from the introduction of the CBAM.

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Introduction

As signatories to the Paris Agreement, the European Union (EU), Albania, Bosnia and Herzegovina, and Serbia committed to limiting global warming to “well below 2°C” and “pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels”. Achieving decarbonisation goals in line with the Paris Agreement necessitates deep emission cuts across all sectors.

In 2021, emissions from the chemicals and petrochemicals sector were ±6%[1] of total global GHG emissions. This sector’s products underpin virtually every aspect of modern economies, providing essential materials or inputs for agriculture, manufacturing, infrastructure, medicines and health equipment, and a myriad of consumer goods.[2]

These emissions stem from two sources, namely emissions from the actual production and processing of chemicals which are categorised as Industrial Processes and Product Use Sector (IPPU) or ‘non-energy’ sector emissions, as well as indirect emissions from energy used in the processing, transportation etc.[3] Achieving carbon neutrality across industry as a whole is necessary to achieve the Paris Agreement’s goal to limit warming to 1.5°C, and heavily carbon-intensive industries such as chemicals thus play a critical role in minimising global GHG emissions. It is in this context that the EU introduced the Carbon Border Adjustment Mechanism (CBAM).

The CBAM is a fundamental shift for exporters of carbon intensive products to the EU market. The mechanism is designed to equalise production costs between domestic producers, who are subject to the EU’s Emissions Trading System (ETS), and international producers in jurisdictions subject to lower or no carbon. The CBAM requires the estimation of the embedded carbon of a traded good, the reporting thereof, and then taxes that carbon in order to raise the cost of carbon-intensive imports. In so doing, the CBAM shifts the financial calculus for importers, where high-carbon products become relatively more expensive to import and lower-carbon products (the intended outcome of the ETS) become relatively less expensive. When the CBAM is fully implemented in 2026, producers of lower carbon products will see a relative advantage.

The three countries in this project all export goods to the EU and will thus be affected. This report is part of a series exploring the impacts of the CBAM on carbon-intensive industries – namely **electricity, cement, steel** and **chemicals –** in Albania, Bosnia and Herzegovina (hereinafter BiH) and Serbia.

[1] Energy-related GHG emissions from electricity and heat of 2.3%; from manufacturing & construction of 1.5% and non-energy emissions from industrial processes of 2.2% of total global GHG emissions.
[2] Science Based Targets Initiative and Guidehouse, *Science Based Target Setting in the Chemicals Sector: Status Report*; International Energy Agency, ‘Chemicals’.
[3] Climate Watch, ‘Climatewatch’.

To do so, we first discuss the complexity of the sector, then the fundamental challenges of decarbonising the sector internationally, before broadly describing the state of the sector in each of the three countries. Given the extraordinarily diverse array of products in this sector, and the inability to cover them all within the scope of this report, **we focus on ammonia production as an important case study**. Finally, we present a number of strategies to shift the market towards decarbonisation, based on research and interviews with industry stakeholders in the target countries.

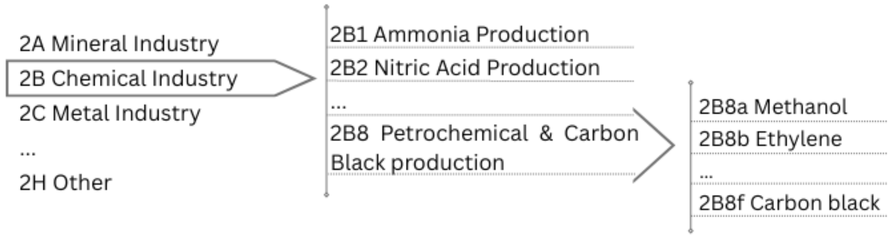
The complexity of the chemicals industry internationally

The chemicals industry (here defined according to the IPCC's GHG inventory categorisation[4]) produces an extraordinarily diverse array of products that have become interwoven with and intrinsic to our modern way of life, producing everything from household cleaners to Personal Protective Equipment in healthcare settings, bicycle tyres, to clothing and fertilisers.[5]

Today's chemicals industry is a by-product of the oil and gas extraction and refinement. The production of chemicals is almost exclusively fossil-based and annually absorbs around 14% of oil and 8% of gas production globally.[6]

Emissions are produced not only when fossil fuels are chemically or physically transformed through steam cracking, reforming, and gasification (for example, CO_2 can be emitted during the production of ammonia) but also when the fossil fuels used to power those transformations are burned to create the high temperatures required for these chemical or physical processes.[7] In short, fossil fuels are both the feedstock and the fuel for the transformation processes of those feedstocks. An estimated 58-70% of fossil fuel inputs are used as feedstock, while the remainder provides the energy needed for processing.[8]

[4] IPPU emissions disaggregated according to IPCC 2006 guidelines - some categories omitted due to space constraints.



[5] Hermanns et al., *Pathways for the Global Chemical Industry to Climate Neutrality*.
[6] SYSTEMIQ et al., *Planet Positive Chemicals. Pathways for the Chemical Industry to Enable a Sustainable Global Economy*.
[7] Michel et al., *Decarbonizing Chemicals Part One: Sectorwide Challenges Will Intensify Beyond 2030*.
[8] Mallapragada et al., 'Decarbonization of the Chemical Industry through Electrification: Barriers and Opportunities'.

Typically, the chemicals value chain is divided into three categories described below[9] and depicted in Figure 1.

- **Primary** (upstream) chemicals – often referred to as basic or base chemicals, are derived directly from oil, natural gas or (less frequently) coal and serve as raw materials for more complex chemistry and numerous downstream industries. These include ammonia, methanol, olefins and aromatics. Emissions from manufacturing base chemicals are mainly from direct process emissions i.e. generated as a byproduct of the chemical reaction itself.

- **Intermediate** (midstream) chemicals – such as benzene, ethylene, polyethylene, polypropylene, and acrylonitrile-butadiene-styrene resins (ABS), formed through polymerisation or chemical reactions (combinations) of base chemicals. Most often processed further into end-use products, though are occasionally used in their intermediate form.

- **Specialty or end-use** (downstream) chemicals – used in the manufacture of pharmaceuticals, solvents, paints, coatings, fertilisers, and detergents. Can be used on their own (e.g. plastic bottles or fertiliser) or as part of a more complex product (e.g. cosmetics, fragrances and flavourings).

