From fluffy pillows to concrete: The uses of captured CO2

By Gabriella Mulligan
Technology of business reporter

9 October 2017

Climate change

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Your fluffy pillows and memory foam mattress could be helping to reduce CO2

Carbon dioxide (CO2) emissions are contributing to global warming, so could technologies removing some of the gas from the atmosphere help slow the

process?

When you tuck yourself into bed tonight - curling up on your memory foam mattress and fluffy pillows - consider this: you could be helping to reduce climate change.

This is because CO2 can now be captured from the air and stored in a range of everyday items in your home and on the street.

It can be used to make plastics for a whole host of things: the insulation in your fridge-freezer; the paint on your car; the soles of your shoes; and the binding of that new book you haven't read yet.

Even the concrete your street is made of could contain captured CO2.

UK-based Econic Technologies has invented a way of encouraging CO2 - a typically unreactive gas - to react with the petrochemical raw materials used in the making of many plastics.

In this catalysed form, the CO2 can make up to 50% of the ingredients needed for making plastic. And recycling existing CO2 in this way reduces the amount of new CO2 emissions usually resulting from the process.

"Our aim is that by 2026, the technology will be used to make at least 30% of the polyols [the units making up plastic] made globally, and that would reduce CO2 emission by 3.5 million tonnes each year," explains Rowena Sellens, chief executive of Econic Technologies.

"This is equivalent to taking more than two million cars off the road."

CARBONCURE

CarbonCure's Robert Niven thinks his firm's concrete is far more environmentally friendly

The company is currently working with partners in industry to introduce its technology to market.

Canadian company CarbonCure Technologies is recycling CO2 and putting it into concrete.

CarbonCure takes waste CO2 from industrial emitters - such as fertiliser producers - and injects controlled doses of the liquid gas directly into the concrete truck or mixer.

The reaction that takes place creates calcium carbonate particles that become permanently bound within the concrete - and make the concrete up to 20% stronger.

Today, CarbonCure's technology is installed in more than 60 concrete plants across Canada and the US, supplying hundreds of construction projects.

Another company, Carbon Engineering, captures CO2 and uses it to make diesel and jet fuel. While Carbon Clean Solutions, in the Indian port of Tuticorin, captures CO2 from a coal-fired power plant and turns it into soda ash (sodium carbonate), an ingredient in fertilisers, synthetic detergents and dyes.

But will such carbon capture efforts really make much difference?

Simply put, levels of "greenhouse gases" - CO2, methane and nitrous oxide are the main ones - have been rising rapidly because we've been burning fossil fuels - coal, oil and gas - to make electricity and power our transportation, amongst other human activities.

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Should we be reducing the amount of CO2 used in making plastics, or simply using less plastic?

At the 2015 Paris climate conference, 195 countries agreed to try to keep global temperatures to within 2C of pre-industrial times by reducing emissions.

But to achieve this target by 2030, the world needs to cut emissions - CO_2 accounts for about 70% - by 12 to 14 gigatonnes per year, says John Christensen, director of a partnership between the UN Environment Programme and the Technical University of Denmark.

A gigatonne is a billion tonnes.

Econic, by contrast, hopes that by 2026, its technology will be responsible for reducing CO_2 emissions by 3.5 million tonnes each year.

And CarbonCure has demonstrated that its technology can help a typical medium-sized concrete producer reduce CO_2 emissions by 900 tonnes a year. Globally, the concrete industry could reduce CO_2 emissions by more than 700 million tonnes a year, the company believes.

"It's great to have these options coming up," says Mr Christensen, "but there's no silver bullet, no single solution."

ASHLEY COOPER

Greenpeace's Doug Parr thinks renewable energy is a better way to reduce CO_2 emissions

Environmentalists are also concerned that such carbon capture technologies merely delay the fundamental shift society needs to make to become a low-carbon economy. A plastics factory producing less CO_2 is still environmentally unfriendly, the argument goes.

