

**JOHN BORDYNUIK'S
PLAN TO**

FIX THE WORLD

**Turning plastic into fuel:
this kind of technology is an economic and
environmental game changer**

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John Bordynuik wants to fix Niagara. To be fair, Bordynuik's ambitions are bigger than that. He's already helped the Massachusetts Institute of Technology (MIT) recover decades of lost research results. He's worked with NASA to protect and archive half a century's data on earth science and space exploration. And now he has his sights set on solving not one, but two of the world's great environmental challenges.

Every year, 5.5 quadrillion (5.5×10^{15}) pellets of plastic are produced worldwide, weighing some 115 billion kilograms (250 billion pounds). Even in wealthy countries like Canada and the United States, as much as 94 per cent of this plastic eventually ends up in landfills. Plastic clogs our waste management system. It litters our streets. It gathers in the ocean, massing in colourful floating reefs, where—according to the United Nations—it kills more than one million seabirds and more than 100,000 sea mammals and sea turtles each year. And Bordynuik plans to clean up this mess.

At the same time, the planet faces dramatically escalating energy pressures and challenges. Oil is increasingly expensive, and subject to growing demand as nations such as China and India race to join the industrialized world in energy consumption. Some argue that we've reached "peak oil"—the point at which demand is beginning to outstrip available supply. Gasoline and energy prices are set to spiral higher, as we wrestle for control over a finite resource. And Bordynuik has a plan to address this challenge.

In fact, Bordynuik's plans for cleaning up the plastic and for easing the pressures on the world's oil supply are one and the same. Working from his offices in Niagara Falls, he's found a way to turn plastic into oil. This kind of technology is an economic and environmental game changer.

"This is it," he suggests nonchalantly. "This is the home run."

If Bordynuik can bring his technology to market, he will change the world. And then he can fix Niagara.



John Bordynuik, 40, was born and raised in Fonthill, and demonstrated his passion for fixing and building technologies at an early age. At seven he began building his own simple robots. By 10, he'd mastered basic computer programming, and soon the robots he made were no longer simple. By the time he was a teenager, he was writing accounting software for his school's administration, and developing the mainframe security system for Grimsby Hydro. His IQ has been measured at 170, in the high genius category.

Like many young Niagara residents, Bordynuik was lured away to the bright lights after high school. He lived in Toronto for more than a decade, eventually settling into a role at Queen's Park as Director of Research and Development for the Ontario Provincial Legislature. It's quite possible that he could have settled into a quiet life of public service, except that his real passion lay in other directions.

Above all, he likes to fix things. He likes to roll up his sleeves and apply his know-how and his energy to solving technical problems. And Bordynuik has a lot of know-how—expertise in software, in data processing, and in information technologies. So in 2006, he left the legislature and moved back to Niagara-on-the-Lake. He set up shop in a rundown warehousing space in a decaying strip mall in Niagara Falls, and opened the doors of John Bordynuik Inc. (JBI), a company dedicated to technical fixes.

One of the first "fixes" he turned his attention to was the problem



JBI recently acquired a 1 million litre fuel-blending and distribution facility in Thorold, which will house the first processor in Canada. Fuel from the P20 processors is blended with additives to make gasoline and diesel that can be sold at the pump. The fuel will first be sold to industrial sources, but in Q4 of this year, they will sell to independent gas stations.

of lost data. Since the 1940s, as computers have become more and more sophisticated, they have changed and evolved with great frequency. Part of this evolution relates to data storage techniques. Card readers gave way to reel-to-reel tapes, which gave way to floppy disks, which gave way to CD-ROMs, which gave way to flash drives, and so on. But somewhere in the rush to innovate and improve, we actually began to lose track of some of the old technology. Eventually we couldn't even read the data stored on some of the abandoned storage technologies. Enter JBI. In collaboration with MIT's Computer Science and Artificial Intelligence Laboratory, Bordynuik developed technology to read MIT's old tapes from the 1960s to the 1990s. Spurred on by this initial success, JBI was retained by NASA to recover data from decades of research, resulting in tens of thousands of tapes with space science and earth science research projects. NASA soon became a permanent client, and JBI was away to the races.



Back in 1984, journalist Steven Levy wrote the groundbreaking book *Hackers: Heroes of the Computer Revolution*. Released long before iPads and iPods, before notebooks and laptops, even before the Internet was widely accessible, the book was a window into an emerging world. Levy focused his book on the actions and ideas of a small group of unknown "techies" who hoped to reshape the world. He called them "hackers," and suggested they "inspired a generation of programmers, thinkers and entrepreneurs—and not just fellow techies . . . The kind of hacker I write about was motivated by the desire to learn and build . . ."

What characterized these hackers was their desire to break problems down into their smallest possible parts, and reassemble them in ways that gave rise to novel ideas, innovative solutions and new technologies. Sure, these hackers knew their way around a computer,



but their real goal was changing the way the world worked. Twenty-five years since the publication of Levy's book, it's astounding to see how completely they have changed the world. Among the struggling, anonymous hackers Levy profiled were Microsoft founder Bill Gates, and Apple co-founders Steve Jobs and Steve Wozniak.

Bordynuik seems to bring much of the same hacker ethos to his work. His goal is not just to create a company, or to sell products. Bordynuik wants to solve problems, to fix the world by taking things apart and reassembling them in new and exciting ways. And after his successes with MIT and NASA, he began to think about bigger fixes to bigger problems. Recognizing that companies and institutions around the world were unwittingly facing the same problems as NASA, he began buying up abandoned data storage devices, especially old data tapes. While everyone else was throwing them away, he began to acquire them. JBI now owns an engineering archive of 60 million documents, representing millions of person-hours of research time and millions of dollars of research investment, much of which the rest of the world has forgotten about. Today, JBI is beginning to data mine those documents for technologies and ideas that will lead to a new generation of ideas for fixing technical problems.