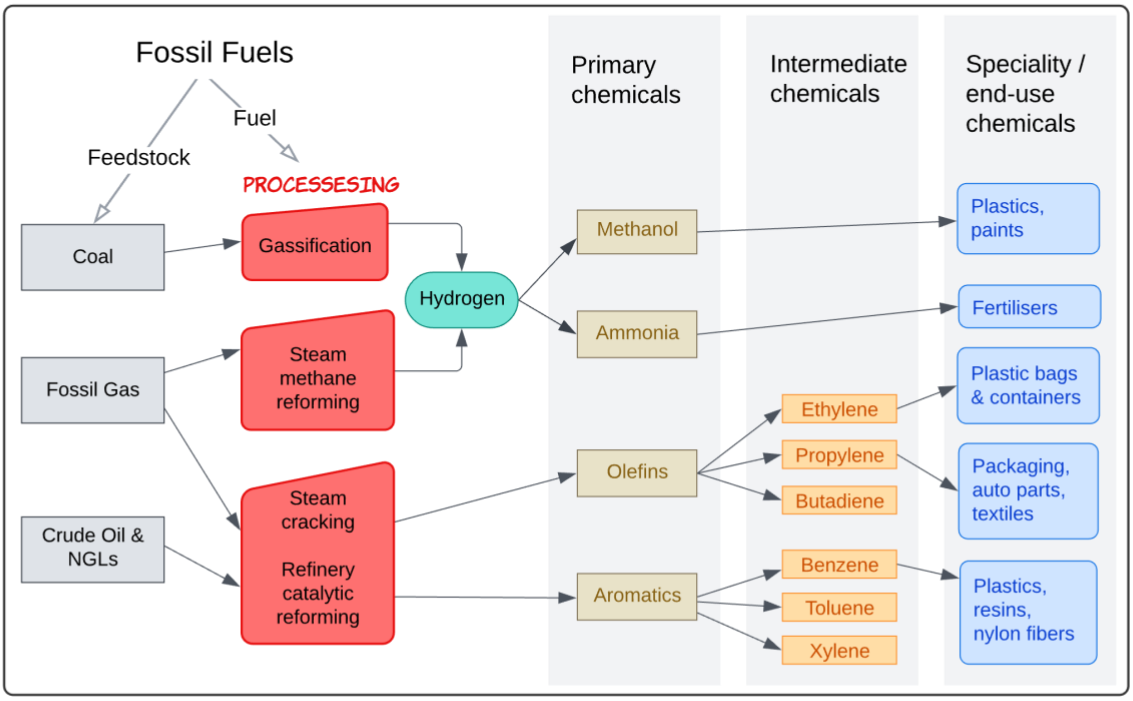


Figure 1: Fossil fuels in the chemicals value chain
Source: various, including Huyett et al., 2025 and the American Fuel & Petrochemical Manufacturers website

The sector's emissions profile is further complicated by its role in downstream use and applications. Chemical products often generate additional emissions when they are used

[9] Ashrafkhanov et al., *Petrochemical Imbalance. Why Chemicals Are Unlikely to Prop up Oil Demand.*; Hermanns et al., *Pathways for the Global Chemical Industry to Climate Neutrality*.

and then disposed of, contributing to what are termed 'downstream Scope 3 emissions' (as discussed in the electricity report in this series)[10] across multiple industries. [11] This will be elaborated upon further in reference to specific products in the country sections below.

From about the middle of the 20th Century, the benefits delivered by the products it produced, combined with the increasing affordability of fossil fuel feedstocks (i.e. the raw material) has accelerated more growth in this industry than experienced by any other resource sector of comparable size.[12] For instance, demand for plastics - an end use product of petrochemicals - almost doubled between 2000 to 2018.[13]

The Challenges of Decarbonising the Chemical Sector

The carbon-intensive sectors - in this series, cement, steel and chemicals – all face significant challenges to decarbonise, however, the decarbonisation of the chemicals industry poses distinct technical, economic, and infrastructural challenges, elaborated upon below. Limitations or obstacles to the decarbonisation alternative are also discussed.

Depending on the chemical, the **energy**-related emissions (from creating heat) can range between 15% and 56% of the overall energy use, and depending on the feedstock and the specific chemical being processed, the 'non-energy' **process** emissions can represent between 48% and 85% of overall emissions produced.[14] The multiplicity of intermediate and final products that comprise this sector renders it challenging to calculate precise life-cycle emissions for each product.

For this report we concentrate on the chemical sector products in-scope of the CBAM and produced by Albania, BiH and Serbia. According to the EU regulations establishing the CBAM this is fertilisers (Annex I) and hydrogen (Annex II).[15] More discussion on this in the CBAM & chemicals section below. **As there is currently minimal hydrogen production, and then only in Serbia, we will focus on fertilisers by unpacking the ammonia production process and the challenges of decarbonising it. Worldwide, 80% of the world's ammonia production is used to create fertilisers,[16] and ammonia is an essential component of all synthetic nitrogen fertilisers which are exported from Albania, BiH and Serbia, to the EU.**

[10] Climate Analytics (2025). Decarbonising electricity in Albania, Bosnia and Herzegovina and Serbia, https://climateanalytics.org/publications/decarbonising-electricity-cement-iron-and-steel-and-chemicals-in-albania-bosnia-and-herzegovina-and-serbia
[11] Siemens Ltd., 'Decarbonising Practices in the Global Chemical Industry'.
[12] Levi and Cullen, 'Mapping Global Flows of Chemicals'.
[13] Levi, 'Petrochemicals Today. Various Roles in Society, the Energy System and the Environment.'
[14] Fitzner et al., 'Sustainable Chemicals Pathways'.
[15] European Commission, 'Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023 Establishing a Carbon Border Adjustment Mechanism (Text with EEA Relevance)'.
[16] Bazzanella and Ausfelder, *Low Carbon Energy and Feedstock for the European Chemical Industry*.

The Hydrogen - Ammonia production process

Understanding options to decarbonise the fertiliser industry, requires unpacking the different ways ammonia (NH_3) is produced to identify the points along the fertiliser production value chain where greenhouse gases are emitted. The broad steps of the process are outlined in Figure 2.

Figure 2: the high-level steps to producing fertiliser

Hydrogen is colour-coded according to the feedstock used to make it; thus, grey hydrogen is made from fossil gas, brown (sometimes called 'black') from coal, and green is from renewable energy. The same colour-coding applies to the ammonia produced from it, hence grey ammonia, green ammonia, etc. This is tabulated in Table 1 and includes a range of approximate emission intensities drawn from literature. Precise intensities will depend on the fuel used (and the quality thereof) and the efficiency of individual plants. The vast majority of ammonia produced worldwide is grey ammonia, therefore the process will be unpacked in some detail after the brief descriptions of each of the other colours of hydrogen/ammonia.

Table 1: Most common types/colours of hydrogen and ammonia
Source: Author based on several authors[17]

	Feedstock	H_2 production process	H_2 emissions intensity [18]	NH_3 production process	NH_3 emissions intensity[19]
Grey	Fossil gas	SMR	12–13.5 kg CO_{2eq} /kg H_2		1.6 to 1.8 tCO_2 /tNH_3
Brown	Coal	Coal gasification	18 - 25kg CO_{2eq} /kg H_2		2.4 - 3.2 tCO_2 /tNH_3
Blue	Fossil gas with carbon capture	SMR + CCS	7.6 – 9.3kg CO_{2eq} /kg H_2[20]	Carbon captured & used	0.1 – 0.6 tCO_2 /tNH_3 depending on capture rate
Turquoise	Methane + renewable	Pyrolysis (aka methane cracking)	3.9 – 8.3kg CO_{2eq} /kg H_2[21]	Carbon captured & stored as a solid	0.1–0.2 tCO_2 /tNH_3
Green	H_2O & RE	Electrolysis of water	2.9 – 7.2kg CO_{2eq} /kg H_2 [22]		Theoretically 0 tCO_2/tNH_3 [23]

[17] Roy et al., 'Comparative Techno-Environmental Analysis of Grey, Blue, Green/Yellow and Pale-Blue Hydrogen Production'; Kumar et al., 'Green, Blue, and Turquoise Hydrogen'; Ausfelder et al., *Perspective Europe 2030*.
[18] Roy et al., 'Comparative Techno-Environmental Analysis of Grey, Blue, Green/Yellow and Pale-Blue Hydrogen Production'.
[19] Hatzell, 'The Colors of Ammonia'.
[20] Patel et al., 'Climate Change Performance of Hydrogen Production Based on Life Cycle Assessment'.
[21] Patel et al., 'Climate Change Performance of Hydrogen Production Based on Life Cycle Assessment'.
[22] Range dependent on efficiency of RE technology used
[23] Dependent on emissions intensity of the electricity

The production of **grey and blue hydrogen** begin with using fossil gas as the feedstock – the distinction lies in the treatment of the process CO_2 generated. Whereas the CO_2 produced during the process is vented to the atmosphere during the production of grey hydrogen, the **blue hydrogen** process includes carbon capture and storage (CCS) to trap CO_2 emissions. Captured CO_2 is either stored underground permanently or repurposed industrially. CCS only delays atmospheric release and doesn't significantly reduce overall emissions, and when used industrially, those process CO_2 emissions - for instance in an integrated ammonia/urea plant – are released into the air when the urea is used on the crops.[24]