"Research into new technologies and approaches that can help reduce carbon emissions is vital, but it must not become an excuse to delay action on tackling the root of the problem - our dependence on fossil fuels," says Doug Parr, chief scientist at Greenpeace UK.

"A process that appears to reduce emissions or increase efficiency can lock us into maintaining industries that could be replaced with much greener options."

In addition, Mr Christensen points out that these carbon capture technologies tend to be very costly because they are so small-scale.

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"The advances are positive but it's far from what is needed," he argues.

Another challenge is what to do with the recycled carbon. Some have suggested burying it in the ground or deep under the ocean, but the consequences of this are not fully understood.

So it's better to reduce the amount of emissions we produce in the first place through increased use of renewable energies, such as wind, hydro and solar power, environmentalists argue. This could reduce emissions by up to 50% of the amount needed.

"Use all the technologies available to bend the [emissions] curve down. Then carbon capture can come in," says Mr Christensen.

"It could have an important role to play."

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'Where there's muck, there's brass': Meet the UK entrepreneurs turning waste CO2 into beer, cement, mattresses and fertiliser

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By **Harry de Quetteville** and **Hannah Boland**

25 JUNE 2019 • 6:07PM

Today will kick off with a session on the Carbonation of industrial by-products and wastes. This afternoon, discussions of photo- and electro-catalysis are on the agenda. It is a conference which sounds notably abstruse. But actually this is the modern version of a simple, age-old quest - to transform waste into gold.

True, its delegates are not alchemists looking to turn base metal into limitless wealth. Instead, the 5-day International Conference on Carbon Dioxide Utilisation (ICCDU) is a gathering of the world's leading experts on redeeming and reusing a substance that for decades has been a byword for catastrophe: carbon dioxide.

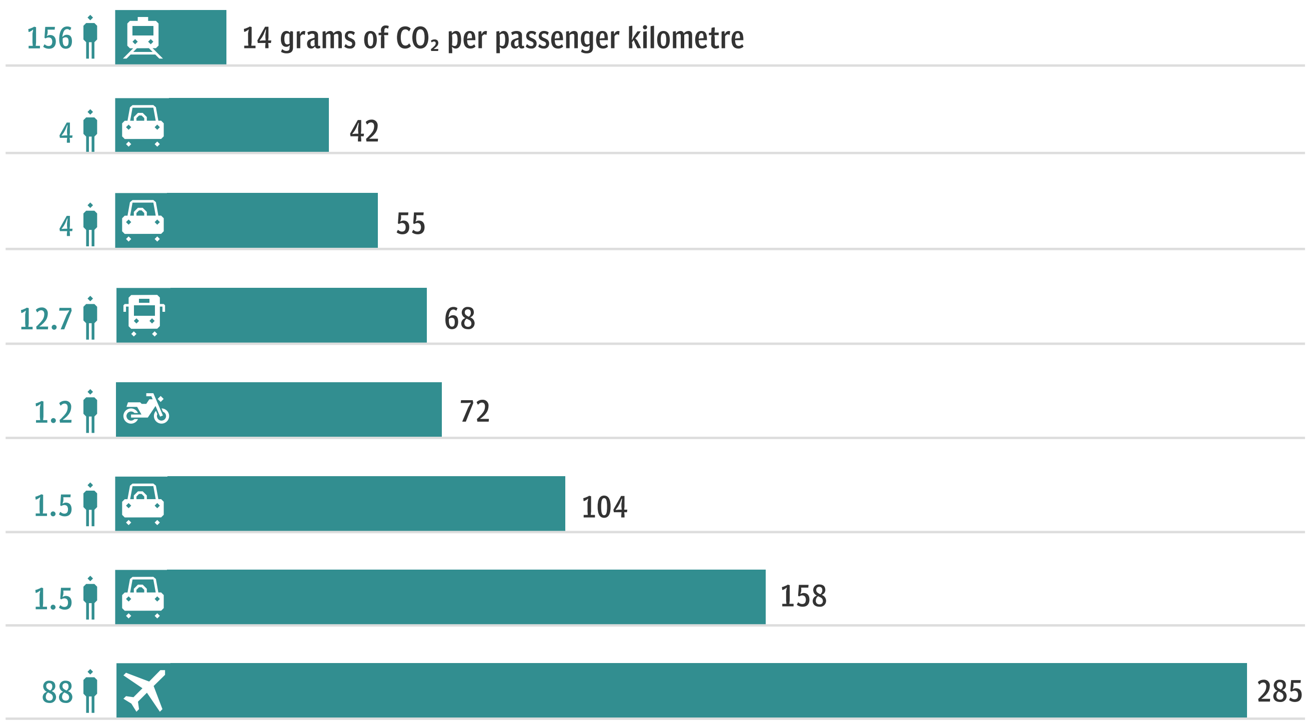
Such menace has already spawned a large industry to limit carbon emissions in renewable energy (https://www.telegraph.co.uk/business/2019/06/12/2050-zero-carbon-emissions-target-means-consumers-business/). But today a growing band of devotees is aiming to go one better - by harnessing the malevolent molecule and making it into something good.