To be fair, this is not a straightforward process. JBI can't push a search button called "plastic recycling" and watch as potential technologies emerge, neatly categorized, from the laser printer. What JBI does is to focus on analyzing and understanding large quantities of research data, looking for ways to make connections between long-forgotten studies and reports, to see how decades of experiments and explorations can be brought together to create a single innovative idea worth pursuing today. From the outside, it looks like some kind of supercharged Google search. For those who know the data field, it's more like Bordynuik is some kind of orchestra conductor, building a symphony from the disparate notes of a hundred forgotten scientific researchers. Sometimes, what emerges is cacophony—just noise and confusion. But sometimes, on those rare occasions where the conductor and the orchestra are in sync, what emerges is pure genius.



Bordynuik doesn't like to talk about where the plastic to oil technology came from. In part, there were some abandoned military technologies in the engineering archive, though that's only a piece of the puzzle. But his secretive approach lies mostly in the fact that the plastic to oil opportunity—referred to in waste management and environmental circles as "P2O"—is such a huge business opportunity. Around the world, dozens of companies are trying to make a go of P2O technologies, sensing a multimillion-dollar market.

In most of the world, companies and communities pay to dispose of plastic. Whether it comes out of the back end of a factory, or out of a municipal blue box collection program, someone is getting paid to take the plastic away. The cost of hauling this plastic away varies with geography and market conditions, but normally falls within a range of \$30 to \$100 per ton. If a technology emerged that could take this plastic at a lower cost, demand would be huge. If that plastic was used as a "feedstock" that could then be turned into a marketable commodity like gasoline or oil? Then the opportunity gets big enough to make investors stand up and take note.

The problem is that P2O isn't that easy. In theory, most plastics are originally made from oil, and it should be easy to reverse the manufacturing process. There are lots of companies that can do it, like Envion in Maryland, Agri-Plas in Oregon or Blest in Japan. However, for most of these companies, there are still technical and financial problems to be overcome. Many of these operations use "infrared heating" or "microwave frequencies" or "depolymerization," mostly code words for heating up the plastic until it melts and some of the oil runs out. Unfortunately, this approach takes huge quantities of energy, and leaves a lot of waste material. The problem is so acute that last year, the United Nations released a report questioning the viability of the entire P2O concept.

JBI's solution to the P2O challenge comes from a completely different starting point. Earlier this year, JBI built a pilot processing unit on an industrial site in Niagara Falls, New York. In its initial testing phase, Bordynuik suggests that "we used 2,000 BTUs of energy to convert one kilogram of plastic to fuel. This produced 44,000 BTUs of fuel, most of it nice, clean diesel gasoline." Today, the large scale processor is "working very well" and is running at steady state and at 20 tons/day or 109 barrels of fuel.

Overall, the process produces a mix of diesel gasoline (about 90 per cent) and natural gas (about 8 per cent). The diesel fuel is an easy commodity to sell commercially, but natural gas is more problematic. "As we began testing," recounts Bordynuik, "everyone's dream became a nightmare. What do we do if we produce too much natural gas? We were producing 4500 ft³ of excess natural gas per hour. So we built a gas compression system that puts the gas back into the furnace to feed the processor." In other words, Bordynuik found a technical fix so that the P2O processor now uses the natural gas to power itself.

Bordynuik is confident his P2O process will work on a commercial scale. "We can build our processing units for one hundred and sixty to two hundred thousand dollars. Our competitors, using technology that doesn't really work, sell their units for five to seven million dollars. The low capital outlay means we can keep our return in investment high, and our roll-out costs low." He estimates that each kilogram of plastic filtered through his processors produces the equivalent of one litre of oil. And with 115 billion kilograms (250 billion pounds) of plastics being produced globally each year, he sees a lot of potential oil. Part of his strategy rests on licensing low-cost processors for use at landfills and recycling facilities around



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the world. Part rests on fitting ships with processors, and collecting some of the billions of kilograms of plastic floating in the world's oceans.

To prepare for these efforts, JBI has recently acquired a fuel-blending facility in Thorold, which will house the first processor in Canada. The site enables the company to blend fuel from the P2O processors with additives to make gasoline and diesel that can be sold at the pump.

"The fuel from the blending site will be sold to industrial sources first because they are supplying us with great plastic and wish to purchase the fuel for their own trucks. We intend to use the blending site to sell fuel to independent gas stations in Q4 this year," says Bordynuik.

The company plans to expand the pilot processing facility in Niagara Falls, New York shortly, and envisions a rapid move into the marketplace. Bordynuik, though, is focused on more than just the financial possibilities as the company expands. "You get to a point in your life where you decide that you're going to take on a project that is positive and interesting, that has some lasting positive impact. . . A project like this, as we make it better, will greatly support environmental efforts. Its benefits far outweigh the costs. Usually I like to take on the technology problem, but this has so

much more. . ."

Bordynuik seems to be thinking about the "more" a fair bit these days. He recently married Lynn, a personal trainer. Together, their blended family consists of four boys, aged 18, 17, 15 and 13. "What I'm trying to do is important," he suggests. "A lot of kids that grow up here. . . well, at 18 they go off to school and they don't come back."

Bordynuik knows that his P2O technology may have a global impact, but the impact that he's most interested in is the one it could have on Niagara. "Our own kids have to get jobs and move away. I brought JBI here because that's what's going to create jobs and keep people here. It's what will keep extraordinary talent in the region."

With P2O, it's clear that Bordynuik is working towards a way to fix a series of major environmental problems with truly global implications. It's encouraging to know that he's also trying to fix Niagara. NM

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