Current CCS technology falls short of what blue hydrogen needs to achieve meaningful climate benefits. Even optimally designed facilities capture only about two-thirds of total emissions. Beyond the process emissions, there is also upstream and downstream methane leakage from the extraction, transportation, and processing of fossil gas.[25]

Turquoise hydrogen is produced from methane pyrolysis (or methane splitting) and can be fed directly into Haber-Bosch loop thereby avoiding process CO_2 and eliminating the need for CO_2 capture and producing solid carbon as by-product, which can be used in for other industrial purposes like the tyre industry.[26] This carbon is only sequestered if the end-product is not combusted/burned during, or at the end of its lifetime. Where the solid carbon is burned, the indirect emissions of the turquoise ammonia route are similar to grey ammonia.[27] This has emerged as an option that can leverage existing gas infrastructure.[28]

In contrast to these, green ammonia is produced from hydrogen created through electrolysis of water (wherein H_2O is decomposed into hydrogen and oxygen). Where green ammonia is economically feasible, deploying it would allow for the emission intensity of ammonia to theoretically decrease toward 0 tCO_2/tNH_3. However, if the electrolysis process is connected to the grid, the emission intensity of the grid would need to drop substantially. Currently limited by high electricity demand, the cost, and intermittency of renewable electricity, which affect overall efficiency and scalability.[29]

More than 95% of ammonia worldwide is made from fossil feedstock i.e. is grey ammonia, and as this is what is produced in BiH and Serbia, it is elaborated upon below.

Grey hydrogen and grey ammonia

Grey ammonia refers to ammonia produced in a high-emissions process called steam methane reforming (SMR) which begins with fossil gas (methane) and generates a

[24] Philiber, 'Methane Splitting and Turquoise Ammonia'.
[25] Howarth and Jacobson, 'How Green Is Blue Hydrogen?'; Riaz et al., *Transforming India's Fertiliser Production with Green Ammonia*.
[26] Ishaq et al., 'Low-Carbon Ammonia Production via Methane Pyrolysis'; Böck, 'The Problem with Turquoise Hydrogen Made from Fossil Gas'.
[27] International Energy Agency, *Ammonia Technology Roadmap*.
[28] Ishaq et al., 'Low-Carbon Ammonia Production via Methane Pyrolysis'.
[29] Ishaq et al., 'Low-Carbon Ammonia Production via Methane Pyrolysis'.

significant amount of CO_2 as a direct by-product which is simply vented into the atmosphere.[30]

In this process ammonia is synthesized at industrial scale by reacting hydrogen with nitrogen in a multi-stage process - via steam methane reforming (SMR), water-gas shift reaction, and the Haber–Bosch process as seen in Figure 3 below. [31] The nitrogen needed is captured from the air through liquid air distillation or an oxidative process where air is burnt and the residual nitrogen is recovered.

In the steam methane reforming (SMR) part of the process (indicated by the rectangles in the figure) the hydrocarbon / fossil fuel feedstock in converted into syngas (a combination of hydrogen, carbon monoxide and CO_2) in multiple steps and at the very high temperatures to bring about the chemical reactions needed. The GHG emissions in this stage are largely carbon dioxide (CO_2) emissions.

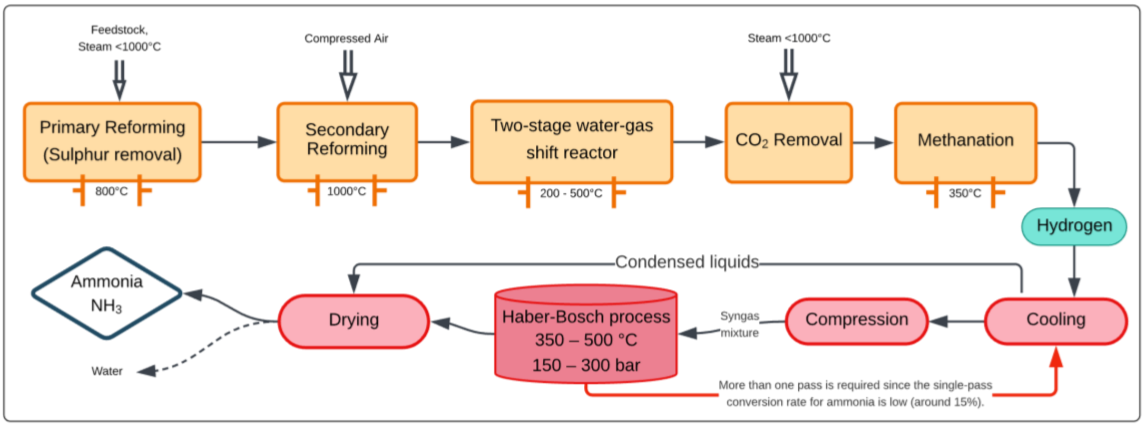


Figure 3: Ammonia production process.
Source: Author, based on Liu et. al, 2020; The Royal Society, 2020 and Riaz, 2025.

Globally, the demand from industry for hydrogen increased almost 3% year-on-year to 55 Mt in 2024, with approximately 60% of the hydrogen produced used to produce ammonia – and with this use case rising 3.4% from 2023.[32] Unabated fossil fuel use to produce hydrogen generated approximately 980 Mt CO_2 in 2024 (up 3% on 2023).[33]

While ammonia itself is not a GHG, its use, release into the air and deposit in soil and water can lead to the conversion of it to nitrous oxide and nitrogen dioxide (collectively referred to as NO_x).[34]

[30] Riaz et al., *Transforming India's Fertiliser Production with Green Ammonia*.
[31] Liu et al., 'Life Cycle Energy Use and Greenhouse Gas Emissions of Ammonia Production from Renewable Resources and Industrial By-Products'.
[32] International Energy Agency, *Global Hydrogen Review 2025*, 48.
[33] International Energy Agency, *Global Hydrogen Review 2025*, 81.
[34] Slanger, 'Clean Energy 101'; The Royal Society, *Ammonia*.

High-level challenges for the chemicals sector

Dependence on fossil carbon as feedstock

Unlike in sectors like power generation or transport, chemicals effectively incorporate fossil carbon directly into the end products (e.g., plastics, fertilisers) because they begin with a fossil fuel feedstock as pictured in Figure 3 above. This so-called 'embedded carbon' is difficult to substitute with renewable or recycled alternatives at scale without novel feedstocks (biomass, CO_2, waste plastics) and complex infrastructure changes.[35] This constraint has led some writers to propose framing it as "defossilisation"– replacing fossil carbon with renewable or recycled alternatives – instead of decarbonisation – aiming to achieve net-zero emissions.[36]

As global pressure to decarbonise industries becomes more pronounced, the chemicals industry looks to decarbonising hydrogen production (essential to ammonia and methanol production) and searching for lower-carbon, bio-based and recycled carbon sources – like biomass and plastic waste –as alternative feedstocks.[37] Given that the same pressures also apply to the transport, cement and steel sectors, the chemicals industry faces competing demands for these alternative feedstocks.[38] Care would also need to be taken to ensure use of biomass as a feedstock does not compete with its potential use as food is limited.[39]

High-temperature process energy requirements

Many essential reactions and processes require extremely high temperatures, traditionally supplied by energy-dense fossil fuels, although this varies substantially across different types of chemical production. High temperatures – around 800°C and above – are particularly necessary in the early stages of the production of base chemicals, for e.g., steam cracking for olefins, ethane crackers and steam methane reformers for (grey, blue) ammonia production.[40]

Electrolysis – the splitting of H_2O, producing so-called green hydrogen – creates a route to fully electrified ammonia production, but requires much more electricity per tonne of ammonia produced than other colours of ammonia. The vast proportion of electricity (95%) is used for hydrogen production, with the remaining 5% used to power the remainer of the process. Furthermore, given this heavy reliance on electricity, and as

