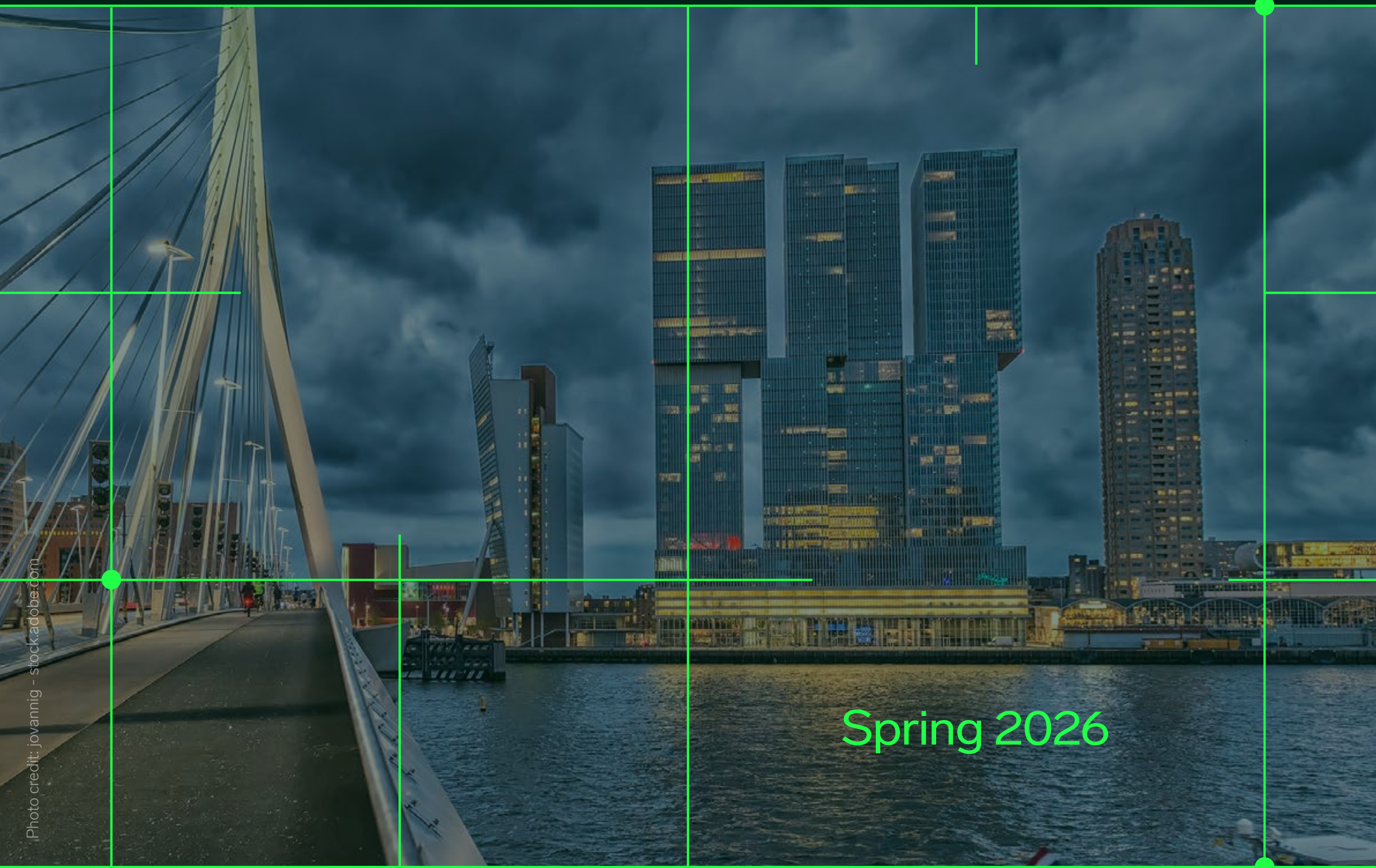
Expana reports from gasworld's European CO_2 Summit 2026

Carbon dioxide supply in Europe

How the merchant CO_2 market is undergoing a structural transformation and what it will mean for food and beverage clients



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In the food and beverage industry, carbon dioxide is an invisible workhorse. It is perhaps most famous for its use in beer and soft drinks, but its uses go far beyond that. It is used to stun animals before slaughter and package meat, seafood, prepared dishes, and more. In dry ice form it can keep items cold without adding water, an application used in both processing and shipping. It is used in refrigeration and cryogenic freezing, and pumped into greenhouses to promote plant growth.

