

Starting from under £45 ex vat

MISCO.co.uk  
sustainable  
IT PROCUREMENT

If this page does not print out automatically, select **Print** from the **File** menu.

## Carbon Dioxide Turns Useful

A new breed of start-ups are finding ways to convert CO<sub>2</sub> into high value materials, simultaneously cutting carbon emissions and providing manufacturers with green raw materials, Sarah Fister Gale investigates

Sarah Fister Gale, Greenbiz.com, [BusinessGreen](#) 27 Nov 2008

While most of the world is looking for ways to reduce their carbon emissions, a few innovative companies are instead looking for ways to take advantage of this vast and otherwise wasted resource.

From plastic bottles and paper to concrete, vinyl sidings and fuel, researchers are transforming carbon dioxide from a destructive planetary force into a stream of valuable renewable products.

Although most of these companies are in the early stages of development, they are quickly gaining attention and venture capital funding from intrigued environmentalists, investors and companies that would like to turn their waste CO<sub>2</sub> into something of value.

### "Zinc-Based Fairy Dust"

[Novomer](#), a materials company based in Ithaca, New York, is one of the most highly publicised players in this emerging field. The four-year-old company, led by president Charles Hamilton, is developing a line of high-performance, biodegradable plastics, polymers and other chemicals using carbon dioxide and carbon monoxide. The company was built around technology developed at Cornell to use CO<sub>2</sub> as a building block for chemicals to produce plastics.

"We can currently make materials that are 50 per cent CO<sub>2</sub> by weight," says Hamilton, who notes that most plastics are made with 100 per cent fossil fuel, and that nine per cent of the world's fossil fuels are used to make plastic. " With this process, we cut that use of fossil fuels in half."

Along with commercial applications, such as plastic bottles and packaging, the materials Novomer is developing can be used in industrial applications requiring a binder that decomposes rapidly, cleanly and in an environmentally friendly manner.

The benefit of such a process is twofold, notes Hamilton. "It captures CO<sub>2</sub> that would otherwise be released into the environment, and that CO<sub>2</sub> replaces the need for fossil fuels," he explains.

Because the materials are biodegradable, the captured CO<sub>2</sub> will eventually be released back into the atmosphere. However, the biodegradability prevents the production of new

CO<sub>2</sub> and eliminates the problem of landfills piled with empty plastic bottles and packaging materials that will outlive us all.

"You don't need a detergent bottle that lasts 1,000 years," says Hamilton. "Our material breaks down in compost conditions in six months."

Novomer's team is also looking at producing materials that would have longer life spans and could be used in applications such as plastic coatings for building materials, foam insulation, and coatings that require a non-biodegradable or longer life profile.

The trick of the technology is getting the CO<sub>2</sub> to react with other chemicals to convert it to a useful feedstock for materials without requiring a lot of energy. "It's difficult to make CO<sub>2</sub> react," Hamilton says of the chemistry.

After years of trial and error, Novomer has found a chemical that works as an effective catalyst with a mixture of liquid epoxide and raw CO<sub>2</sub>. "We think of it as zinc-based pixie dust," he says. "You take a bit of the catalyst and sprinkle it on mixture and the reaction is like a pressure cooker."

The catalyst zips the epoxide and the CO<sub>2</sub> together, forming a polymer with the consistency of honey. What's impressive about Novomer's process is that it only requires 150 psi to convert the mix to a polymer, which means it is more easily scalable because it requires less energy, and thus less cost.

Now the company is looking for reliable sources of CO<sub>2</sub> and epoxide to scale up production. Concrete manufacturers make the cleanest CO<sub>2</sub>, according to Hamilton. "The tricky bit is sourcing the epoxide near the source of the CO<sub>2</sub>," he says.

The company is in talks with chemical companies about forming partnerships to move the technology forward, and it's already received funding and support from [Physic Ventures](#), the San Francisco-based venture capital firm focused on supporting science-based, consumer-directed health and sustainable living companies. Physic is supported by several global homecare products brands, including Unilever, which could stand to benefit from such an innovative technology.

"These companies are interested in alternatives to 100 per cent fossil fuel based materials," Hamilton notes.