For those that pull off that transformation, the prospect of riches await; riches in a field whose keenest researchers have long been considered dreamers, plugging away pointlessly with a gas that was written off as thermodynamically, reactively and financially valueless.

“The perception of CO2 [was] that of an environmentally malicious greenhouse gas without economic value,” note Professor Walter Leitner and Dr Christoph Gürtler, who chair the ICCDU. “Today, creative inventions to utilise CO2… are being commercialised by major industrial players as well as by agile start-up companies.”

Many of those start-ups are in Britain, where core academic research is being translated into startling real-world products, from breeze blocks to mattresses.

Carbon dioxide emissions from passenger transport



Take Deep Branch Biotechnology, which uses a strain of bacteria to “ferment” carbon dioxide, with hydrogen, producing a single-cell protein which is dried and can be used as fish food.

“We can basically take CO2 directly from industry and make money from it, making revenue from something that's conventionally viewed as a waste stream,” says Peter Rowe, chief executive of Deep Branch, which he co-founded last July. He says that the benefits are two-fold. “As well as giving companies that have a lot of CO_2 emissions a route to make money from those emissions, it generates a replacement product that is far more sustainable than the conventional sources of protein that we could normally use in animal feeds, like soy or fishmeal.”

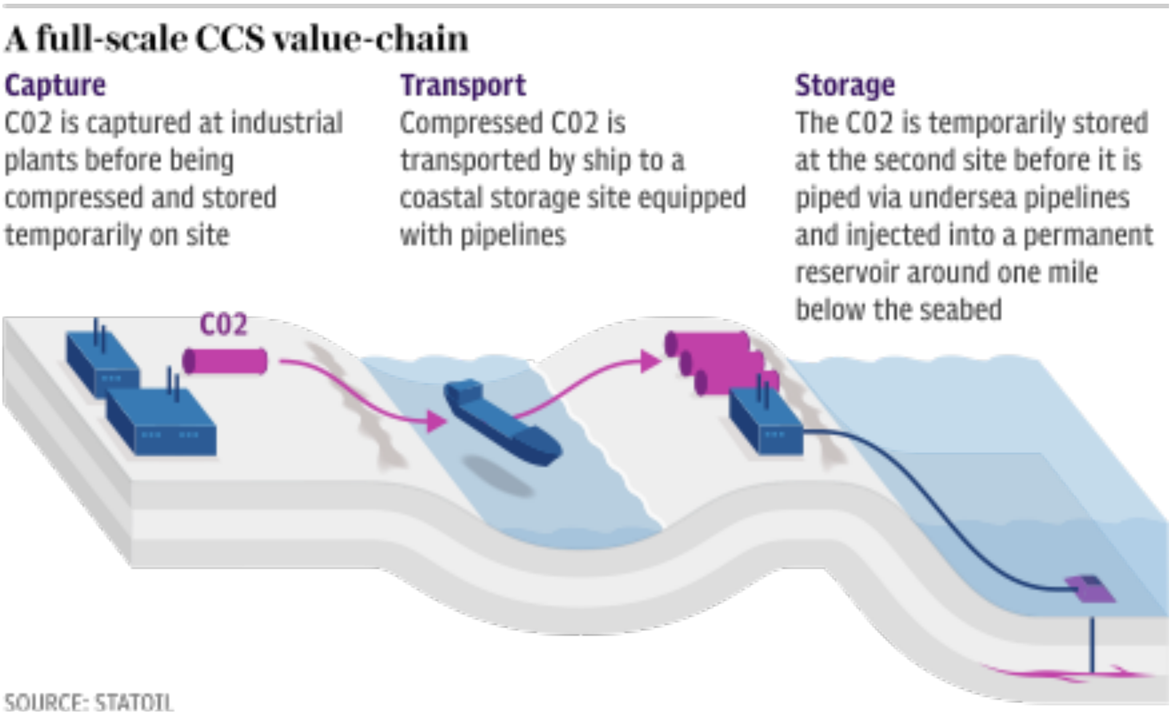
Like many founders in the field, he has passed down the well-trodden route from academia to biotechnology, (https://www.telegraph.co.uk/business/2019/04/03/algorithms-slash-drug-development-time-biotech-firm/) helping to develop what he happily admits “is essentially a fermentation process”, except with CO_2 replacing sugar. The result, he says, is “a big commercial opportunity in the animal feed space.”