Unfortunately, despite carbon dioxide's essential role in growing, processing, packaging, and shipping food, its supply is often at the mercy of dynamics in other markets. That is because production of the raw CO_2 is dependent on other industrial processes prone to shutdowns, especially in times of expensive energy prices, which has periodically left the merchant market without this critical ingredient.

This white paper, built off of presentations and discussions at gasworld's European CO_2 Summit in Rotterdam in March 2026, unpacks these dependencies and the work that the supply chain is doing to build resilience, spotlights concerns that the food and beverage industry might need to consider amid the CO_2 supply chain's structural transformation, and discusses whether the current crisis in global energy and fertilizer markets is liable to spill over into European CO_2 supply.

Traditional dependency on ammonia and ethanol production

To begin with, a whopping three quarters of Europe's merchant CO_2 supply is made as a byproduct of producing either syngas (most notably used for ammonia manufacturing, although it has other applications as well) or ethanol, according to gasworld's data intelligence director Aidan Sparrowhawk. This means that it is the margins and market developments in those products, *and not the need for CO_2*, which determine whether the ammonia and ethanol plants which are also making CO_2 will even run.

This is especially important in periods of high energy costs. LNG represents an estimated 80% of the cost of ammonia production. If its cost goes beyond a certain point, production of ammonia becomes unprofitable, regardless of what is happening in the market for the CO_2 byproduct.

"Whenever these [ammonia or ethanol] plants are in a position where it's not physically economical to run these plants, the first thing that comes to mind for them is, 'does it make sense for us to continue to run the plant' and the last thing on their mind is, 'well, what about CO_2?'" observes Gabriel Kiewek, COO and VP of operations at Nippon Gases. "CO_2 has always been a case of the dog wagging the tail, and not the other way around."

Unfortunately, European industry has suffered high gas prices for much of this decade. Peaks in 2018 and 2022 caused production shutdowns, which resulted in allocations or Force Majeure declarations by CO_2 providers, which rippled out across the food industry, impacting availability of items from chicken to beer in markets such as the UK.

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However, even outside of these periods of acute crisis, this dynamic is critical to understanding CO_2 supply. For example, it is largely responsible for the sizeable seasonal shifts in availability, as ammonia plants tend to go offline for maintenance in the summer, in line with the rhythms of the fertilizer markets, leaving the CO_2 market with less material at a time when demand for beverages and refrigerants is at a peak.

Beyond these noticeable but temporary disruptions, there have also been structural impacts. As the European energy crisis has dragged on, some facilities have shut, bringing CO_2 capacity offline for good.

Kiewek claims that 1 million tons of ammonia production has closed down since 2022, with more on the chopping block in years to come. Capacity is also being lost in other sectors whose CO_2 byproduct entered the merchant market, such as ethanol and chemical production; Expana's discussions with market participants on the sideline of the gasworld European CO_2 summit revealed that reductions in operations at chemicals giant BASF had contributed to supply loss in southern Germany, for example.

"As the European energy crisis has dragged on, some facilities have shut, bringing CO_2 capacity offline for good."

Moving towards resilience with emerging sources and decentralized production

Of course, the industrial gas companies, responsible for sourcing the raw CO_2 from such operations, processing it, and delivering it to clients in the merchant market, are well aware of this Achilles heel. And with the food and beverage industry representing around 46% of European demand for merchant CO_2 according to Sparrowhawk's data, they are also keenly aware of their duty to keep this essential product flowing. Therefore, building resilience into the system is of paramount importance.

Kiewek explains that Nippon Gases has been preparing by investing in monitoring and decision-making tools to identify where shortages may occur and how CO_2 can be reallocated within their system to avoid impacting customers, as well as transportation solutions such as ships and trucks beyond the dedicated local delivery fleets to help bring that gas from one region to another when needed.

Moreover, even though large-scale traditional sources, like Yara's ammonia and fertilizer plant in Sluiskil, in the Netherlands, will unequivocally remain part of Nippon Gases's network for the foreseeable future, Kiewek concludes "Europe is moving towards a structural transformation of its CO_2 supply." Nippon Gases, along with the rest of the industry, are also increasingly looking beyond the traditional sources of raw CO_2 to an emerging suite of alternatives, such as CO_2 derived from upgrading biogas to biomethane.

