Decarbonising Fertilizers by 2050

The industry's roadmap
towards climate neutrality

Fertilizers Europe

Fertilizer's **industry ambitions**

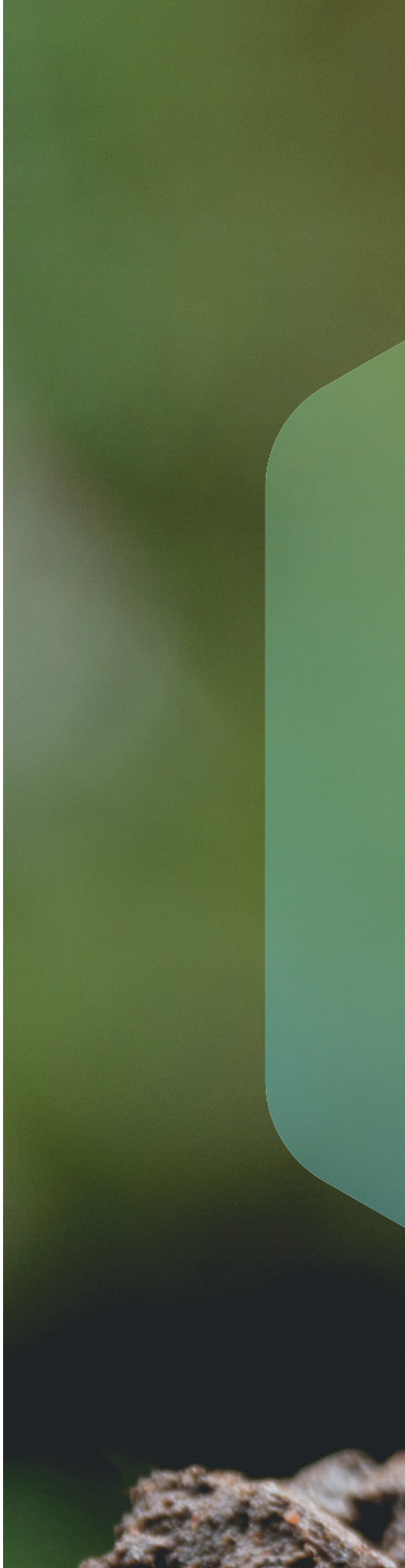
1. By 2026, all Fertilizers Europe member companies will adopt a masterplan for the decarbonisation of their assets;

2. By 2040, Fertilizers Europe members commit to reducing their scope 1 and 2 GHG emissions by 70% compared to 2020;

3. By 2050, European fertilizer production will be climate-neutral.

A combination of policy solutions and access to affordable, low-carbon and renewable energy is needed to enable the transition of EU fertilizer production to a climate-neutral economy by 2050 while keeping its current assets competitive.

From 2005 and 2020, the **EU fertilizers industry already reduced its scope 1 and 2 emissions by 49%.**



Climate-neutral fertilizer production by 2050

Fertilizers enable 50% of food production.

Fertilizers are essential to ensure food security for all and strategic autonomy for Europe, **enabling half of all global food production.** The European fertilizer industry provides an essential supply of fertilizers to European agriculture.

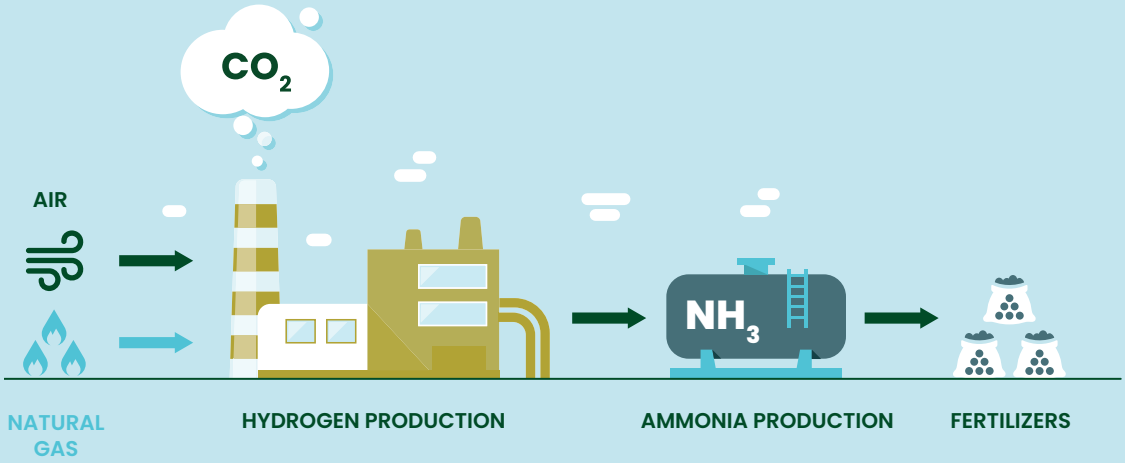
The production of nitrogen-based fertilizers today is predominantly based on natural gas. While significant progress has been made to reduce the carbon intensity of fertilizer production, more needs to be done. The European industry is already investing in low-carbon and renewable production processes that will decarbonise fertilizer and thus food production and will contribute to the transition to climate neutrality in the EU.