From breeze blocks to beer

Meanwhile, Strutt and Parker Farms in Suffolk has turned to the human drink space, capturing the gases from the muck and manure of Newmarket races, then deploying a membrane to refine that to industrial grade CO_2 which it sells to local breweries.

It may sound a convoluted way of putting bubbles in beer, but supply lines have been scrutinised since last year, when a CO_2 shortage was triggered by several European plants closing for maintenance at the same time.

Scientists have even turned CO_2 into alcohol itself - in the form of ethanol, which can also be used in fuel for vehicles, though the technology is only starting to be commercialised.



The process of turning carbon emissions into natural gas fuels, by contrast, is nothing new. Yet what is technologically possible is not always financially viable. In 2012 Air Fuels Synthesis, from Stockton-on-Tees, generated headlines (https://www.telegraph.co.uk/news/earth/energy/fuel/9619269/British-engineers-produce-amazing-petrol-from-air-technology.html) by announcing it could create "petrol from air" in a process which saw the company use CO2 to create methanol and, ultimately, petrol. It went bust in 2016.

Recently, however, advances have made CO2 fuel processes both less expensive and less energy-intensive. One technique uses electrolysis technology to split carbon dioxide into oxygen and carbon monoxide, with the latter mixed with hydrogen to create "synthesised gas", sometimes known as syngas.

Using the cities we live in to fix carbon

Perhaps the biggest target, though, is construction (https://www.telegraph.co.uk/construction-industry/). Around 6pc of all carbon emissions come from the cement industry.

This is no surprise. According to Dr Mohammed Salah-Eldin Imbabi, with the Aberdeen-based firm The Carbon Capture Machine, founded in September 2017, cement is the "world's most popular material" and comes only "second to water in terms of the materials we consume".

Around 4 billion tonnes of cement are used every year, and that figure is rising, expected to hit 6 billion by the end of the decade. This is why the Scottish business sees it as such a big opportunity. "It's a very good sink for CO2," says Dr Imbabi.

He envisages a world where future greenhouse gases are not locked up in the bark and branches of green, rural forests, but in the cementised, thermally-cured blocks of tomorrow's grey, urban forests.

He is not alone. "Our new Leeds plant will permanently capture the same quantity of CO2 every year as 200,000 trees do," boasts the website of Carbon-8, which uses CO2 to produce aggregate for the construction industry. (https://www.telegraph.co.uk/business/2019/02/04/construction-sector-falters-recession-fears-loom/) "Our process permanently captures more carbon dioxide than is generated during its manufacture, making C8Agg the world's first truly carbon-negative aggregate."

