Capture & Recovery: Potential Set in Stone?

By Anthony Wright on Mar 09, 2023 | 0 NEWS | CARBON DIOXIDE

With recent reports that the US is to introduce legislation between utilisation and sequestration, capture and recovery is a hot topic within the industrial gas sector.

But how can the US and Europe integrate when it comes to enabling and developing new utilisation and sequestration technologies and methods?

Discussing this topic and more in the fourth and final session of **gas**world's Europe CO2 Summit 2023, Jeff Holyoak from TOMCO Systems spoke about the potential impact of US legislation and market forces on European CO2.

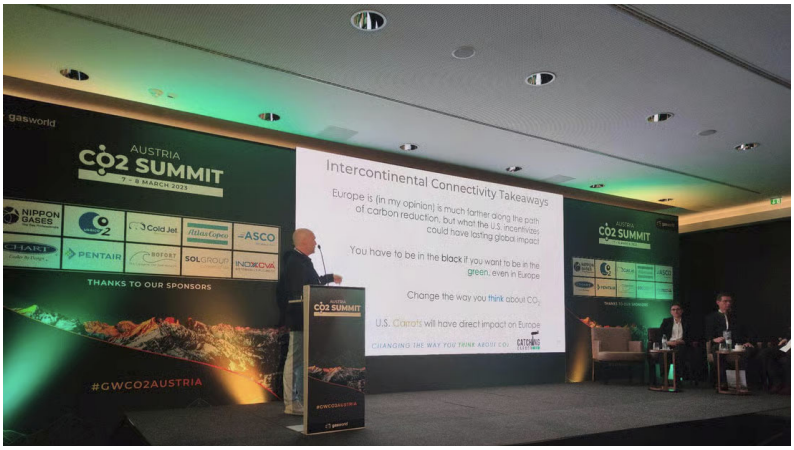
What is 45Q and how is it impacting the European market?

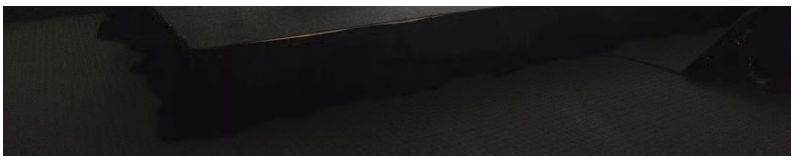
According to Holyoak, legislation and investment driving the energy transition in American may have indirect impact on European CO2 markets.

What is 45Q?

45Q is a tax credit for qualifying CCUS projects initiated by 2033. It originated as a federal bill put together in 2008 in the US designed for power generation.

"A lot of our CO2 is generated from power generation sites so they said if you can capture it and store it we will give you $50 a tonne. If you use it for EOR we'll give you $35 a tonne."





It wasn't being used, so the IRA increased the numbers, increasing awareness of the incentive. This led to payments increasing to $85 per tonne captured and stored, $60 per tonne captured and utilised and $180 per tonne captured for DAC.

The credits are available for 12 years after implementation and require a minimum volume of 12,000 TPD (tonnes per year) – although there are variants for EOR.

"The problem is that they passed the bill in June and it hasn't been declared who applies the credits," said Holyoak.

"We haven't moved forward on any of these things because no one knows who applies it to the companies."

Hydrogen was also highly incentivised in the IRA, which put forth upwards of $25bn towards hydrogen.

Why does it matter?

"All of this investment opens up the opportunity to invest in a range of applications including efuels, SAF, cement, polymers, biomass."

"I firmly believe the US will move towards biogas. The energy transition is going to drive more investment into hydrogen, increasing investment into CO2, sparking more innovation."

According to Holyoak, Europe will continue to strive for energy independence, high cost LNG from the US will further that.

"US currently supplies more than half of Europe's imported LNG, there were record exports in 2022," he added.

The price doubled during that time frame and $35bn of LNG was exported in 2022 compared to $.8.3bn in 2021.

"CO2 production in Europe from traditional, non-sustainable sources will approach zero – the demand won't,.

The IRA and 45Q all driving investment and innovation that could help European energy find a bigger global market.

"A lot of you are farther along in innovation, carbon capture utilisation and alternative sources, biogas."

"In the US we don't do biogas, we vent all of the CO2

"You have to be in the black if you want to be in the green, even in Europe," he concluded.

Carbon capture and its potential in global energy transition.

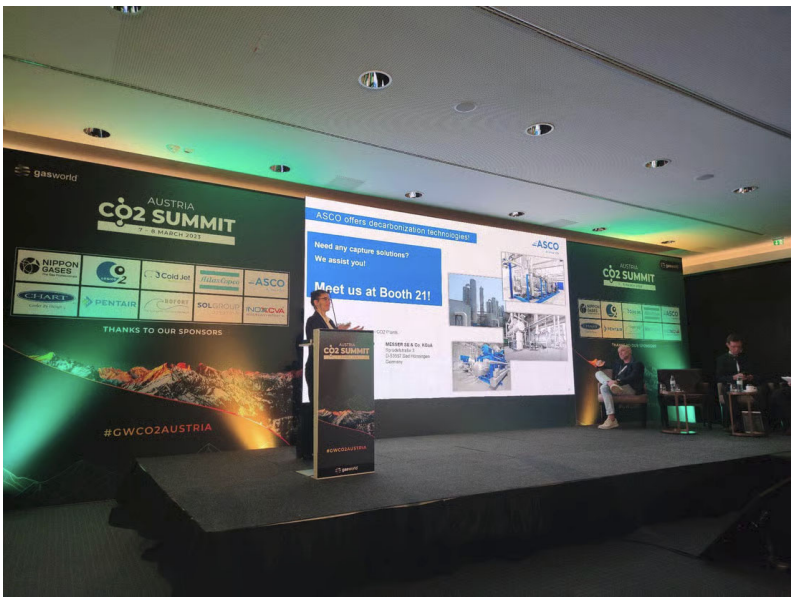
What role can carbon capture play in the global energy transition?