[35] Kochenburger et al., 'Fine Chemicals Production in a Carbon-Neutral Economy'; Malehmirchegini and Chapman, 'Strategies for Achieving Carbon Neutrality within the Chemical Industry'.
[36] Gabrielli et al., 'Net-Zero Emissions Chemical Industry in a World of Limited Resources'; The Royal Society, *Catalysing Change: Defossilising the Chemical Industry*.
[37] Huyett et al., 'Chemistry in Transition'.
[38] Gabrielli et al., 'Net-Zero Emissions Chemical Industry in a World of Limited Resources'; The Royal Society, *Catalysing Change: Defossilising the Chemical Industry*.
[39] Agrawal and Siirola, 'Decarbonization of Chemical Process Industries via Electrification'.
[40] Michel et al., *Decarbonizing Chemicals Part One: Sectorwide Challenges Will Intensify Beyond 2030*; Agrawal and Siirola, 'Decarbonization of Chemical Process Industries via Electrification'.

indicated in Table 1 above, the emissions intensity of green ammonia is dependent on the CO_2 intensity of the grid electricity.[41]

More generally, electrification, while promising, is only viable for some processes requiring temperatures of below 150°C, and challenges remain in achieving the necessary temperature ranges efficiently and economically.[42] Successful electrification also requires accelerated deployment of new renewable electricity generation capacity and upgrading or building of new transmission grids to transfer power to chemical production sites.

Additionally, electrification may require the adaptation of chemical processes to manage the fluctuations in renewable energy supply – and the development of better energy storage solutions for both energy and chemical intermediates.[43] These improvements would facilitate a more stable and sustainable transition to electrified chemical production.[44]

Capital intensity and long project lifespans

Chemical production facilities typically operate for lifespans of 30–50 years. Retrofitting for electric heating, carbon capture, or green hydrogen, demands significant investment and long-term regulatory certainty – as well as potential disruptions to complex supply chains and employment.[45] The lifespan and massive investment costs for chemical infrastructure, together create high path dependency and historical lock-in, limit opportunities and incentives for green innovation.[46]

Technology readiness and infrastructure

To integrate into existing systems, carbon capture, utilisation, and storage (CCS) and green hydrogen technologies require regional transport and storage networks. These are currently underdeveloped in most regions, and the Balkans is no exception.[47] Many such breakthrough technologies remain between Technology Readiness Levels (TRL) 3–7, making implementation of these solutions currently economically untenable in most situations and not ready to be scaled up.[48]

[41] International Energy Agency, *Ammonia Technology Roadmap*. Accordingly the intensity of the grid must be 180 g CO_2/kWh or less whereas the current global average is 475 g CO_2/kWh
[42] Agrawal and Siirola, 'Decarbonization of Chemical Process Industries via Electrification'; Malehmirchegini and Chapman, 'Strategies for Achieving Carbon Neutrality within the Chemical Industry'.
[43] International Energy Agency, *Ammonia Technology Roadmap*.
[44] Bauer et al., 'Mapping GHG Emissions and Prospects for Renewable Energy in the Chemical Industry'.
[45] Kochenburger et al., 'Fine Chemicals Production in a Carbon-Neutral Economy'; Kurias et al., *Decarbonizing Chemicals Part Two: The Credit Risks and Mitigants*.
[46] Bauer et al., 'Mapping GHG Emissions and Prospects for Renewable Energy in the Chemical Industry'.
[47] Kochenburger et al., 'Fine Chemicals Production in a Carbon-Neutral Economy'; Kurias et al., *Decarbonizing Chemicals Part Two: The Credit Risks and Mitigants*.
[48] Huyett et al., 'Chemistry in Transition'; Malehmirchegini and Chapman, 'Strategies for Achieving Carbon Neutrality within the Chemical Industry'.

The sector's complexity, as well as the range of opinions and largely untested nature of many abatement measures (like the use of 'green' hydrogen), reflects the current patchy state of the policy and regulatory frameworks.[49]

Product and process diversity

The sector produces over 70,000 products with diverse process requirements, making a "one-size-fits-all" decarbonisation strategy unlikely.[50] Each plant and product may require bespoke solutions, undermining any potential cost-savings available from scaling-up and rolling out solutions. The complexity of the task will require downtime in the plants as they are retooled, create additional technical risks and therefore substantially increase the costs.[51]

In addition, the chemical products that produce the highest carbon emissions are typically mass-volume commodities that generate relatively low profits. This reduces the incentive for companies to invest in innovative technologies or processes to reduce their carbon footprint.[52] Conversely, substituting 'grey' (fossil fuel produced) hydrogen, ammonia or methanol with 'green' (produced using renewables) could potentially decarbonise hundreds or even thousands of products at once.

[49] Kurias et al., *Decarbonizing Chemicals Part Two: The Credit Risks and Mitigants*.
[50] Segovia-Hernández et al., 'Electrification in the Chemical Industry and Its Role in Achieving Carbon Neutrality'; The Royal Society, *Catalysing Change: Defossilising the Chemical Industry*.
[51] Kurias et al., *Decarbonizing Chemicals Part Two: The Credit Risks and Mitigants*.
[52] Mallapragada et al., 'Decarbonization of the Chemical Industry through Electrification: Barriers and Opportunities'.

The chemicals industry in the Western Balkans

The chemicals industry in the Western Balkans suffers from a legacy of underinvestment since the 1990s, ageing infrastructure, the small scale of many facilities, and a continued heavy reliance on and fossil-based feedstocks – mostly fossil gas and coal. These characteristics expose the industries in these countries to extra costs as the CBAM came into full force from 01 January 2026. The financial obligations under CBAM will be phased in gradually – in parallel with and proportionate to – the phaseout of free allocation under the EU ETS.

Albania's production is more modest, concentrating on fertilisers and some industrial chemicals linked to its hydrocarbon and mining sectors. BiH is historically known for its small but diversified chemical firms. It retains limited capacities in plastics, detergents and agrochemicals, and is largely dependent on imported feedstocks. Serbia's chemical industry emissions are dominated by the petrochemical and fertiliser industries, largely powered by energy generation from lignite.

The regional product mix — dominated by fertilisers, ammonia, methanol, and selected polymers — nevertheless has substantial emissions reduction potential given the right support.

CBAM & chemicals

From January 2026 EU importers of goods from Albania, BiH and Serbia must purchase and surrender CBAM certificates corresponding to the assessed embedded emissions of the commodity.

All commodity imports to the EU are coded by the exporters according to the EU's Combined Nomenclature (CN). This EU-specific coding system builds on the 4-digit codes in the International Harmonized System (HS) of trade categorisation by adding further digits to differentiate commodities subject to the CBAM.

In table 2 are the chemicals exported to the EU that are "in scope" for CBAM[53] with an overview of the years for which there is trade data. The colours are echoed in the country-exports graphs to follow.

Table 2: CN codes for "in scope" chemicals and hydrogen

			Exports to the EU from		
CN/HS Code	Description		ALB	BiH	SRB
280410	Hydrogen	(red)	N	N	Y (2014-2024)
280800	Nitric acid; sulphonitric acids	(orange)	N	N	Intermittent (2015, 2016, 2018, 2021, 2024)
2814	Ammonia, anhydrous or in aqueous solution	(yellow)	N	N	Y (2014-2024)
283421	Nitrates of potassium	(green)	N	N	Sporadic (2021, 2024)
3102	Mineral or chemical fertilisers, nitrogenous	(blue)	Intermittent (2021)	Y (2014-2024)	Y (2014-2024)
3105	Mineral or chemical fertilisers containing two or three of the fertilising elements nitrogen, phosphorus, and potassium (excl. 3105 60 00)	(purple)	Y (2018-2024)	Y (2014-2024)	Y (2014-2024)