Perhaps the most eye-catching British start-up hoping to make a fortune from CO2, however, is Econic Technologies, a British company spun out from Imperial College London. It has developed catalysts and processes it claims can incorporate CO2 into polymers, which it mixes with oil-based raw materials to create anything from mattresses and car seats to bendy phones.

"It has the potential to knock out 50pc of the oil-based raw material and replace it with carbon dioxide," says Richard French at Econic. "And it is beginning to be profitable."

Breakthroughs in creating plastic from carbon dioxide have also been made at the University of Bath, where teams have managed to form "biodegradable" plastics which could be used for lenses of glasses, for drinks bottles and even, potentially, medical implants. (https://www.bath.ac.uk/case-studies/scientists-make-plastic-from-sugar-and-carbon-dioxide/)

From despised waste product to useful raw material

Combined, the efforts of such CO_2 alchemists could see the gas undergo the most radical transformation of all, from despised waste product to useful raw material. Already start-ups like C-Capture, spun out from the University of Leeds, are sourcing CO_2 by "scrubbing" it from major emitters like Drax Power Station, where it began operating in February. Drax and BP both invested in C-Capture that same month.

The reality is that, for more than two decades, the energy industry has done a lot of talking about carbon capture. In the past, however, the aim has always been simply to bury the captured CO_2. Now, it seems, a host of companies want to transform it into something useful, potentially transforming the economics of a process which is backers hope will save the planet and *make them rich at the same time*. That would be alchemy.

"The world clearly has a big CO_2 emissions problem," says Dr Imbabi. "But there is no

THE TIMES
FRIDAY JANUARY 8 2021

Econic Technologies has developed catalysts that allow carbon dioxide to be used to produce polyols

Econic process turns carbon dioxide into green plastic

Peter Cunliffe

Saturday August 19 2017, 12.00am BST, The Times

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Scientists have spent decades trying to turn waste carbon dioxide into a raw material that could be used to produce plastics and now a British company has announced a breakthrough.

Converting the greenhouse gas into one of the building blocks for polyurethane could herald a new age for plastics used in a wide range of products including running shoes, car seats, mattresses and building insulation.

Econic Technologies has developed catalysts that allow CO_2 to be used to produce polyols, which are one of the building blocks of polyurethane.

Not only is CO_2 cheaper than the oil-based raw materials used in production methods, its use also reduces dangerous emissions. Although it is produced in vast quantities by industrial processes, it is highly unreactive, which has made it difficult to use to produce a feedstock for polymers.

Econic said its technology was a gamechanger and it estimated that if it were used in 30 per cent of polyol products by 2027, it would save 3.5 million tonnes of CO_2 emissions each year, equivalent to taking two million cars off the road. It hopes the saving could eventually reach 18 million tonnes.

The company, based on the Manchester Science Partnership's Alderley Park site in Cheshire, said that its process has a big advantage for manufacturers because it was "tunable".

Rowena Sellens, chief executive, said: "The positive potential for businesses and the planet provided by Econic Technologies' catalysts is huge — and so are our ambitions.

"As the tunable catalyst moves out of the lab and into mainstream use, we are aiming to work with our customers to totally transform polyurethane manufacturing, making it greener, cheaper and safer. There aren't many ways to put a green label on polyurethane."

For every tonne of CO_2 used in the process, another two tonnes are saved in the production of the petrochemical alternative. "It won't cure the world's CO_2 problems, but it can take a big bite out of that particular challenge," she added.

The polyol market is worth £15 billion a year and Dr Sellens said that by using Econic's catalyst, producers could cut the cost of feedstock. For a typical production plant with an output of 50,000 tonnes per year that would generate annual savings of £36 million and help manufacturers address growing regulatory pressures.

Dr Sellens said: “People are truly interested in the environmental aspect of it but their willingness to take the risk of adopting new technology is highly lubricated by the fact that there is a strong economic argument as well.”

Econic is working with partners in the chemicals industry on commercialising the process for use in polyurethane but longer term sees other uses such as thermoplastics and lubricants.