Explaining the role that carbon capture can play, Dr. Dilan Celebi from ASCO Carbon Dioxide/Messer Engineering held an in depth discussion on carbon emission reduction strategies.

Anticipating a 50% global energy demand growth by 2050, Dr. Celebi revealed that to meet targets, "We have to cut emissions by 45% by 2030 and reach Net Zero by 2050.

"At the moment it's 83%. There are two strategies to mitigate effects of climate change," she said. "The first is reducing emissions, so emitting less CO2 in the first

place, the second strategy is to remove the CO2 that's already been emitted, increasing this from 0GT CO2 per year to around 10GT by 2050."



In the UEA's Net Zero Emissions scenario, it's planned that by 2030 we will use all of the CO2 reduction tools already in place.

"After 2030 we see the penetration of CCUS technologies and also electrification and hydrogen production itself."

CCUS technology can abate 20% of emissions to achieve Net Zero by 2050.

The focus of CCUS from around 2040 will increase for DAC and bioenergy sources to ensure negative emissions.

The main industries to decarbonise will be notoriously high emitters such as cement, iron and steel and chemicals.

"By the year of 2070, CCS will reduce almost 24% from these hard to decarbonise sectors," explained Calebi.

Global CCS projects

"There are 196 storage facilities worldwide with a total capture capacity of 244m tonnes. This doesn't mean they're all functioning, the operational proportion of these facilities are still low or in early development stages."

"Since 2021, storage projects have increased by 44%."

But this may not be enough. It has to be 56 million tonnes per year by 2026 to achieve Net Zero.

North America is leading these projects, followed by Europe due to a slower production time.

Potential

What is the potential of CCUS?

"It's obvious that global electricity generation will grow by 75% by 2050 ,with 90% coming from renewable energy."

"We still have the emissions, there is no other option other than to incorporate carbon capture into these industries."

Captured CO2 can then be used in a range of industries such as food and beverage, pharmaceuticals, and using renewable hydrogen that is coming from renewable electricity to create synthetic fuels for aviation, shipping and onshore transport.

CCS vs CCU

Revealing the potential of CCS vs CCU, Calebi explained that about 93% of CO2 will be used for storage in 2050 and just 7% will be used.

The utilisation potential of CO2 by 2030 will be the most significant in aggregates, followed by concrete, however the market potential by 2030 will be most significant in concrete and fuels.

Set in Stone: The viability in CO2 mineralisation

A tried and tested method of reducing unnecessary CO2 emissions, carbon capture and storage (CCS) has been proven to work but is heavily reliant on the area having the correct sub-surface geological conditions.

So what are the alternatives? Carbon capture and mineralisation (CCM) is essentially the same as CCS but instead of storing the CO2 underground, the gas is reacted with chemicals to form inert mineral salts.

“There is a gulf between hard-to-abate and unavoidable. That must be understood by anyone regulating CO2 or CO2 sources,” said Stephen B. Harrison of sbh4 Consulting. He explained that if we are using steel, cement and glass in 2050, we will be using refractory bricks. Production of these materials and the refractory bricks themselves yields unavoidable CO2 emissions.

“It’s nothing to do with hard-to-abate, I’m talking unavoidable,” he said. “I can decarbonise the heat, but I can’t avoid the geogenic CO2 coming from these processes. Steel, cement and glass are fundamental building blocks of our future.”

A company in Israel called Airovation Technologies has patented a CO2 capture and mineralisation process called CCM. “It’s effectively a single-stage process but it’s a capture and mineralisation process all in one. It is a very old technology but the process is new,” Harrison said.

“They are using incredibly common chemicals to achieve mineralisation.”

The technology captures CO2 from the gas stream before it is mineralised, which results in a cloudy precipitate.

What do we get? “Maybe we get sodium carbonate, maybe we get bicarbonate – a range of minerals can be produced.”

The tenth most widely used inorganic chemical in the world, sodium carbonate, also known as soda ash, is used in flat glass and container glass making.

According to Harrison, the mineral produced can have a much higher value than the CO2 gas that is recovered from traditional solvent absorption or alternative adsorption technologies.

The process is based on the in-situ generation of highly concentrated superoxide radicals in an aqueous environment. The superoxide radical is highly reactive and rapidly catalyses the removal of carbon monoxide (CO) and CO2 from flue gas stream, with capture rates exceeding 95%.

Additional advantages of Airovation’s CCM process include the minimal heat and power requirement at the capture site, and it also uses readily available chemical feedstocks.

For specialty glassmaking it can be used for geogenic (unavoidable) CO2 emissions capture and conversion to minerals, Na2CO3 production as a feedstock for glassmaking, and promotes circularity in glassmaking materials.

The technology also has applications in the biotechnology sphere. It can be used in biogenic CO2 capture and conversion to bio-materials, NaHCO3 production for water softening, and O2 production for bio-reactor process intensification.