Decarbonising fertilizer **production**

Currently ammonia is produced by combining nitrogen and hydrogen in the Haber-Bosch process with the hydrogen produced from natural gas in a Steam Methane Reformer (SMR).

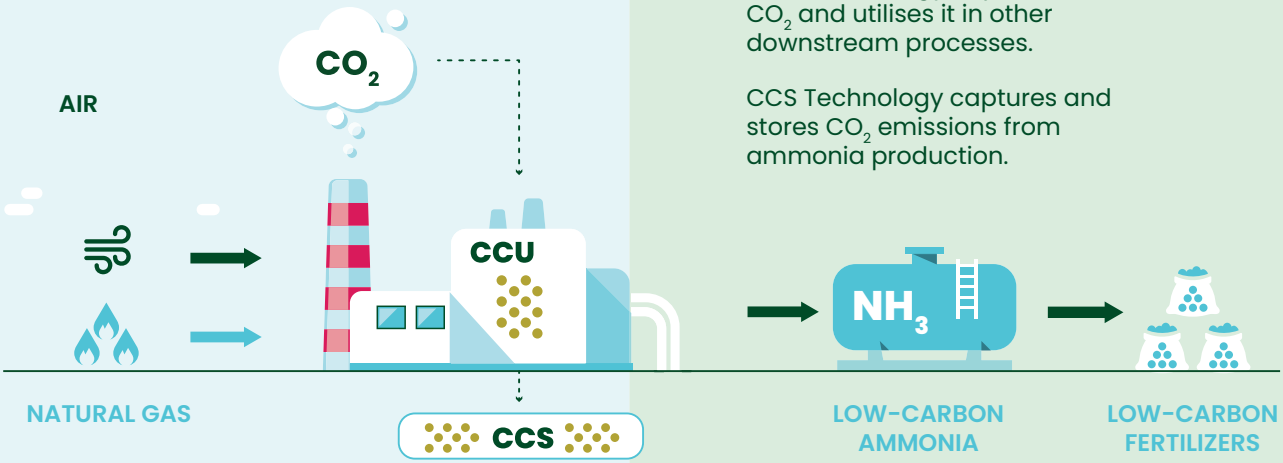
Alternative production technologies to reduce and eliminate GHG emissions include replacing natural gas as our primary feedstock with bio-methane or biogas, capturing and storing CO_2 generated in the production processes and large-scale electrolysis.

Traditional fertilizer production



Low-carbon and **renewable ammonia** production technologies

Low-carbon ammonia production



CCU/CCS TECHNOLOGY

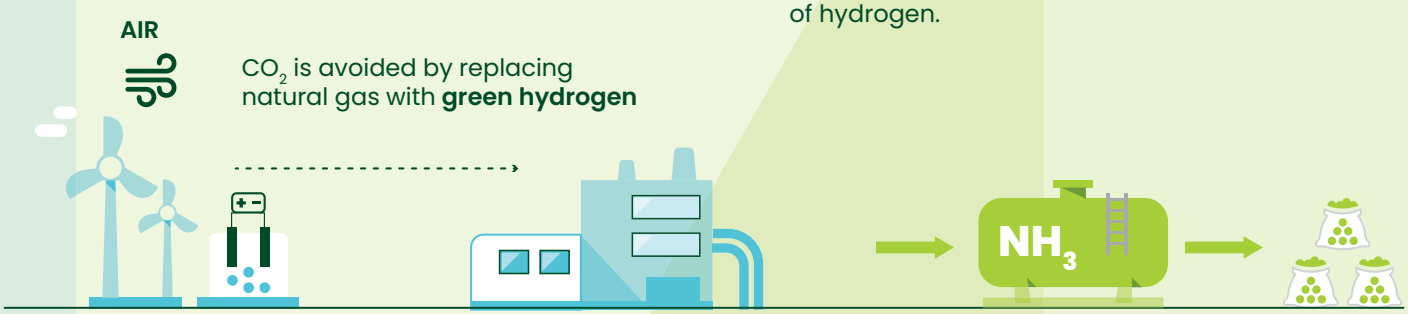
CCU Technology captures CO_2 and utilises it in other downstream processes.