Econic was founded in 2011 by Charlotte Williams, who led a team of scientists at Imperial College London and laid the groundwork for the catalyst technology. She is a professor of inorganic chemistry at the University of Oxford and remains a director of the company, which moved to Cheshire in January and employs 26 people, mainly scientists and engineers, including 13 with PhDs.

Financial backers include Touchstone Innovations, formerly Imperial Innovations, Jetstream Capital of the US and Neil Woodford’s Woodford Investment Management.

Another round of fundraising is planned this year and long-term options include a sale or stock market listing, but Dr Sellens emphasised: “The ambition and focus is on growing a sustainable company rather than looking for a quick exit.”

NewScientist

How concrete and condoms could turn a greenhouse gas green

We need to suck CO_2 from the air to solve the climate crisis, but what do we do with it? A budding industry is turning the gas into useful stuff

EARTH 14 March 2018

By Michael Marshall

Bratislav Milenkovic

TAKE a breath. You have just inhaled about 0.6 grams of air, including 0.4 milligrams of carbon dioxide. Had you lived in the 1600s, you would have taken in less than 0.3 milligrams of CO_2 with each breath. Although it might not seem like a big difference, the additional greenhouse gas now in the atmosphere is altering the climate at a pace that threatens global havoc.

What if we could take CO_2 right back out of the air and put it to use? What if, instead of being the most dangerous waste product in human history, it could become the basis for new industries that clean up the planet instead of harming it – and turn a profit too?

That is the promise of carbon capture and use (CCU), a burgeoning industry that has attracted billions of dollars in investment, some of it from major oil and gas companies. There are notable success stories. Already, companies are turning carbon dioxide into plastics, fuel and concrete – meaning that you could build your house or power your car with products that keep carbon dioxide out of the atmosphere.

The real question is whether these start-ups can grow fast enough and to be big enough to make a difference. For that, they need to use enough CO_2 to make a significant dent in the billions of tonnes that we emit each year.

Governments have agreed to reduce annual emissions and limit global warming to 1.5 or 2°C, the international target enshrined in the 2016 Paris Agreement. But they have left it so late that even if we all made huge cuts to our greenhouse gas emissions tomorrow, the target is nigh-on impossible.

A decade ago, policy-makers began advocating the idea of grabbing CO_2 and storing it underground, a technology called carbon capture and storage (CCS). Oil and gas companies had been doing this on a small scale since the 1970s, because it helped their bottom line. By pushing the gases emitted by their industrial plants back down into nearly spent oil seams, they were able to squeeze out the last remaining drops of crude.

On a technical level, CCS works. The Boundary Dam coal-fired power plant in Canada has been burying much of its CO_2 emissions since 2014, for example. But despite a number of governments appearing to back the technology in the early 2000s, CCS is stuck on the starting line. The sector has come up against a significant challenge: capturing carbon is expensive, and there are no financial rewards for storing it.

That is where the "use" bit of CCU comes in. Could CO_2 make money? Aside from enhancing oil extraction, it forms the bubbles in fizzy drinks and fuels plant growth in greenhouses. All this adds up to a global demand of about 80 million tonnes each year, according to a 2011 report by the Global CCS Institute. This is a mere 0.2 per cent of the 37 gigatonnes emitted globally in 2017. To increase that, researchers are now proposing that instead of trying to use pure CO_2 directly, we should make other things with it. The gas is already used to produce urea, for instance, sold as fertiliser. And in the 19th and early 20th centuries, chemists developed reactions involving carbon dioxide to make something that most of us have in our medicine cabinets: acetylsalicylic acid. "Aspirin was probably the first [product] to be done commercially," says Peter Styring at the University of Sheffield, UK. The drug was initially extracted from willow bark. Then, in 1859, Hermann Kolbe at the University of Marburg in Germany found that he could produce aspirin's precursor, salicylic acid, by reacting sodium phenolate with CO_2.

