# CREATING A SUSTAINABLE BREWERY

**AS A RELATIVELY CHEAP, ABUNDANT AND INERT GAS, NITROGEN HAS MANY USES IN THE FOOD AND BEVERAGE SECTOR FOR PRESERVATION, PACKING AND TRANSPORTATION. A HYBRID APPROACH BETWEEN NITROGEN AND CO2 HAS ALSO SEEN BREWERIES DRASTICALLY REDUCE COSTS AND IMPROVE PROCESS EFFICIENCIES. HERE, CHART INDUSTRIES OUTLINE A NUMBER SOLUTIONS THAT REDUCE COST AND WASTE AND SIMULTANEOUSLY IMPROVE YOUR ENVIRONMENTAL FOOTPRINT.**

Nitrogen dosing is used during the canning or bottling process and reduces the Total Package Oxygen (TPO) by displacing oxygen in the headspace and dissolved oxygen in the product.
One part of liquid nitrogen warms and expands into 600 parts gaseous nitrogen pushing the oxygen out of the headspace before the container is closed.
This process can be used in both bottles and cans and because of the volumetric effect is far more efficient than gaseous nitrogen purging.

The primary reason for liquid nitrogen dosing is preservation and shelf-life extension through nitrogen's inert properties. However, the use of nitrogen over CO2 in certain beers has been a notable innovation as it provides a creamier, smoother mouthfeel compared to the prickly sensation of CO2.
These so called "Nitro Beers" also provide an aesthetic cascade of nitrogen bubbles in the glass when the beer is poured.
The science behind this is that nitrogen in the headspace of a closed beer ensures that the CO2 stays dissolved and bubbles are unable to form.

However, when the can or bottle is opened nitrogen gas is released and the CO2 bubbles out of the beer creating the much sought after visual cascade effect.
For in-can "Nitrogenation" craft brewers should package the low carbohydrate beer from the brite tank within 1.2-1.8 vol range and fill using an open-air or counter pressure filler, dose with nitrogen, seam, and store cold for 5 days.
The time needed for the nitrogen to dissolve into solution can be accelerated by increasing the amount of liquid exposed to the nitrogen molecules in the headspace over a shorter period of time.
This can be done by simply shaking the can of pressurized beer dosed with liquid nitrogen for 2-5 minutes and will produce an equivalent solubility state as 5 days of cold storage.

A further benefit of liquid nitrogen dosing is a reduction in packaging materials.
The trapped liquid nitrogen vaporizes craeting pressure that adds rigidity to the container meaning thinner container walls and hence less material.

## CO2 RECOVERY AND RE-USE

Since 2016 CiCi® technology has been simultaneously eliminating emissions and reducing costs and supply chain volatility through a circular economy where carbon dioxide from the fermentation process is affordably captured, purified, liquefied and returned at >99.9% purity for re-use during carbonation.
In a three step process, gas is dried to remove moisture, scrubbed to remove volatile organic compounds (VOCs) and other impurities, and chilled below -34.7 °C to convert carbon dioxide gas to a liquid.
The CiCi range spans three models and is suitable for brew pubs with an annual production around 2K hL all the way to much larger operations producing >200K hL.
With a small footprint, the system can fit into existing spaces and begin recovering CO2 for re-use immediately after installation.
Specially developed software controls gas processing for 24/7 unmanned operation with full system updates and carbon capture volumes available remotely in real time.
Pioneered and proven in the US, CiCi is now available across Europe with manufacturing in Germany and aftermarket support from 22 centres.

## LIQUID CYLINDERS

In both dosing and carbon capture nitrogen and carbon dioxide are stored in liquid form in specially designed portable liquid gas cylinders or tanks.
For economic storage of gases the volume has to be reduced through compression or liquefaction. The former typically results in banks of high pressure cylinders that have to be manually handled and are susceptible to running out.
Liquid cylinders are low pressure and hence much safer plus manual handling is eliminated, which is a further safety benefit.
Oftentimes liquid gas deliveries are triggered automatically through telemetry, which optimizes the ordering process and prevents cylinder run outs.