CCS Technology captures and stores CO_2 emissions from ammonia production.

Renewable ammonia production

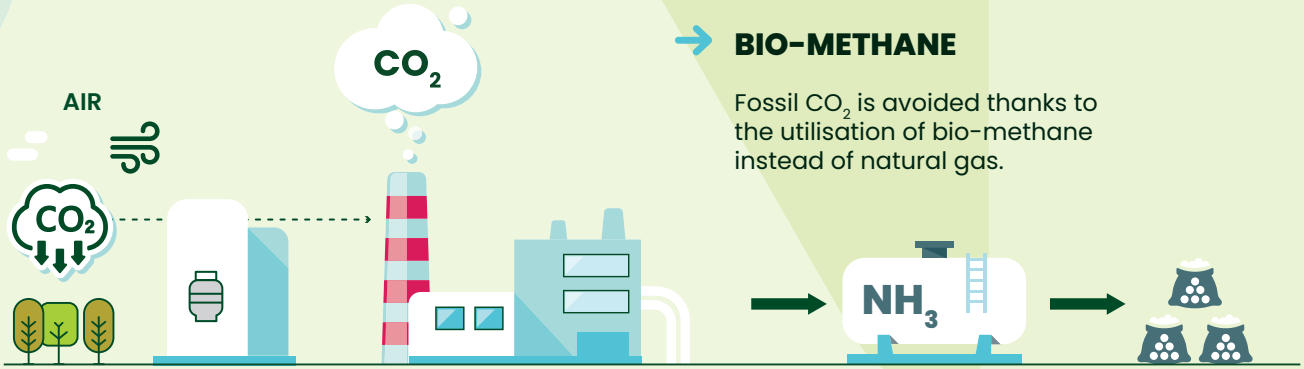
ELECTROLYSIS OR ALTERNATIVE SOURCES OF HYDROGEN

Green hydrogen produced via electrolysis or alternative sources of hydrogen.



BIO-METHANE

Fossil CO_2 is avoided thanks to the utilisation of bio-methane instead of natural gas.



Pathways to a **decarbonised future**

Fertilizers Europe in collaboration with Guidehouse has conducted a study of the European fertilizer industry and has explored two main pathways to deliver this essential change for the sector in Europe.

The choice between these alternative scenarios will be based on the unique needs of each plant and the availability and cost of the required energy carriers, which will vary significantly over different European regions.

The CO_2 reduction refers only to scope 1 and 2 emissions, of which scope 2 represents around 5%.

TECHNOLOGY NEUTRAL PATHWAY

Implementation of a mix of technology solutions depending on the availability of infrastructure and energy carriers.

2 tonnes of CO_2 production per tonne of ammonia.

2020

GREEN HYDROGEN PATHWAY

Renewable fuels of non-biological origin (RFNBO) replace natural gas-derived hydrogen, creating a need to source bio-based CO_2 for urea production.

Guidehouse

35%
CO_2 reduction

Leading to 1.33 tonnes of CO_2 per tonne of ammonia produced.

68%
CO_2 reduction

Leading to 0.67 tonnes of CO_2 per tonne of ammonia. Where available, large amounts of electrolysis-based hydrogen are used.

100%
CO_2 reduction

CO_2 emissions abated in ammonia production combined with a mix of electrolysis-based hydrogen and bio-methane.

2030

2040

2050

50%
CO_2 reduction

Leading to 1.02 tonne of CO_2 per tonne of ammonia produced.

75%
CO_2 reduction

Leading to 0.51 tonne of CO_2 per tonne of ammonia produced, using RFNBO compliant hydrogen.

100%
CO_2 reduction

Emissions eliminated in ammonia production.

Decarbonising fertilizer **production**. **Which way to go** ?