But since these early experiments, few reactions have been devised that use the chemical, says Charlotte Williams at the University of Oxford. As a result, many of the fundamentals of CO_2 chemistry are still unknown, including how to break the bonds between the oxygen atoms and the carbon at the centre of the molecule. Carbon dioxide is fairly unreactive but certainly not inert, says Styring. “It needs a little bit of help to react.” That help comes in the form of catalysts, which lower the amount of energy that has to be put in, and so much of the research around CCU involves finding the right catalysts for the job.

Sunfire, in Germany, is building power plants that convert water and carbon dioxide to liquid fuel
Sunfire GmbH, Dresden/renedeutscher.de

Williams has had her own trials and tribulations attempting to break carbon dioxide’s bonds. Her expertise is in polymers, the long, chain-like molecules that plastics are made of. At the start of her academic career, in the early 2000s, she became fascinated by the idea of taking the carbon out of carbon dioxide and using it to build a polymer backbone. The idea was simple but impossible to implement without the right catalyst to start the reactions. “We went through four years of complete failure,” she says, before finally identifying several that worked.

Her team immediately filed patents and formed Econic Technologies, based in Macclesfield, UK. Today, the firm sells its catalysts to major chemical companies making polyurethane, a plastic widely used in insulating foams, kitchen sponges, the wheels on shopping carts and skateboards, and even latex-free condoms.

Williams brought samples of plastics that had been made using Econic’s catalysts to a meeting on CCU just outside London in October 2017, where dozens of researchers, investors and industry representatives gathered to discuss the prospects of the growing industry. The meeting was convened by the Sackler Forum, a collaboration of the UK Royal Society and the US National Academies of Sciences, to assess the potential of CCU technologies and look at the range of existing ventures, from synthetic fuels to building materials (see “Out of thin air”).

Some of these may seem odd at first glance. Why change carbon dioxide into artificial petrol? The reason is that by doing so we can keep using familiar, liquid fuels in our existing infrastructure without digging up additional fossil reserves. In theory, fuel made from CO_2 should also be carbon neutral, generating no net greenhouse gas emissions: carbon dioxide equivalent to that released as the fuel is burned is captured and recycled to make the next batch of fuel.

“Aspirin was probably the first commercial product to be made from CO_2”

This is particularly useful for aircraft, which need a lot of energy to fly long distances, but can’t carry heavy batteries powered on eco- electricity. Today, they burn energy-dense but polluting kerosene. An artificial kerosene made from CO_2 might be the best way to make planes climate-friendly, says Styring.

Similarly, it may not seem obvious that CO_2 can be used to make buildings, but it is a simple chemical step away from limestone and other carbonates. “I can take a slurry of calcium oxide, put CO_2 into a bottle, shake it up and it’ll react very quickly [to make calcium carbonate],” says Styring.

All these reactions depend on new catalysts like Econic’s, and much of the talk at the Sackler Forum centred on trial-and-error attempts to find the ones that work best, minimising the energy we must put in.

The other challenge the meeting highlighted was hydrogen. Many CCU products, including some of the synthetic fuels, are built around a carbon and hydrogen backbone that we can make only if lots of hydrogen is available to react with CO_2. The trouble is, hydrogen gas is hard to come by. Its molecules are so light that the newly formed Earth had already lost almost all its free hydrogen to space. Nowadays, the planet’s hydrogen is locked up in molecules like water, and breaking them apart, as with CO_2, takes energy.

The hydrogen hurdle may simply narrow the usefulness of CCU, says Styring. It might not be worthwhile to create synthetic fuels for cars if you have to first make hydrogen – we can make electric cars instead. But the trade-off might make sense for aircraft since batteries cannot carry enough power for them.

Undoubtedly, it is early days yet, but it hasn’t stopped big bucks from pouring in. “We think that by 2030 the market opportunity would be between 800 billion and 1.1 trillion dollars a year,” says Issam Dairanieh of the Global CO_2 Initiative, a private company that both funds research into CCU and invests in start-ups working in the field.

