Fuel of the Future

Will Algae-Based Oil Be the New Black Gold? Manta Biofuel Thinks So

BY TIFFANY R. JANSEN

In Frederick, Md., lies 16 acres of land dotted with ponds. The ponds are rife with algae, the scummy aquatic organisms that turn water an unpleasant and uninviting green. But that's just fine with Onur Unal and Ryan Powell, founders of Manta Biofuel. In fact, it's part of their business model.

The Baltimore-based biotechnology company is actively growing the algae to be harvested and converted into crude oil. "Crude oil is sold to refineries where they refine this mixture of all of these different oils to produce gasoline, diesel, jet fuel, kerosene and all these various petroleum products," Unal explains. "Our product would be a drop-in replacement for fossil-based crude oil at the refinery level."

Fossils – decayed plant and animal matter covered by layers of rock and dirt and exposed to extreme temperatures and pressure over millions of years – slowly turns to oil, which is then mined and refined for use as an energy source. It's a finite resource, and once expended, takes millions of years to replenish. Burning fossil fuels also increases carbon dioxide levels in the atmosphere, contributing to air pollution and greenhouse gas emissions.

Algae-based fuel, on the other hand, is carbon neutral, releasing carbon dioxide that had only just been taken out of the atmosphere by the algae weeks earlier. And it's sustainable and renewable. Infamous for its ability to multiply at remarkable speed (the algae Manta Biofuel works with can double its biomass in 24 hours), algae can be grown pretty much anywhere there is sunlight, carbon dioxide and water.

Manta Biofuel isn't the only company exploring this niche. Sapphire Energy in California and Algenol in Florida, founded in 2007 and 2009 respectively, are also in the algae-to-oil business. Though the conversion process is the same, they use a different and much more costly harvesting technique.

"Sure they can do it for, let's say $160 per barrel" Unal posits. "[But] oil prices, market prices, wiped out to $50 per barrel." Thanks to new technology licensed from the University of Maryland, Unal estimates that Manta Biofuel can produce oil for $20 a barrel.

As a doctoral student at the University of Maryland's Institute of Marine and Environmental Technology (IMET), Powell discovered that algae could be harvested using magnetic beads. "These are iron-based particles that bind to algae with high affinity within seconds," Unal says, allowing the extraction, condensing and drying of the algae in a single step.

Armed with Powell's harvesting method, he and Unal started Manta Biofuel in 2014. The intervening years have been spent developing the technology and building the necessary equipment. According to Unal, Manta Biofuel now has eight employees, five of which are full-time.

Surplus chicken manure from local farms is added to the ponds to supply the algae with the nitrogen and phosphorus it needs to grow and thrive. Portable harvesters are then placed in the water, where they float around, skimming the water for algae, much like a feeding manta ray. The collected algae biomass is then converted into oil by subjecting it to intense temperature and pressure in a process called hydrothermal liquefaction.

In February of this year, the company moved from Harbor Launch, an incubator at IMET, to the Business Center at Owings Mills. "At the incubator, we had office space, meeting space, limited lab space, but we didn't have workshop space," Unal says. The Owings Mills facility, with its high ceilings and warehouse-style qualities, has allowed the company to add a manufacturing area so that more of the development and engineering work can be done in house.

At this point, Manta Biofuel is still working with prototype devices, so production is slow. But Unal says they're close to commercialization. They're hoping to make their first sale sometime this year.

Initially, they'll be selling the product as No. 6 fuel oil, largely used at power plants and by the maritime industry. Small quantities can be sold through distributors or directly to end-users and can be used without any upgrading or refining.

"After we scale up, hopefully by 2019 or 2020, we will start selling to a refinery as crude oil," Unal says.

Scaling up means harvesting more algae, a demand the ponds in Frederick simply cannot fill on their own. More ponds will need to be set up in multiple areas in states around the country. The equipment, which Manta Biofuel is engineering to be portable, can be shipped to those locations where oil can be produced on site. It could also mean removing algae from water bodies where it's not wanted and turning it into oil.

Dense accumulations of algae, known as algal blooms, pose numerous threats: water and seafood contamination, marine dead zones and boat damage, to name a few. "We can potentially in the future go out and provide this remediation service where we can harvest the natural harmful blooms," Unal says.

In fact, the Maryland Department of Natural Resources is eyeing Manta Biofuel as a potential future contractor to work on the Chesapeake Bay, which is frequently plagued by algal blooms. "We can collect the algae and turn it into crude oil and then sell that [to] make additional revenue," Unal says. Eventually, the plan is to make the transition from biotechnology company to agricultural equipment manufacturer and supplier. I95

Previous page: Onur Unal (left) and Ryan Powell in front of the new Manta headquarters in Owings Mills; algal blooms in Manta's production ponds. *Left:* algal blooms; harvested and concentrated algae, ready to be converted to crude oil.