Fertilizer plants are strategically located across Europe based on the availability of natural gas, raw materials, logistics infrastructure and proximity to agricultural markets.

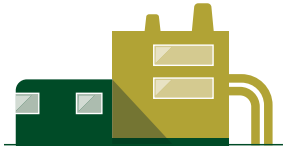
For a successful transition, **the availability of sufficient competitively priced low-carbon and renewable electricity, biomethane or hydrogen, and CO_2 infrastructure is key**. In addition, proximity to ports (for ammonia imports if required), availability of nutrients (for recycling) and water are also important factors.

Technology neutral pathway

Decarbonise through a combination of technologies like **electrolysis**, **CCU**, **CCS** and **Bio-methane**.

Green hydrogen pathway

Decarbonise through **electrolysis**



Do I have **access to renewable energy** ?

YES

Is the **renewable energy competitively priced** and is there **a supportive regulatory framework?**

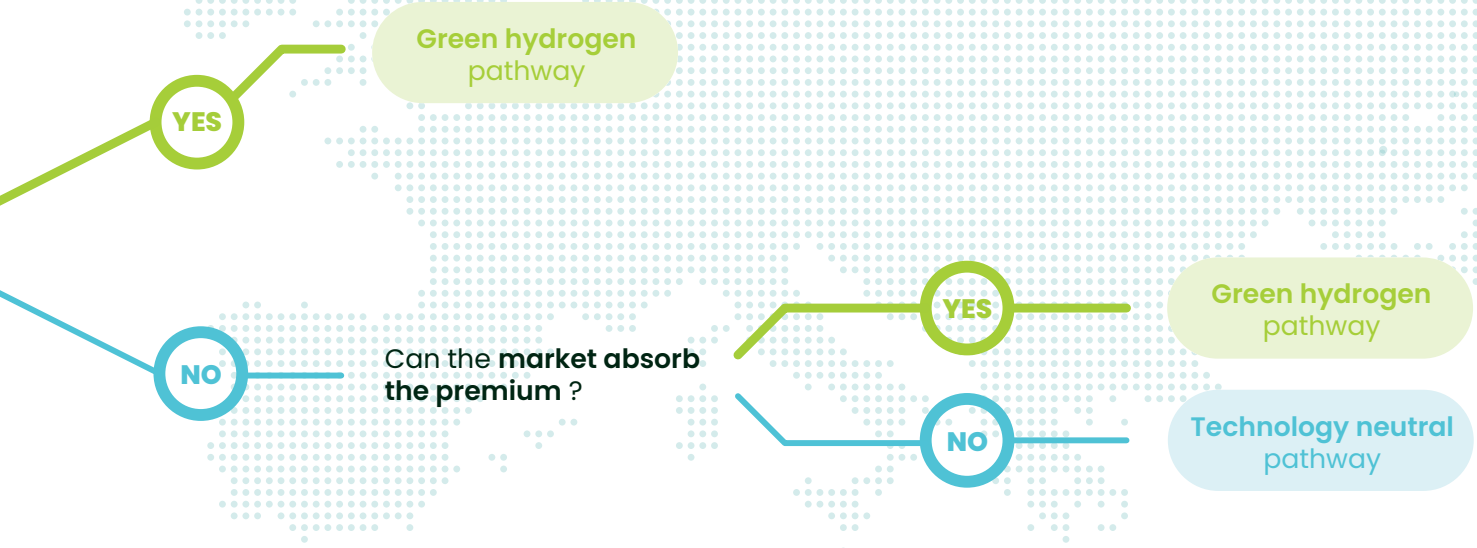
NO

Technology neutral pathway

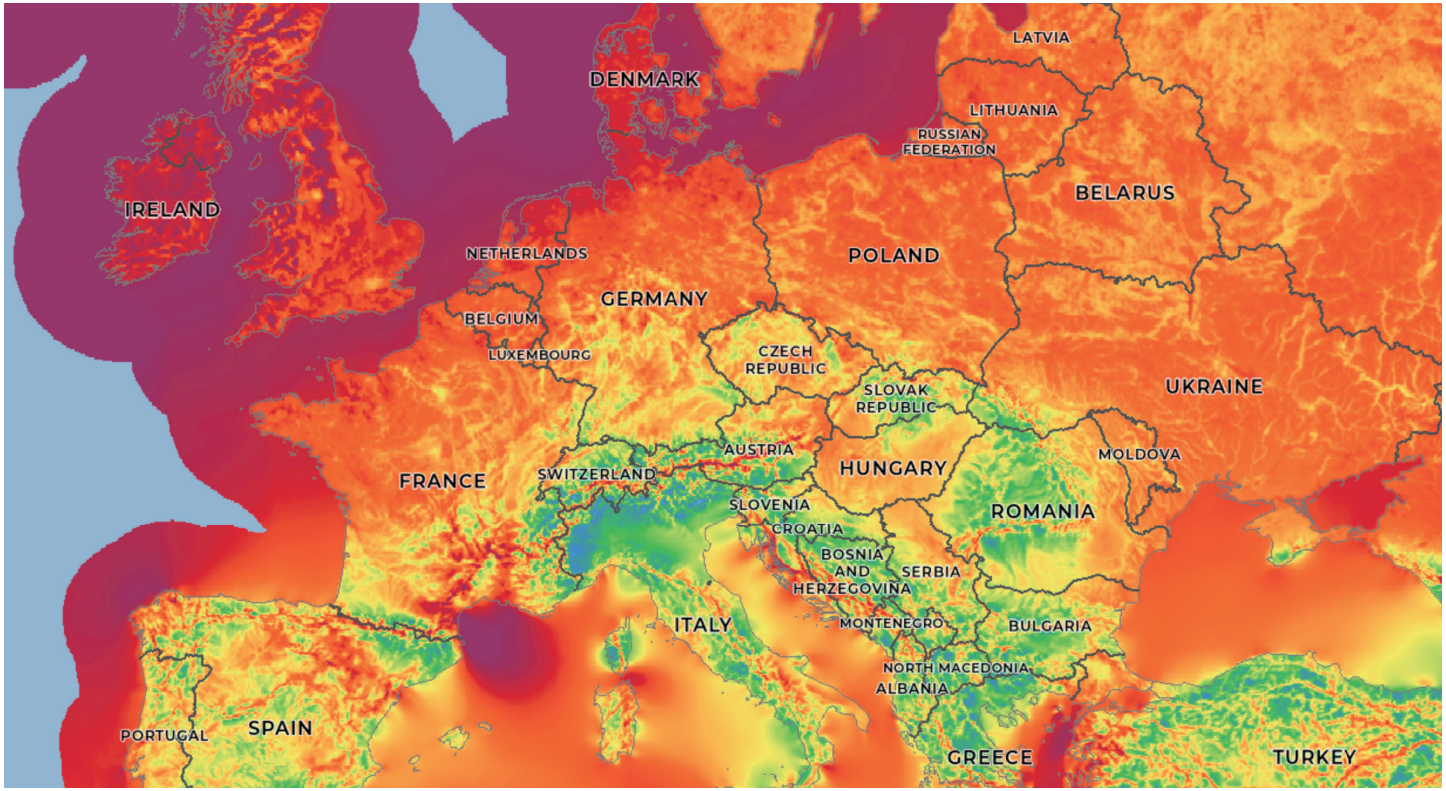
Implementation of a sustainable, climate-neutral nitrogen fertilizer economy in Europe will be region-and product-specific and will require adaptable policies.

Appropriate European and national policy frameworks will need to be put in place to enable a successful transition across all EU Member States and regions.