As mentioned earlier in the report, CBAM regulations do not cover all of the chemicals produced by Albania, BiH and Serbia. Specifically, CBAM excludes organic chemicals and polymer industries due to the technical limitations and difficulties preventing accurate calculation of products' embedded emissions.[54] In the review conducted by the European Commission on the interim phases of the CBAM (2023-2025) the following steps were outlined for the future. In 2026–2027, consideration of proposals on downstream extension, anti-circumvention rules and rules for calculating the embedded emissions of electricity, and a temporary solution to support sectors (in the EU) exposed to carbon leakage. Particularly applicable to the chemicals exported by these countries, in 2027 the Commission will consider the possibility to provide for further extensions to other downstream products and other ETS sectors such as chemicals, indirect emissions.[55]

Albania

The EU is Albania's principal trading partner, accounting for over 70% of Albania's total exports. Chemicals, however, are not a significant export for the country. In 2023, for example, Albania's **total chemical sector exports** amounted to only $83.6 million, with

[53] European Commission, 'Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023 Establishing a Carbon Border Adjustment Mechanism (Text with EEA Relevance)' Annex 1.
[54] European Commission, 'Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023 Establishing a Carbon Border Adjustment Mechanism (Text with EEA Relevance)' (paragraphs 34 & 35).
[55] European Commission, *Report from the Commission to the European Parliament and the Council on the Application of the Regulation on the Carbon Border Adjustment Mechanism*.

most exports destined for regional neighbours Serbia, Montenegro and EU members – Italy, Greece – and the USA.[56,57]

The legacy oil refining sector provides limited petrochemical feedstock potential, so Albania's chemicals production remains modest and is primarily focused on nitrogen fertilisers, bitumen derivatives, and basic industrial chemicals. The sector is so modest that, according to Albania's 2025 National GHG inventory, only when combined with emissions from the cement sector do chemicals account for around 10% of total IPPU sector emissions.[58] Opportunities for Albania's chemical sector lie in overall industrial energy efficiency improvements and leveraging the country's substantial renewable energy capacity—particularly hydropower—for cleaner, electricity-based chemical production and the development of bio-based industries linked to agriculture.[59]

Implications of CBAM for the chemicals industry in Albania

Albania's chemical sector is modest in regional terms and in 2024, chemicals accounted for only 1.5% of Albania's total exports to the EU, or EUR 36 million out of EUR 2.4 billion.[60] Chemical industry exports are focused mainly on fertilisers (notably ammonia-based, ammonia which is imported), basic inorganic chemicals (such as sodium carbonate and chlorine), and some plastics and solvents. The sector's output is largely used domestically, with limited, intermittent, but growing, exports to the EU of nitrogenous fertilisers (CN 3102) and NPK fertilisers (CN 3105) – see Figure 4.

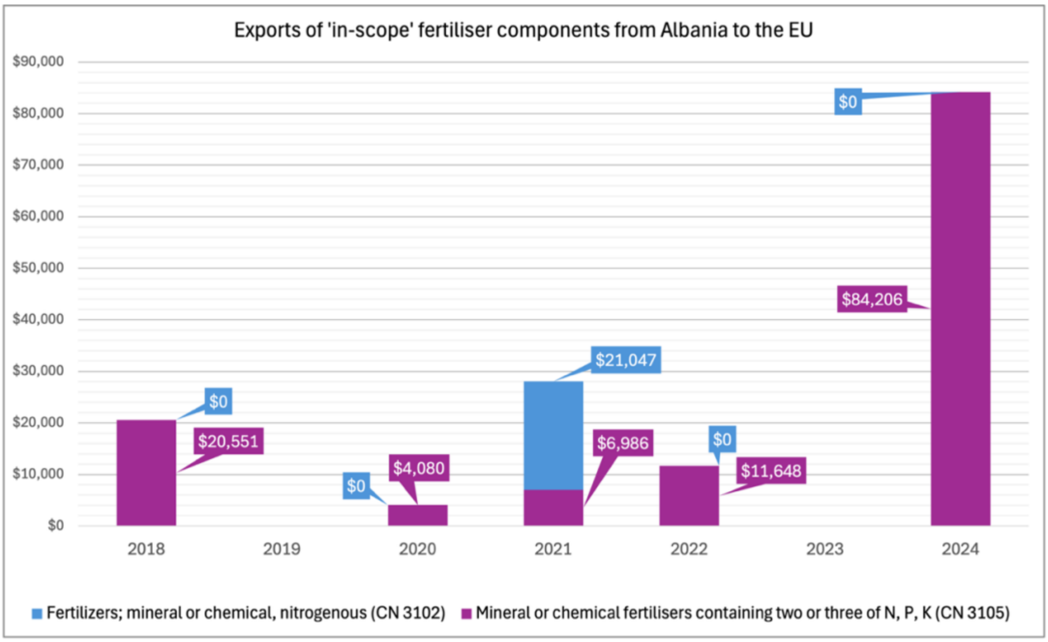


Figure 4: Fertiliser exports (in USD) from Albania to the EU.
Source: https://comtradeplus.un.org/

[56] OEC, 'Chemical Products in Albania'.
[57] Serbia (40% | $34M) and Montenegro (7% | $6M) - and EU members – Italy (17% | $14M), Greece (3.7% | $3M) – and the USA (8.6% | $7M)
[58] Republic of Albania, *First Biennial Transparency Report of the Republic of Albania under the Paris Agreement*.
[59] World Bank Group, *Albania Country Compendium*.
[60] Directorate General Trade and Economic Security, 'European Union, Trade in Goods with Albania'.

The direct impact of the CBAM on Albania's chemical sector is currently small due to limited fertiliser export volumes and their hydro-dominated electricity mix (95% renewable), which may result in lower "indirect" embedded emissions for its chemical products. Despite this renewable-rich electricity emissions, Albania lacks a domestic Emissions Trading System (ETS) or full market coupling with the EU, meaning it cannot currently offset CBAM costs through local carbon payments.

From January 2026 the fully implemented CBAM will require Albanian exporters to monitor and report GHG emissions for covered products and pay a carbon price like that faced by EU producers. This will likely erode the price competitiveness of Albanian chemical products in EU markets, particularly where production is energy- or emissions-intensive.[61]

Wider economic impacts could include reduced export revenues, potential job losses in affected sectors, and pressure on the balance of payments if Albanian products become less competitive. As the EU increases the scope of CBAM, these impacts could grow, especially if Albania seeks to expand its chemicals sector as part of industrial diversification.[62] Albania's chemical sector is less developed compared to the sectors in Serbia and Bosnia and Herzegovina, which might limit its immediate options for implementing advanced decarbonisation technologies. With external support, however, this would also present an opportunity to build new chemical production facilities with decarbonisation in mind from the outset.

Bosnia and Herzegovina

Bosnia and Herzegovina's industrial landscape includes sub-sectors such as detergents, agrochemicals, and minor polymer manufacturing – often operating with dated infrastructure. In 2023, the country's **total chemical industry exports** totalled USD 458 million, or about 7.7% of its overall exports to the EU.[63] The sector's energy and carbon intensity is high, largely due to a heavy reliance on coal-fired power, which increases indirect emissions and the carbon-intensity of its products.

Implications of CBAM for the chemicals industry in Bosnia and Herzegovina

BiH is one of the most carbon- and energy-intensive GDPs in Europe, with a carbon intensity almost three times the EU average.[64] While EUR 5.9 billion of exports to the EU in 2024 included EUR 458 million in chemicals, the sector's exposure to CBAM is less acute than for steel or cement – but this will grow as the CBAM's scope widens.[65]

[61] Risteska et al., *The EU's Carbon Border Adjustment Mechanism: Challenges and Opportunities for the Western Balkan Countries*; World Bank Group, *Albania Country Compendium*.
[62] World Bank Group, *Albania Country Compendium*.
[63] Directorate General Trade and Economic Security, 'European Union, Trade in Goods with Bosnia-Herzegovina'.
[64] World Bank Group, *Bosnia and Herzegovina Country Compendium*.
[65] Directorate General Trade and Economic Security, 'European Union, Trade in Goods with Bosnia-Herzegovina'.

