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Article

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The paradox of CO2: Leading cause of climate change essential for food, drink – and COVID vaccines

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Carbon dioxide is the leading cause of climate change; it pollutes our air and damages our health. Yet, strange as it may sound, the United Kingdom experienced a shortage of carbon dioxide last year, driving consumer fears of higher prices for food and drink. The same could happen in Canada.

At the heart of this paradox is the fact that, for all the damage that CO2 does, it also has some valuable – even essential – uses in modern society.

The colourless, odourless gas is used in liquid and solid forms. As a liquid, CO2 fizzes up draft beer, pushes out oxygen from packaged food to make it last longer, and stuns pigs and poultry before slaughter. The solid version, known as dry ice, refrigerates food and vaccines, making it critical in the fight against COVID.

Food and beverages make up most of CO2's industrial uses – roughly 70 per cent in the United States – says Maura Garvey, principal and director of market research at Intelligas Consulting in Westwood, Mass.

Last September, the U.K. food industry suddenly faced a 60 per cent drop in carbon dioxide supplies. Not for the first time, either: A similar shortage occurred during the 2018 FIFA World Cup, when consumer demand was at its peak as fans filled pubs to watch soccer games.

How did the British end up in this situation?

Most industrial CO2 in the U.K. is produced by ammonia and fertilizer plants, which use natural gas as an energy source and feedstock. The CO2 is captured and sold instead of being released into the atmosphere.

“Fertilizer plants are run to make fertilizer. You run your plant when the fertilizer price is high, and the natural gas price is low. You shut down your plant when the natural gas price is high and the fertilizer price is low,” says Stephen B. Harrison, managing director at sbh4 GmbH, a German industrial gas consultancy.

“As far as the fertilizer producer is concerned, the carbon dioxide is a byproduct. He’s very happy that he can sell it and get a little bit of money for it but running an ammonia plant to make carbon dioxide is not economical.”

Natural gas prices in the U.K. more than tripled from mid-August to early October 2021. Coupled with lower demand – and therefore lower prices – for fertilizer after the end of the growing season, it thus no longer made sense to make ammonia.

No ammonia meant no food-grade carbon dioxide.

The U.K. is particularly vulnerable to CO2 shortages because its sources are so closely tied to ammonia production, says Harrison. Even carbon dioxide imports come largely from fertilizer plants in Norway.

Although the U.K. did try to diversify its sources of carbon dioxide after the 2018 shortage, another big problem has emerged: Brexit. It is more difficult now to bring in goods, including CO2, from the European Union. There is also a shortage of drivers to transport the CO2 as many of them came from the E.U. and can no longer work in the U.K.

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“Clearly, (the U.K.) didn’t diversify enough for a really bad year,” says Harrison. Indeed, the government’s first temporary fix – subsidizing an American-owned fertilizer plant on U.K. soil – lasted only until January. A new three-month agreement has been arranged with the fertilizer plant but was not finalized until early February.

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In addition to being the active component of alcoholic drinks, ethanol is a renewable gasoline additive. Several U.S. states and Canadian provinces mandate that gasoline contain a minimum amount of ethanol, typically 5-10 per cent by volume, because it releases less greenhouse gas than unblended gasoline.

Ethanol is produced from the fermentation of the sugars in corn, a process that also releases a stream of nearly pure carbon dioxide that can be easily liquefied and sold.

“Fifteen years ago, ethanol was not so big but with all the (green) credits (and use in gasoline), it really grew as a source,” says Garvey. It now accounts for 27 per cent of Canadian CO2 production.

But adding ethanol to gasoline is controversial. Its corn feedstock could be used for food; large amounts of water, land and energy are required in its production; and it can damage car engines.

“In March 2020, when COVID first hit, people literally stopped driving. When driving stopped, there was no demand for ethanol, so the ethanol guys stopped running the ethanol plants,” says Rich Gottwald, president and CEO of the Compressed Gas Association in McLean, Va., an industry group. “With no production of ethanol, there was no carbon dioxide (from ethanol). That was a real challenge from March through to July 2020.”

The saving grace was a sharp drop in demand for beverages and dry ice during the summer of 2020, says Gottwald.

“Between demand going down and supply picking up, we were able to get through COVID.”

What’s more, CO2 producers prioritized vaccines, thereby preventing supply disruptions.

Even so, COVID continues to pose problems for the CO2 industry. Railcars, used to ship carbon dioxide across long distances in North America, were stuck outside Montreal last fall because CN had trouble finding train crews to move them, says Sam Rushing, president of Advanced Cryogenics, a consultancy in Key Largo, Fla.

The environmental damage caused by CO2 has prompted calls for investment tax credits that incentivize industries to capture and sequester their emissions. The gas can be stored underground or used as a feedstock in other industrial processes, such as making concrete. But this idea, currently under consideration by both the Canadian and U.S. governments, risks causing further supply-chain disruptions.

“If you start paying people more to sequester it, then you’re going to have less carbon dioxide for these other applications. It has a lot of people that use carbon dioxide – like in the food industry – very concerned,” says Garvey.