These emerging sources tend to produce much lower volumes than the traditional sources; 7,000 tons per year is about standard for European plants equipped with CO_2 capture, according to Kiewek. On the one hand, he explains, this creates a "hard math" problem when it comes to making the activity profitable after capex (mainly the liquefier), operational expenditures, and the increasingly complex logistics and transport are accounted for. But on the other hand, it also creates less strategic dependence on a small number of big producers in the network.

Biogas-derived CO_2: a growing part of the CO_2 supply mix

How do you get CO_2 from biogas?

Start with a large volume of biomass, anything from household waste to large-scale agricultural residues. Break it down with naturally-occurring bacteria. The output, besides the digestate, is biogas, made up of about 60% biomethane and 40% CO_2.

When the two gases are separated, the biomethane, which has traditionally been seen as the principal product, becomes an energy source: it can be injected into the grid, used for transport, heating, or in industry, replacing fossil-based methane. Meanwhile, what remains is a high-purity CO_2 product – one which relies on a circular economy model using locally-available inputs, instead of being dependent on (often imported) fossil fuels.

25 biomethane plants captured 1.17 million tonnes of CO_2 in 2025, claims Pablo Molina of the European Biogas Association (EBA). Although the EBA is not certain of the destination of all of that CO_2, it understands that at least 68% went into utilization (as opposed to sequestration); of that, at least 245,000 tonnes were used by the food and beverage industry, while at least 374,400 tonnes were used by greenhouses.

According to Aidan Sparrowhawk of gasworld, biogenic CO_2 (a category including but not necessarily limited to biogas-derived CO_2, while excluding fossil-based sources like ammonia) was seen to be growing as a share of the overall EU CO_2 market, up two percentage points over 10 years. And within that larger category, biogas-based CO_2 specifically is growing fast: as per Molina's numbers, an additional 25 capture projects will boost biogas's total by 0.5 million tonnes in 2026, a 43% increase in output this year alone.

This growth is coming within the context of a European CO_2 market which has come to realize the downsides of over-reliance on a few conventional fossil-based sources. For example, ammonia production went offline during spikes in natural gas prices in Europe following the Russian invasion of Ukraine, causing shortages of CO_2. In other words, biogas-derived CO_2 matters because it is seen as an alternative that would contribute to increased resilience in Europe's production network.

Gabriel Kiewek of Nippon Gases sees the growth of biogas-derived CO_2 and the decline in the share of CO_2 provided by ammonia as part of a structural shift underway in the CO_2 industry. "Going forward, as we are seeing the increase of these biogas plants across Europe, the size of these plants is growing, and it is going to make much more sense to put in the capacity to liquify [the CO_2]," he says. "Decline in industrial sources – the traditional parts of the CO_2 [supply ecosystem] – we believe that will continue to be the case. This will be replaced with the biogenic CO_2 and a [decentralized] system that will allow us to [supply CO_2] in a much more consistent, much more reliable type of way."

Similarly, Philipp Lukas of Future Biogas, comparing the current supply environment in the UK with that of recent periods of shortage, believes that biogenic CO_2 has contributed to increased stability. "We're in a very different place from where we were in 2018. We're also in a different place to where we were in 2022. We have a lot of anaerobic digesters that have had CO_2 capture connected, and more in the pipeline."

Beyond building the resilience of the CO_2 supply, biogenic CO_2 has another edge over fossil-based CO_2: sustainability. David Christopherson of Future Biogas, for example, calls for a paradigm shift, from viewing biomethane and CO_2 as the products of an AD company to seeing sustainability itself as the product. "Increasingly, I'm almost tempted to go out and talk about our product as being one that is focused on emissions abatement rather than as a supply of energy or [CO_2]," he says.

While sustainability credentials and a biogenic origin are not characteristics that command a price premium in the merchant market from food and beverage industry customers, it is still worth understanding, because it matters a great deal for emerging applications such as long-term sequestration or sustainable aviation fuel, both of which are increasingly looming on the horizon as competing sources of demand for CO_2 and drivers of carbon capture activities.