The sector's output is largely used domestically, with limited exports to the EU of nitrogenous fertilisers (CN 3102) and NPK fertilisers (CN 3105).

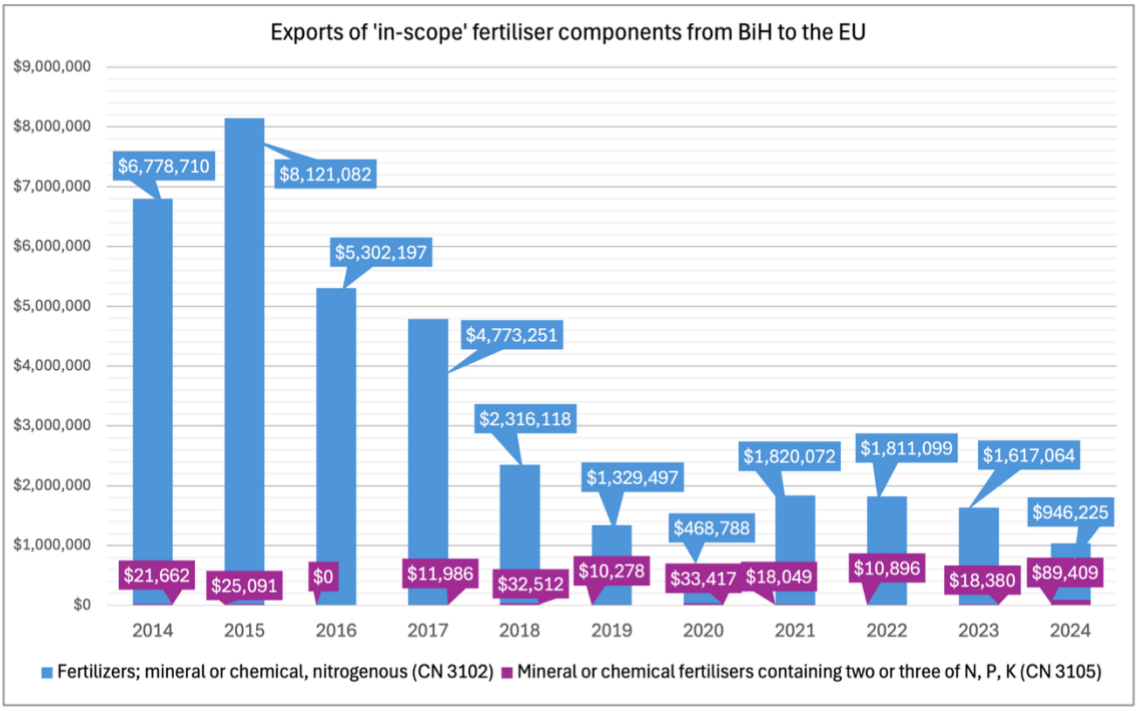


Figure 5: Nitrogenous fertiliser (CN 3102) and mixed / compound fertiliser (CN 3105) exports
Source: https://comtradeplus.un.org/

Implementation of more advanced decarbonisation technologies in the chemical industry (such as carbon capture and utilisation, or extensive electrification of processes) would require substantial investments and technological transfers, which could be challenging in the short and medium terms. The decarbonisation agenda of extensive electrification of chemical production would also reduce the influence of Russia which supplied close to 100 % of the gas needs of Bosnia as of 2022/2023.[66]

Transition strategies must prioritise energy efficiency and renewable integration to lower electricity-related carbon intensity.[67] While BiH has developed strategies for just transition in several of its carbon-intensive industries, including energy, steel, and cement, the chemical industry is not yet a primary focus.[68] The sector's competitiveness in the EU market will increasingly depend on access to cleaner energy sources and the ability to comply with CBAM's monitoring, reporting, and verification (MRV) requirements.

BiH exporters may benefit from the EU's efforts to diversify its supply of fertilisers (and component chemicals) away from Russian imports. However, until Bosnia implements a domestic carbon pricing system equivalent to the EU ETS, its exports will be subject to

[66] Staniaszek and Caprile, *Russia and the Western Balkans*.
[67] Damir et al., 'Overview of Challenges and Requirements for Sustainable Energy Transition in Western Balkans with Focus on Bosnia and Herzegovina'.
[68] Bengtsson et al., *Decarbonizing the Chemical Industry*.

the full CBAM certificate price for 100% of their embedded emissions from the beginning of January 2026 when full implementation of CBAM begins.

Serbia

Serbia leads the Western Balkan region in the production of chemicals, with substantial output centred around Pančevo and Šabac where petrochemical complexes produce ethylene, propylene high- and low-density polyethylene, ammonia-based fertilisers and other organic chemicals. The sector is inextricably linked to oil refining and gas extraction through Naftna Industrija Srbije (NIS), however, petrochemical products are not in-scope chemicals.

Serbia's **chemical** exports to the EU was 7.9% (EUR 1.5 billion) of Serbia's EUR 18.8 billion total exports to the EU in 2024.[69] The shape of the chemical industry changed between 1990 and 2023 with the closure of ammonia and nitric acid plants around 2018 leading to a considerable decrease in CO_2 and nitrous oxide (N_2O) and the reduction of flaring at refineries which decreased fugitive GHG emissions from oil and natural gas systems (down 62%).[70] These closures clearly impacted exports as can be seen in Figure 6 (the yellow labels) below.

Decarbonization in Serbia's chemicals industry will depend on electrification of cracking units, green hydrogen substitution for ammonia, and potential CCUS deployment—technological pathways highlighted in recent sector studies.[71] Furthermore, Serbia would also have to rapidly move away from burning low-quality lignite to generate electricity – which produced 670g of CO_2 /kWh in 2024, significantly more than the EU average of 187g of CO_2e /kWh[72] - and extricate itself from its over-reliance on Russian gas.[73] The carbon intensity of Serbia's exports is further driven by the indirect emissions from energy generation (Scope 2) and from suppliers' inputs (Scope 3).[74] Integration into EU carbon regulation frameworks (including CBAM) will be a decisive factor in shaping Serbia's industrial transition.[75]

Implications of CBAM for the chemicals industry in Serbia

Integration into EU carbon regulation frameworks (including CBAM) will be a decisive factor in shaping Serbia's industrial transition.[76] Serbia is better positioned than its neighbours to implement advanced decarbonisation technologies, given its more developed chemical and petrochemical infrastructure and its efforts to pursue pathways

[69] Directorate General Trade and Economic Security, 'European Union, Trade in Goods with Serbia'.
[70] Republic of Serbia, *National Greenhouse Gas Inventory Report of Serbia. 2025*.
[71] Bauer et al., 'Mapping GHG Emissions and Prospects for Renewable Energy in the Chemical Industry'; PWC, 'Green Hydrogen Economy - Predicted Development of Tomorrow: PwC'.
[72] European Environment Agency, 'Greenhouse Gas Emission Intensity of Electricity Generation in Europe'; Rakic, 'Serbia Produces the "dirtiest" Electricity in Europe'.
[73] Allert et al., *The Energy Transition in the Western Balkans: Bottom-up Approaches for an Accelerated Structural Change*.
[74] World Bank Group, *Serbia Country Compendium*.
[75] Bauer et al., 'Mapping GHG Emissions and Prospects for Renewable Energy in the Chemical Industry'.
[76] Directorate General Trade and Economic Security, 'European Union, Trade in Goods with Serbia'.

to decarbonise its economy.[77] One chemical company interviewed, for instance, pointed to their ability to provide actual emissions values from their first CBAM report (submitted in January 2024) and not having to rely on default values, as well as clearly documenting the methodology for doing so (SRB1) – both indicators of a level of reporting and data-collection sophistication not widely see in the sector.