Andrew Williamson, director of Physic Ventures agrees. "We are looking for products and technology that enable a sustainable lifestyle," he says.

Physic was drawn to Novomer's green chemistry because it can convert CO<sub>2</sub> into a biodegradable polymer without using a lot of energy or water, and it doesn't produce toxic by-products, says Williamson. "In our scouting for green technologies, Novomer is the best company we've seen in a while," he adds.

But it is certainly not the only one. There is a growing industry emerging in which chemists with a green frame of mind are applying scientific innovation to the capture and applications of CO<sub>2</sub>.

### **Paper, Concrete, Fuel**

[Calera Corporation](#) in Los Gatos, California, for example, has developed a nature-mimicking

process that converts CO<sub>2</sub> into cement - which is a product known for producing high levels of CO<sub>2</sub>. By removing CO<sub>2</sub> from the atmosphere in the process of making a product that usually produces a lot of CO<sub>2</sub> using other methods, the company is in a position to help reverse human-caused global warming and ocean acidification.

The company's founder, Brent Constantz, has stated that its able to sequester half a ton of CO<sub>2</sub> in every ton of cement it makes.

**Carbon Sciences** is another company gaining a lot of media attention for its process of turning CO<sub>2</sub> waste into carbonate, and eventually into fuels. The company, led by chief executive Derek McLeish, is focusing on two applications for its technologies. In the near term, says McLeish, the company is working on a CO<sub>2</sub>-to-carbonate technology that combines CO<sub>2</sub> with industrial waste minerals and transforms them into calcium carbonate, a high value chemical compound used in paper production, pharmaceuticals and plastics.

"In your everyday life, you touch many products that either contain calcium carbonates or use them during production," he says. Carbon Sciences' technology is capable of capturing 440 kilograms of CO<sub>2</sub> for every ton of precipitated calcium carbonate.

"This technology offers two benefits: it lowers the cost of production and it is carbon neutral," he says, noting that it would enable paper plants to transform their own CO<sub>2</sub> emissions into precipitated calcium carbonate for use in paper production. "It turns the paper industry into a neutral CO<sub>2</sub> emitter instead of a gross CO<sub>2</sub> emitter."

The company is currently demo-ing the process and scaling up a pilot plant to showcase its applications. McLeish expects to be in full production within three to four years.

The company's longer term development plans focus on transforming CO<sub>2</sub> into basic fuel building blocks required to produce gasoline, diesel fuel, jet fuel and other fuels.

### **Part of the Solution**

While companies like these are not an end-all solution for removing carbon dioxide from the atmosphere, they are a bold step in the right direction.

"You can't bet on the regulatory environment to give carbon credits forever, " notes McLeish. "Technology got us into this mess, now technology has to get us out."

The innovations of the leaders at Carbon Sciences, Novomer and others are creating alternatives that can make product manufacturers leaner and greener, and offer another avenue for reducing the harmful impact of carbon dioxide on our world.

"We don't see ourselves as taking on all the CO<sub>2</sub> in the world, but we do see ourselves helping to reduce our reliance on fossil fuels," says Hamilton.

"Everyone wants to reduce the CO<sub>2</sub> of their products," agrees Williamson. "If we can find ways to sequester CO<sub>2</sub> rather than make CO<sub>2</sub>, we've turned an environmental loss into a gain."

Based on the innovations of these companies, it's a trend that is bound to offer many more solutions in the near future.

*Sarah Fister Gale is a freelance writer based in Chicago*

*This article first appeared at [Greenbiz.com](http://www.greenbiz.com)*

Permalink: <http://www.businessgreen.com/2231410>

[www.businessgreen.com/2231410](http://www.businessgreen.com/2231410)

---

This article was printed from the **BusinessGreen** web site

© Incisive Media Ltd. 2008

Incisive Media Limited, Haymarket House, 28-29 Haymarket, London SW1Y 4RX, is a company registered in the United Kingdom with company registration number 04038503

---

**Close** this window to return to the website

---

Starting from under **£45** ex vat

**MISCO**.co.uk  
sustainable  
IT PROCUREMENT