Implementation barriers in the food and beverage sector

Despite biogas's potential to strengthen European CO_2 resilience, practical challenges could limit adoption in the food and beverage industry, particularly around contamination risk and customer perception.

Novel contaminants and quality assurance

One is the possibility of novel contaminants. Sieg Mueller from Analytical Science & Technologies Group explains how the thinking about contamination risk for bio-based CO_2 evolved: whereas in the early days, he says, it was assumed that the risk profiles would be similar to products from other anaerobic-based processes, like fermentation, important differences eventually emerged: "What we found is that anaerobic digestion (AD) sources follow different metabolic pathways, therefore they produce different contaminants."

Moreover, beyond contaminants which emerged from metabolic processes, there's also the possibility of, for example, pesticide and fungicide residue on agriculture waste used as biomass for the fermentation process. To be clear, he adds, this is not only an issue with biogas-based CO_2: novel contaminants are also a risk for other emerging CO_2 sources, such as direct air capture, or indeed traditional sources like geological CO_2. Still, as new sources of biomass are tapped for biogas production, rigorous testing for chemical and microbiological contaminants is certainly in order. "They all have their own nuances, all things that we need to understand at an expert level before we turn around and put it into the market," Mueller says.

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> "We're in a very different place from where we were in 2018 [or] in 2022."
> — Philipp Lukas, Future Biogas

Perception, certification, and market adoption

Meanwhile, even if CO_2 from biogas passes the most stringent quality standards, there can still be something of a perception issue, a potential "ick" factor to be concerned with. Some customers in food and beverage are leery of the reputational risk of using CO_2 which is essentially derived from waste products. On the one hand, in the age when social media can make a lurid claim go viral quickly, this is understandable. But on the other hand, it is also frustrating for a CO_2 industry painfully aware of the need to diversify away from traditional sources to see valuable molecules being left on the table because of where they came from; at the end of the day, if the gas is free of microbiological and chemical contaminants, why not use it?

"The food industry needs to understand: it's the same molecule, at the same purity level. If you want reliable supply, the best you can do is bio plants," observes one actor in the industry.

However, for certain subsections of the food and beverage industry, the stakes are even higher. Take the example of biogas derived from animal waste: could CO_2 from this source be used in vegetarian, Halal, or Kosher foods? Would it matter if the CO_2 was not an ingredient, per se, but used in the processing of the food – for example, for temperature control? At the moment, there are no clear answers to either question, nor are there necessarily certification systems in place to verify compliance with whatever standards might be appropriate for these more demanding applications.

In other words, it looks like this is being worked out on a case-by-case basis between suppliers and clients. One representative of a gas supplier shares with Expana how the company's embrace of biogas-derived CO_2 had meant investing in parallel infrastructure, including storage trucks and tanks, in order to be able to offer what is basically two different kinds of food-grade CO_2 – two products which were essentially identical in composition but different in origin.

According to this person, the gas meets the standards for use as a food ingredient, but since its origin is in biogas, it is used in more auxiliary roles – in greenhouses, dry ice production, or for cryogenic freezing, rather than for applications like MAP.

In a market like that of European CO_2, which regularly faces supply constraints, customers from the food and beverage industry might be well advised to think about these sorts of questions in advance of any crisis. Is your CO_2 supplier (wisely) diversifying their own sourcing base, to ensure that high fossil fuel prices don't leave them short of material? If so, how compatible with your needs are these new sources?

The test: Europe's CO_2 market faces Middle East conflict with calm wariness

Europe's CO_2 market entered 2026's Middle East conflict with structural advantages unavailable during previous crises. Yet, facing sky-high energy prices as the conflict in the Middle East has impacted both the production and transport of natural gas, the industry remains cautious about the timing and scale of potential disruption to ammonia-dependent supply.

At first glance, the relative calm seen by market participants in the first weeks of the conflict might be somewhat surprising. After all, merchant CO_2 markets have traditionally been sensitive to peaks in global energy prices. When natural gas, an important input for ammonia production, becomes expensive, ammonia production may be curtailed, meaning that the CO_2 byproduct from this manufacturing process is unavailable to the merchant CO_2 market. And ammonia production is the most important single source of raw CO_2 being exploited in Europe; Nippon Gases' COO Gabriel Kiewek estimates that nearly 38% of Europe's installed "conventional" CO_2 liquefication capacity was attached to ammonia. So why isn't there more concern about the immediate future of that ammonia-linked supply?