➔ **One size will not fit all from a policy perspective.**



Wind and **Solar energy potential** in EU

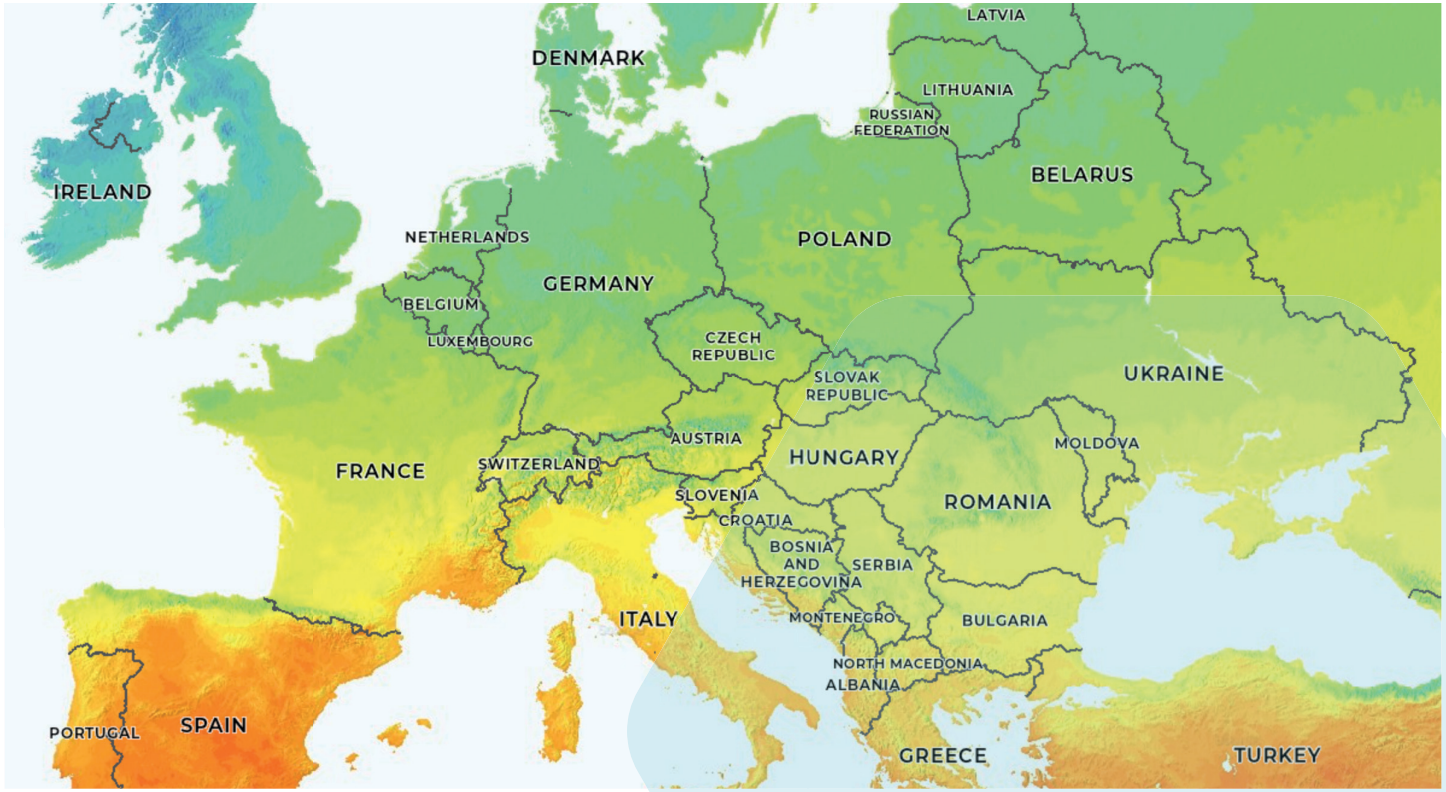


m/s

0 10+

Wind energy potential (m/s)

Source: Global Wind Atlas (Technical University of Denmark, World Bank Group)



Long-term average of photovoltaic power potential (PVOUT) **kWh/kWp**

Daily totals

2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.2	5.6	6.0	6.4
730	876	1022	1168	1314	1461	1607	1753	1899	2045	2191	2337

Yearly totals

Photovoltaic Power Potential by Country

Source: Global Solar Atlas (Solargis, World Bank Group)

The cost of technological change

The technologies required to decarbonise the industry are much more expensive than current production processes. However, if quickly implemented at scale, they are expected to become competitive compared to the fossil-based technologies in the medium term.

The production cost for these new technologies depends heavily on the future ratio between the price of natural gas, the price of bio-methane/ biogas and the cost and availability of renewable electricity resources and renewable hydrogen from the grid.

€17 billion
ELECTROLYSERS ONLY

€3 billion
FOR A **HYDROGEN PIPELINE NETWORK**

€64 billion
FOR **OFFSHORE WIND PARKS**

is the investment needed for all hydrogen used in ammonia production to be replaced by electrolysers running offshore wind.

€1.2 billion
IS THE YEARLY **AVERAGE INVESTMENT** OF THE **EU FERTILIZER INDUSTRY**

The lead time for investments in the sector is up to **7 YEARS** and could be longer for the implementation of the necessary energy carriers and associated infrastructure.

Toward a **future-proof and competitive EU fertilizers industry**

A competitive European fertilizer sector is of key importance to ensure Europe's long term food security.

