

Forbes

OCTOBER 31, 2005 | WWW.FORBES.COM

Innovation

Where does it go? Computers, fax machines, cell phones, refrigerators, microwave ovens. What they have in common is that when they break down it is cheaper to toss than to repair them. Metal recyclers suck out most of the valuable stuff, but much of the rest goes into landfills. New regulations in Europe require producers to take back and recycle electronic and electrical waste. Some burn the plastics that are left. Mike Biddle, a California entrepreneur, is building a business around a better solution.



Innovation



Junk Into Money

Here's one fellow who has no objection to \$65 oil: a plastics recycler | By Kerry A. Dolan

COURTESY BEGINS INSIDE Michael Biddle's 45,000-square-foot recycling plant in Richmond, Calif. Pieces of fax machines, telephones, keyboards and cell phones are fed into green hoppers atop 20-foot-tall chutes. Pipes and conveyor belts run everywhere. Amid the whirring fans and clanging grinders, you can pluck out the sounds of metal clinking as it gets socked out by ejectors, plastic ping-pong as it is pulled away from foil and paper, air jets whooshing as they separate light-color plastic from dark. Out the end come gray pellets, sorted into six or more grades of reusable plastic.

To Biddle it's a symphony, the result of nearly two decades of hard work. He claims to be the first to figure out how to take nearly any kind of plastic trash, which is usually a mongrel blend of up to 20 different plastics, and separate it by chemical

type. Biddle's factories make the three important plastics used in durable goods and electronics: polypropylene, acrylonitrile butadiene styrene (also ABS) and polystyrene. "We're changing the way plastic is made, just like minimally changed the way steel was made," he says.

Every year 40 million tons of plastic—in cars, refrigerators, personal computers, fax machines, coffeemakers, food bins, bottles and so on—are dumped in landfills in the U.S. Landfill space happens to be plentiful at the moment, but it might not be for long, and in any event many Americans are wracked with guilt at the notion of all this compressed garbage sitting around. Pressure to recycle is building. In Europe it is mandatory for producers of electronic goods to take back their products and recycle them.

The swelling waste stream is the fuel for Biddle's MBA Polymers. "They're clearly pioneers. If anybody's in a position to suc-



MBA Polymers' recycling plants cost between \$14 million and \$23 million to build—half the sum needed to construct a virgin plastic plant with the same output. To begin the recycling process, chunks of fax machines and computers are fed into hoppers and go through a series of automated steps—many borrowed from other industries—that suck out metal, wood, foil, dust, foam and the like.

ceed, it's MBA Polymers," says Michael Fisher, senior director of technology at the American Plastics Council, an industry group of the largest plasticsmakers. The economics of Biddle's business may, in the end, hinge on getting paid to take discarded plastic items off people's hands.

At the pilot line in Richmond, MBA Polymers can process 3 tons an hour of plastic waste. Two new factories opening in the next several months, one in Guangzhou, China and another in Anatria, will more than quadruple that capacity, each churning out 45,000 tons of plastic annually. "We will have the most advanced plastics recycling on the face of the planet," boasts Biddle.

Put this in context. Just one polystyrene plant, Total's in Carville, La., could churn out 825,000 tons of plastic a year at full capacity. But MBA could make a notable dent in the waste heap. Biddle says he can build more 45,000-ton recycling plants for between \$14 million and \$23 million each, half the cost of erecting a virgin plastics factory with the same output. And, because he's not making the plastic from oil, his energy consumption is only 5% to 10% that

of a virgin plastics plant.

About half the time MBA gets paid to take unwanted scrap. Over time, Biddle hopes, the green marketing cachet will enable him to sell his output at a premium. Profits are still elusive at the moment, but Biddle predicts that they will arrive next year on \$10 million in revenue.

Biddle says his output is chemically the same and just as durable as virgin raw material but concedes it doesn't take color

like a fax machine or keyboard may be made out of different types of plastic of varying grades blended with flame retardants or brewed to suit different production methods such as extrusion, blow molding or injection molding. You can't just melt it all down. Extruded plastic is like peanut butter when melted; the injection-molded stuff looks like syrup. The challenge of separating the types and grades of plastic is a big reason only 2% to 4% of plastics are

recycled in the U.S., versus 71% of steel.

Biddle, 49, set his sights on closing that gap when he started MBA Polymers 11 years ago. An outdoorsman and self-described environmentalist, Biddle says, "As a kid I would go around and turn off the light switches when someone left the room." After getting his Ph.D. in plastics engineering from Case Western Reserve in 1987, Biddle scored a research post at Dow Chemical's lab in Walnut Creek, Calif. He suggested to his boss that Dow work on plastics recycling. After spending \$7 million from government and private sources, he eventually got a pilot line going at Dow, but the project never moved beyond the labs.