For one thing, as several industrial gas experts observe, natural gas is not the only commodity affected by this situation; fertilizer itself is trending upwards, both because material produced in the Gulf is unable

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to reach global markets with the Straits of Hormuz closed and because sizeable production operations located in the region have gone offline because of the conflict. Therefore, the argument goes, ammonia margins might be preserved, even if input prices go up, and the owners of those plants will not take them offline. At least one attendee expressed skepticism of this argument, though, doubting whether EU farmers, squeezed by their own buyers and unable to pass on increasing costs, would be able to support an even higher fertilizer price.

There is also the observation that, unlike in the 2022 market upset following Russia's invasion of Ukraine, today's natural gas tightness is not concentrating the pain in Europe, but is instead affecting most importing countries. Therefore, European ammonia producers will not necessarily find themselves at a competitive disadvantage compared with those in other parts of the world, and the European CO_2 supply may therefore avoid concentrated disruption.

Finally, a look at the recent and ongoing development of the industry suggests that it may be structurally better equipped to ride out this storm compared to previous crises.

Although still high, the share of syngas (an input for ammonia as well as other products like methanol) as a source for raw CO_2 in Europe has declined 5% over the past 10 years, according to gasworld's data intelligence director Aidan Sparrowhawk. Meanwhile, Pablo Molina of the European Biogas Association, makes the point that biogenic CO_2 from biogas can help the industry break the dependency on ammonia production reliant on imported natural gas. Kiewek, too, believes that the new sources are slowly coming together to shore up the supply situation: "In the next 24 months we will continue to see a significant grind to get molecules and to stabilize the market in Europe, to make sure that our customers can get the CO_2 in a consistent way... [but] for Europe we believe that this will change after 2027 with the addition of all these bio[genic] sources."

Beyond the possibility of ammonia production shutdowns, the war could have other impacts on the wider CO_2 economy. For example, amid the urgency of the conflict, decarbonization may be shunted onto the back burner; Sparrowhawk cites analysis suggesting that carbon capture and utilization (CCUS) targets to 2030 may drop by as much as 40% as funds are reallocated.

But one takeaway emerges again and again, perhaps best expressed by Kiewek's colleague Massimo de Mola of Nippon Gases: "Let's say, from what we know [now], in the super-short term, say the span of one month, we don't see risks [for ammonia production from high gas prices]. It depends very much how long this will escalate, and on the time to recover to normal. We have to watch and see how it develops, and be ready with [contingency] plans."

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Conclusion: monitoring the transition

Europe's CO_2 market stands at an inflection point. The traditional model—where merchant supply hinges on ammonia and ethanol margins—has proven structurally fragile, leaving food and beverage producers vulnerable to energy shocks beyond their control. That vulnerability is unlikely to disappear overnight. But the industry's deliberate shift toward decentralized, biogenic sources represents a genuine attempt to break this dependency. Biogas-derived CO_2 is expanding rapidly and logistics networks are becoming more flexible. What remains uncertain is whether this transition will accelerate fast enough to materially reduce the concentration risk that has periodically disrupted supply.

For food and beverage companies, three factors warrant close attention. First: understand your supplier's sourcing strategy. Are they actively diversifying away from ammonia and ethanol, or relying primarily on a few sources? Second: be prepared for conversations about CO_2 origin. As biogas and other biogenic sources grow, questions about quality, certification, and compatibility with your own sustainability or regulatory claims will become unavoidable. Third: watch the timeline. If 2027 is indeed when biogenic sources begin to significantly shore up European supply, then the next 18 months remain a window of structural vulnerability, a period when geopolitical shocks, energy spikes, or plant outages could still trigger the kinds of allocations and force majeure declarations that have disrupted supply in past crises.

The Middle East conflict has not yet materially impacted European CO_2 availability, and industry participants expect ammonia margins to hold in the near term. But this period of calm should not breed complacency. The resilience Europe's CO_2 sector is building is real, but fragile. How quickly biogas capture scales, how readily the food industry embraces its output, and whether unexpected disruptions force a faster reckoning than the market expects will determine whether Europe's CO_2 supply remains genuinely stable in the near term.

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