A dedicated sectorial strategy

Now is the time for the EU to step up its efforts to ensure a future for its domestic fertilizer industry. A dedicated sectorial strategy is therefore key to develop the right legislative framework and to streamline financing to ensure a successful transformation of the sector.

The fertilizer industry is navigating in unchartered territories.

New realities like the gas price volatilities seen as a result of Russia's invasion of Ukraine have brought new challenges to the sector. With such volatile prices, it is imperative to accelerate the supply of sufficient renewable and low-carbon energy to enable the timely transformation of the EU fertilizer industry.

Streamlining decarbonisation investments in EU

Foreign investment frameworks signal the importance of retaining domestic fertilizer production. The Inflation Reduction Act (IRA) will make green hydrogen cost-competitive for the industry in the US. Europe needs to match such support to avoid the risk of investment leakage. The IRA has brought the topic of competitiveness to the EU agenda.

The EU's Innovation Fund and the Hydrogen Bank are important tools to support the decarbonisation of the ammonia and fertilizer industry in Europe, but sector specific support and a long-term strategy are essential for the necessary green investments to take place in Europe.

Supporting the decarbonisation of domestic industry will avoid the substitution of Russian fossil fuel reliance for third country fertilizers, ensuring the strategic autonomy and self-reliance of European food.

Ammonia - decarbonisation catalyst
for key EU sectors

Energy **storage**

Transport - Shipping

Agriculture and food
low-carbon fertilizers

Green chemicals

Future markets

As a producer and consumer of about 40% of the total European hydrogen, the fertilizer industry is uniquely placed to contribute to the EU Green Deal and the development of a hydrogen economy in Europe.

Low-carbon and renewable ammonia also open up vast decarbonisation opportunities in other sectors beyond agriculture, including carbon-free energy storage and energy carriers, transportation (in particular for shipping), and green chemical production.

Low-carbon and renewable ammonia has what it takes to act as the workhorse of the hydrogen economy thus accelerating the overall transition to a zero-carbon European economy.

EU Fertilizer industry **is producing and consuming about 40%** of the total European hydrogen.

Joint endeavor

To make investment decisions, the industry will need to be certain that energy carriers and infrastructure will be available in time, that there is a level policy playing field with countries outside the EU, and that the investments are sufficiently attractive.

Coordination and speed between all stakeholders and policymakers are essential to ensure that we all contribute in a timely manner to meet the targets. On our side, we will ensure that each of our plants in the EU will, by mid-2026, have prepared a masterplan and consulted with its critical stakeholders to outline how it will eliminate its GHG emissions from its ammonia production, what technologies and infrastructure will be required and by when.

5 prerequisites to **boost decarbonisation and strategic autonomy** of the EU

1 Enable and promote access to sustainable energy and feedstock

Access to **affordable green and low carbon energy** is essential to bridge the competitive gap between Europe and competing regions.

2 Boost demand for climate-neutral EU fertilizers

Boost demand for climate-neutral EU produced fertilizers through a **labelling system** accompanied by a mandatory purchasing target for all EU nitrogen fertilizer purchasers.

3 Stimulate targeted investment

Implement measures to **'de-risk' the early investment** required to close gaps between the cost of the proposed alternative routes and current production routes.

Promote **dedicated funding programs such as the hydrogen bank** with a sector specific approach in order to enable investments in required technologies to achieve climate-neutrality.

4 Prevent an unfair competitive advantage from non-EU producers

Ensure timely and effective development and implementation **of the Carbon Border Adjustment Mechanism** to prevent unfair competitive advantage for non-EU producers importing to Europe.

Develop and provide concrete safeguards to guarantee continuous competitiveness of European export-oriented production.

5 Provide a supportive legal and funding framework

Enable rapid and targeted access to **public funding** and/or support and facilitate the **permitting or licensing** for construction of facilities to enable the transition – including new-build or refurbished nitrogen fertilizer plants, renewable electricity generation and retrofitted infrastructure.

About us

Fertilizers Europe represents the interests of the majority of mineral fertilizer manufacturers in the European Union.

Our membership comprises **16 fertilizer manufacturers** from countries across the EU and 9 national fertilizer associations.

In 2020, the European Fertilizer Industry **produced 15.4 million tonnes of ammonia.**

The sector represents a combined annual **turnover of €9.8 billion, employs 75 000 people and invests €1.4 billion annually**.

For more information visit:
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