Serbia is the only one of the three countries in this report that produces and exports hydrogen to the EU (red labels in Figure 6). Figure 6 shows the exports of hydrogen, nitric acid, ammonia and nitrogenous fertilisers from Serbia to the EU as these chemicals are 'in-scope' i.e. subject to the CBAM. The dominant exports are chemicals categorised under the CN 3105 code i.e. 'mineral or chemical fertilisers containing 2 or 3 of the elements of nitrogen, phosphorus or potassium'. One of the dominant chemical producers in the country exports between 30-50% of the mineral-based fertilisers they produce to the EU, and thus while CBAM regulations are relevant, they are not yet exerting a dominant influence on the company's overall operation (SRB1). Other chemicals subject to CBAM - nitric acid (CN 2808), ammonia (CN 2814) and potassium nitrates (CN 283421) are exported - but in very small amounts.

Notably, Serbia stopped producing ammonia in 2018 but still exports small amounts to the EU as seen in the yellow labels in Figure 6 below.

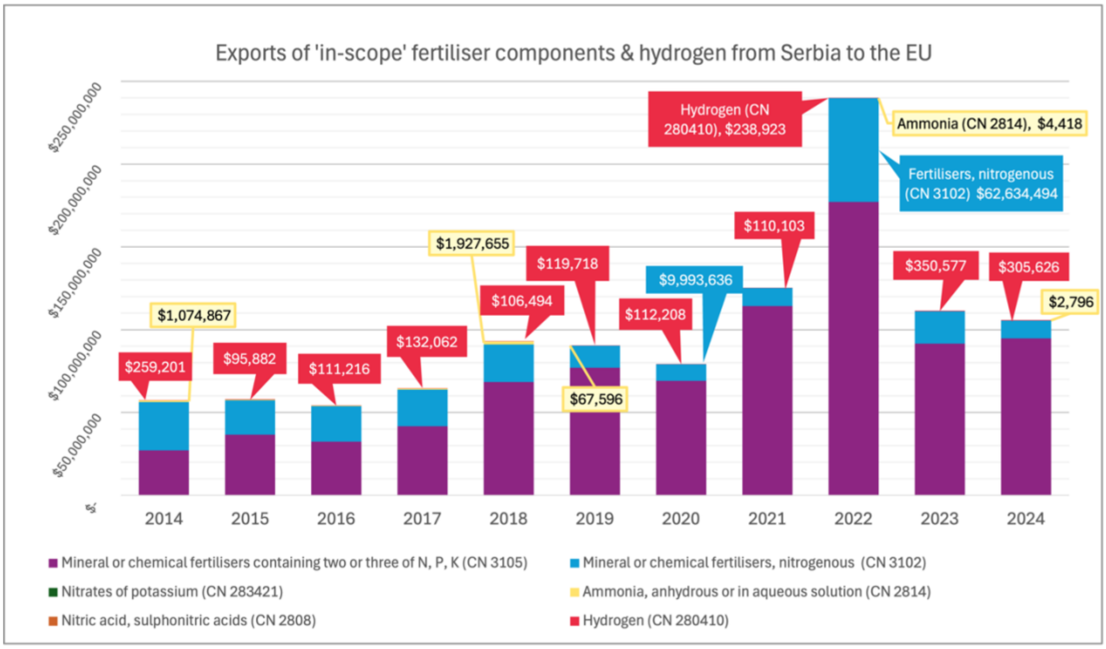


Figure 6: Main fertiliser, and related exports from Serbia to the EU in USD, 2014-2024.
Source: https://comtradeplus.un.org/

Mitigating this exposure to CBAM impacts somewhat, however, is the introduction of a national carbon dioxide (CO_2) emissions tax of €4 per ton of CO_{2eq}, from the first of January 2026, introduced by the *Serbian Law on Greenhouse Gas Emissions Tax* and also applies to nitrous oxide (N_2O) and perfluorocarbons (PFCs). The *Law on the Tax on*

[77] Bengtsson et al., *Decarbonizing the Chemical Industry*.

Imports of Carbon-Intensive Products is a mechanism corresponding to the EU's CBAM. The domestic price may be deducted from the total CBAM obligation due in the EU. Notably, this Law does not apply to high-carbon electricity in the absence of a precise methodology for taxing these imports and other technical limitations.[78] While a broader range of organic chemicals and polymers have been discussed for future inclusion, they are not currently subject to CBAM financial obligations in 2026. There is an exemption threshold (the 'de minimis' exemption) allowing up to 50 tonnes of imported goods per importer per year to be exempt from CBAM.

Serbia's challenge is to ensure its chemical exports remain competitive in the EU by investing in cleaner technologies, improving energy efficiency, and developing MRV systems to comply with CBAM requirements. Failure to do so could lead to reduced market access and economic impacts in this strategically important sector.

Shifting the market towards decarbonised chemicals

The CBAM is designed to impose a carbon price on imports of certain carbon-intensive products (including iron, steel, cement, fertilisers, aluminium, electricity, and hydrogen) into the EU, so that non-EU producers face similar carbon costs to those operating within the EU's Emissions Trading System (ETS).[79] CBAM puts a price on carbon once a product is imported into the EU, but only if that carbon not already priced in the country of manufacture.

While importers (i.e. the EU in this case) incur the direct costs of the CBAM, products from exporters in the Western Balkans will cost more and thus likely become less appealing in the European market. Exporters will be impacted by increased reporting requirements throughout the supply chain, as importers will need that information to calculate the embedded carbon in the products they buy.

The imperative for decarbonisation extends beyond climate commitments to include impacts on competitiveness and market access and on energy security and economic resilience. For the former, the introduction of measures such as the European Union's Carbon Border Adjustment Mechanism (CBAM) will penalise exports (from non-EU countries) of carbon-intensive products. For Western Balkan manufacturers seeking greater integration with EU markets, decarbonisation is therefore a prerequisite for trade competitiveness.[80]

[78] Todorović, 'Serbia Rolls out Taxes on Greenhouse Gas Emissions, Imported Carbon-Intensive Products'; EU Delegation to Serbia 2025, 'Serbia Introduces National Carbon Tax as of January 1'.
[79] Risteska et al., *The EU's Carbon Border Adjustment Mechanism: Challenges and Opportunities for the Western Balkan Countries*.
[80] Lam et al., *Study on the Inclusion of the Chemical Sector in CBAM*.

As to the latter, reducing dependence on imported natural gas and oil can strengthen national energy security, minimise exposure to price and supply volatility and stimulate innovation in bio-based or circular processes.[81] In short, mitigating emissions offers both environmental and strategic benefits, ensuring long-term viability for domestic industries amid tightening EU regulations (carbon pricing and CBAM) and global market shifts.

To get a more accurate picture of the specific decarbonisation technologies that these countries' chemical industries can implement, it would be necessary to conduct a detailed assessment of their current technological capabilities, economic situations, and specific characteristics of their chemical sectors. Given the huge number of products produced by the chemical industry as a whole, and the limited number of in-scope (of CBAM) chemical products, we focused on ammonia – an essential component of fertilisers which are an important export for both BiH and Serbia- to unpack the impact of CBAM on the local producers. Fertilisers and basic chemicals are among the first chemical-related products covered and are some of the main chemical industry exports to the EU.

Technology overview and innovations

Internationally five main technological categories shape industrial decarbonisation broadly speaking:[82]

- **Electrification of heat and processes** – replacing fossil combustion for heating with electric boilers, heat pumps, or plasma/electrochemical systems.
- Use of renewable feedstocks – including bio-based inputs (e.g., bio-ethanol, lignin-derived tonics), CO_2-derived intermediates, and waste plastics as circular carbon sources.
- **Energy efficiency and digitalisation** – process optimisation, waste heat recovery, and AI-based operational controls.
- **Hydrogen as a fuel and feedstock** – replacing fossil hydrogen used in ammonia, methanol, and refinery processes with green hydrogen produced via renewable electrolysis. As of December 2025, however, the only renewable energy electrolysis projected recorded on the IEA's hydrogen tracker site in the West Balkans is still at the feasibility stage [83]
- **Carbon capture, utilisation and storage (CCUS)** – capturing CO_2 from high-purity streams such as ammonia or ethylene oxide production for reuse or sequestration.