In 1992 Dow shut down its Walnut Creek lab and Biddle went off on his own, consulting for the plastics, automotive and electronics industries on what it would take to recycle plastics. In doing so he schooled himself on sorting, crushing and separating technologies used in a variety of industries, including metals recycling, mining and grain processing. He set up a miniature lab in his two-car garage in Pittsburg, Calif.: a wet chemistry setup and a bunch of measuring instruments including scales, sizing screens (some he built himself) and other lab equipment he scavenged from auctions. When neighbors wandered by to ask what he was up to, he'd show them samples of shredded computers and the like. "Some thought I was just a crazy scientist and others applauded me for trying to save the world," recalls Biddle.

In 1994, with a \$1 million loan from the state of California, he moved from his garage to a

10,000-square-foot space in Berkeley, with four employees. By 1997 Biddle was convinced he had accumulated more knowledge than anyone about complex-plastics recycling. Rather than sell his ideas to others, he decided to create a real business. Since then he has raised \$30 million from angel investors, venture capitalists and two formidable companies: GE's plastics and capital divisions and contract manufacturer Flextronics International. He says he owns between 10% and 20% of the company.

The plants he's building around the world subject plastic waste streams to 30 transforming steps, half of which Biddle borrowed from other industries. Before the plastic even reaches MBA Polymers, it goes to a metal recycler, where most of the metal is removed and the equipment is shredded into pieces anywhere from 5 to 12 inches long.

The first dozen steps separate all the nonplastic stuff, which can make up as much as 40% of the incoming material. Magnets pluck out ferrous metal such as steel and iron. It is possible to grab nonferrous metals like copper and aluminum by subjecting them to oscillating magnetic

"We will have the most advanced plastics recycling on the face of the planet."

as well—the cool blue, say, of a Dell notebook. "It's probably best used for internal parts," says James Sachernin, former chief marketing officer at contract manufacturer Flextronics International, which owns a piece of MBA Polymers.

Plenty of plastics recyclers exist already, but they almost all focus on much simpler streams of material than Biddle is tackling. Plastic soda bottles made of polyethylene terephthalate, or PET, can be washed, shredded and extruded into new pellets of PET.

recycled in the U.S., versus 71% of steel.

Biddle, 49, set his sights on closing that gap when he started MBA Polymers 11 years ago. An outdoorsman and self-described environmentalist, Biddle says, "As a kid I would go around and turn off the light switches when someone left the room." After getting his Ph.D. in plastics engineering from Case Western Reserve in 1987, Biddle scored a research post at Dow Chemical's lab in Walnut Creek, Calif. He suggested to his boss that Dow



Fields that induce eddy currents. This creates a tiny magnetic pole in the metal scrap, enabling it to be flung off a conveyor belt into a collection bin. The remaining plastic waste is shredded until the pieces are the size of a small fingernail. The size reduction dislodges things like wood, foam and foils that may be attached to the plastic. These unwanted bits are separated with air classifiers invented in the food-processing industry to winnow chaff from grain. Then comes the hard part, separating the plastic bits by polymer type. The company has three patents awarded and five more pending.

There have been setbacks. In October 2000 the factory in Richmond caught fire and one worker died. The line was down for nearly a year and MBA Polymers insurers paid \$ million to settle lawsuits brought against it. The suspected cause: dust from toner cartridges. MBA no longer accepts toner cartridges.

Biddle wants to build at least five more factories with joint venture partners in the next five years. Most will be in Europe, where the greens are ascendant and demand for his services is greatest. China is anything but green, but demand should be strong there, too, since

his plants use less energy and water than virgin plants do, and both those components are in short supply. China imports 50% of its plastic and is the fastest growing plastics market in the world. If all goes well, Biddle will take a piece out of the trade deficit as well as the neighborhood landfill.



The Story of Garbage

Plastics recycling rates are among the lowest because of the challenges involved in separating the different types.

72 million tons amount of trash recycled in 2003

15 million tons amount of trash recycled in 1980

93% amount of **auto batteries** recycled

71% amount of recycling in the **steel industry**

48% amount of **paper and paperboard** recycled

44% amount of **aluminum, beer and soft drink cans** recycled

32% amount of **plastic milk containers** recycled

22% amount of **glass containers** recycled

2% to 4% estimated amount of **all plastics** recycled

48 cents price per pound of virgin high-impact polystyrene in 2002

68 cents price per pound of virgin high-impact polystyrene in 2005

Recycling figures are for U.S. Sources: Environmental Protection Agency; Plastics Technology; Recycling Today; MBA Polymers.