The company estimates that CCU's future market potential is about double the size of today's smartphone market. Coming from an organisation that has money in the game, that shouldn't be a surprise. But it is worth noting that big oil is also dipping its toe in the CCU pond. The Oil and Gas Climate Initiative (OGCI) is a collaboration between large fossil fuel companies, including Shell, BP, Statoil and Total. Together, they have committed to investing $1 billion in CCU start-ups over the next 10 years. Pratima Rangarajan, CEO of the OGCI's investment wing and formerly employed in the renewables sector, says CCU is in the same place recycling was 20 years ago.

Carbon recycling

"People said, 'Look, there's no way everyone's going to collect all the rubbish and people won't separate it'," she says. Newspapers also mocked the idea that they might one day be published on "second-rate recycled paper". Yet in 2016, 67 per cent of paper used in the US was recycled, according to the American Forest & Paper Association.

Rangarajan says CCU needs to become normalised the way recycling has been. "If it's just 10 companies and only we are successful, we might make a lot of money, but we're not going to make the impact we need," she says.

Profit is ultimately what people like Rangarajan hope will distinguish carbon capture and use from its predecessor, carbon capture and storage. "It has to make commercial sense," says Dairanieh. The firms may need help at the start, but ultimately some will succeed and make money.

Governments could provide support in a number of ways, from accelerating patent applications to setting a high price on carbon emissions. The latter is a long-cherished dream of many climate activists. A global price on carbon is still a long way off, but regions are setting precedents, such as in the Canadian province of Ontario, where a sweeping carbon price system came into force in January 2017.

"We need to move towards a circular economy, where everything is reused"

Even if all this comes to pass, CCU is not, by itself, going to mop up all of our greenhouse gas emissions. In 2015, Styring and his colleague Katy Armstrong outlined a "realistic yet challenging" scenario in which we would make use of 1.3 gigatonnes of CO_2 annually by 2030. That is only 3.5 per cent of our current annual emissions. A more optimistic report published in 2016 by the Global CO_2 Initiative, using data from consultants McKinsey, said we could be using 7 gigatonnes of CO_2 per year by 2030 – still far short of what is needed.

There is also the matter of timing. Most CCU technologies are "still in the difficult phase of needing to prove [themselves] at scale, engage with customers and get product to market", says Williams. So CCU is not the proverbial silver bullet. "The way to solve [climate change] is to stop burning fossil oil, and that's the only way," says Styring bluntly.

CCU's promise is that it fleshes out a vital principle. Every year, environmentalists mark Earth Overshoot Day: the point when our collective demand for resources passes what the environment can generate in a year. In 2017, it fell on 2 August. To stop us living on credit, many environmentalists advocate moving towards a circular economy, one where everything we use is reused. Not just paper and glass, but every by-product of industrial processes – including gases. As one participant pointed out at the Sackler Forum: "Carbon dioxide is the only gas we can emit into the atmosphere with impunity." It is time we started recycling it.

Out of thin air

A flurry of companies are selling products that use carbon dioxide. The gas is either extracted from industrial emissions before they are released or sucked from the air

Carbon8 Aggregates (UK)

Creates a building material from industrial waste and contaminated soil using CO_2

CCm Research (UK)

Has developed a system to enrich fertilisers with carbon from CO_2 and make CO_2-coated fibres that are incorporated into plastics

Covestro (Germany)

Makes polyurethane plastics for mattress foams

Sunfire (Germany)

Has developed a synthetic fuel called Blue Crude. Mass production is scheduled to begin in 2020, using CO_2 from air capture. Partnered with Audi

Oberon Fuels (California)

Makes dimethyl ether, a synthetic diesel that emits less particulate pollution and no sulphur. Partnered with Volvo, Ford and US truck manufacturer Mack

CarbonCure (Canada)

Sells a system that infuses CO_2 into concrete. The firm announced in January that a major US producer, Thomas Concrete, will be installing the technology at 22 of its plants

Solidia Technologies (New Jersey)

Makes a concrete that locks up CO_2. Claims to reduce energy and water use

This article appeared in print under the headline "From pollution to solution"