These strategies are complemented by the emergence of "electrified steam crackers," now being piloted by BASF, SABIC, and Linde, which aim to deliver the same outputs with renewable electricity as the heat source.[84] In parallel, modular electrochemical and

[81] European Commission, *A European Chemicals Industry Action Plan*.

plasma reactors offer promising—but still immature—options for producing ammonia, methanol, or olefins under mild, low-emission conditions.[85]

However, the three countries present markedly different starting positions: Albania, with its 97-98% hydropower-based electricity system, possesses a natural advantage for green hydrogen production with near-zero grid carbon intensity. The critical question for Albania is not whether to use renewables for electrolysis, but rather how to expand renewable capacity beyond its existing hydro base - through solar and wind development - to meet both growing electricity demand and any potential hydrogen production without compromising grid stability during seasonal hydro variations.

Serbia and Bosnia & Herzegovina face a more complex challenge. With coal currently providing 60-70% of their electricity the additionality principle applies. This principle holds that in electricity systems dominated by fossil fuels, newly installed renewable capacity should primarily displace coal and gas generation rather than supply green hydrogen production. This is particularly relevant given that both countries have aging coal fleets averaging over 40 years old, which must be phased out to meet Energy Community Treaty commitments and EU accession requirements. This maximizes near-term emissions reductions by decarbonising the existing grid before creating new electricity demand for hydrogen.[86]

For fossil fuel-based hydrogen pathways with carbon capture, the barrier is access to CO_2 transport and storage infrastructure. While Serbia is actively developing its legal and regulatory framework for geological CO_2 storage (including in depleted gas fields), and has identified potential storage capacity in hydrocarbon reservoirs, the region more broadly lacks the CO_2 transport networks and storage facilities needed to support industrial-scale carbon capture. The CO2StoP database includes geological assessments for Serbia, but Albania and Bosnia & Herzegovina remain largely unassessed for CO_2 storage potential.[87] Building this infrastructure would require investments in CO_2 pipelines ranging from tens to hundreds of kilometres and storage capacity measured in millions of tons annually—infrastructure that does not yet exist in the Western Balkans.

Good practices

While decarbonising the chemical industry faces many barriers -as outlined above - there are some notable examples of successful decarbonisation efforts in the EU chemical industry.

Focusing on renewable energy-generated electrification is BASF's stated approach to becoming climate-neutral by 2050. Initial efforts have been focused on plants in Antwerp (Belgium) and Ludwigshafen and Schwarzheide (Germany). Key to this will be

[86] Spek et al., 'Perspective on the Hydrogen Economy as a Pathway to Reach Net-Zero CO2 Emissions in Europe'.
[87] The European CO_2 storage database: https://setis.ec.europa.eu/european-co2-storage-database_en

improving process energy efficiency and the purchase of green energy from third parties' processes, including electric steam crackers and heat pumps.[88]

Another example of using of renewable energy is found at Shell's chemical complex in Moerdijk, the Netherlands – a solar park of 27 MW capacity to power its utilities. This is only a small percentage of the electricity required by the complex but further CO_2 reductions requires more than accessing renewable electricity.[89] Shell has commissioned a 10 MW electrolyzer at its refinery in Germany and is now increasing the capacity to 100 MW.

Carbon Capture and Utilization (CCU): In mid-2021, Tata Chemicals Europe (TCE) established a "first of its kind" Carbon Capture & Utilisation plant in the UK at its Northwich Combined Heat and Power plant (CHP). This plant is an important step in decarbonising industrial activity and was partially funded by the UK government to support their target of net zero carbon emissions by 2050. In addition to the reduction of CO2 emissions, in the future the CCU plant would provide a sustainable supply of carbon dioxide gas which would then be used in the manufacture of sodium bicarbonate.[90]

Conclusions

The chemicals sector lies at the heart of the modern economy, underpinning value chains as diverse as agriculture, construction, automotive, packaging, and healthcare. Its emissions profile is both direct – stemming from the transformation of fossil-based feedstocks – and indirect, through the energy required for high-temperature processes. As such, decarbonising the chemicals sector not only contributes to national climate goals, but also facilitates emissions reductions across the broader economy, reduces dependence on imports, creates new jobs and creates opportunities for export of new products. Without significant progress in this sector, overall industrial and national decarbonisation targets will remain out of reach.

For Albania, Bosnia and Herzegovina, and Serbia, decarbonising chemicals and petrochemicals is both a formidable challenge and potentially a strategic opportunity. The region's legacy of lignite-based power generation and dated industrial infrastructure means that carbon intensity remains among the highest in Europe. Chemicals production is deeply entwined with fossil fuel supply chains – particularly in Serbia, where large-scale petrochemical complexes produce ethylene, polyethylene, and ammonia-based fertilisers. In Bosnia and Herzegovina, coal-fired electricity drives up

[88] Siemens Ltd., 'Decarbonising Practices in the Global Chemical Industry'.
[89] Lange, 'Towards Circular Carbo-Chemicals – the Metamorphosis of Petrochemicals'.
[90] Tata Chemicals Europe, *Carbon Capture & Utilisation*.

the carbon intensity of even modest chemicals output. While Albania's sector, though smaller, still faces the dual challenge of increasing competitiveness and reducing emissions.

The EU's Carbon Border Adjustment Mechanism (CBAM) fundamentally alters the calculus for these countries. CBAM ensures that the carbon cost borne by EU producers under the Emissions Trading System (ETS) is mirrored for imports, penalising high-carbon products and rewarding lower-carbon alternatives. As the mechanism phases in, Albanian, Bosnian, and Serbian exporters will need to monitor, report, and ultimately pay for the embedded emissions in their EU-bound chemical products. While the immediate impact may be limited for Albania's small sector, the risk grows as the scope of CBAM expands and as regional industries seek to move up the value chain.

Transforming the region's chemicals sector requires a multi-pronged approach. Electrification of cracking units, green hydrogen substitution for ammonia, and the deployment of carbon capture, utilisation, and storage (CCUS) technologies are all critical, but will demand substantial investment and regional cooperation. The long lifespans and capital intensity of chemical plants mean that policy certainty and access to finance are essential. Shared regional infrastructure for hydrogen and CO_2 transport, as well as knowledge exchange, could accelerate progress and attract sustainable investment.

The stakes are high: a 2022 assessment found that, without a shift away from lignite and toward cleaner energy, CBAM could halve regional exports by 2040, particularly if new lignite units are added.[91] Conversely, rapid decarbonisation could secure the region's place in future European supply chains, supporting economic growth and industrial resilience. In summary, decarbonising the chemicals sector in Albania, Bosnia and Herzegovina, and Serbia is not only technically and economically challenging, but also essential for climate and economic policy. Success will depend on tailored national strategies, robust regional cooperation, and the ability to turn the challenge of CBAM into an opportunity for transformative industrial renewal.

[91] Risteska et al., *The EU's Carbon Border Adjustment Mechanism: Challenges and Opportunities for the Western Balkan Countries*.

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Annex 1

List of industry interviewees

Interviewee	Country	Industry
ALB1	Albania	Cement
ALB2	Albania	Cement
ALB3	Albania	Cement
ALB4	Albania	Cement
ALB5	Albania	NGO
BIH1	Bosnia and Herzegovina	Cement
BIH2	Bosnia and Herzegovina	Metals and manufacturing
BIH3	Bosnia and Herzegovina	Cement
BIH4	Bosnia and Herzegovina	Metals and manufacturing
BIH5	Bosnia and Herzegovina	Metals and manufacturing
SRB1	Serbia	Chemicals
SRB2	Serbia	Mining and metals
SRB3	Serbia	Construction
SRB4	Serbia	Construction
SRB5	Serbia	Steel

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