# It Comes From Space to Solve our Energy Problems

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Figure 1: Early prototype bioreactor on the roof of the MIT cogeneration plant. Greenfuel has advanced the design and scale since. Cambridge, Mass (photo courtesy of: the http://fraserdomain.com)

GreenFuel Technologies Corporation, a start-up company in Cambridge Massachusetts, wants to use little green algae to cleanse the smoke from polluting smokestacks, converting it back into bio-fuels such as diesel or ethanol.

Originally inspired by NASA studies into regenerative life-support, the

technology incorporates specially shaped tubes of water and site-specific algae at the end of large-scale sources of Carbon Dioxide such as coal-burning plants, reducing $CO_2$ emissions by up to 40% and $NO_x$ by up to 86%, according to the company.

“This is a really big idea.” said GreenFuel founder and MIT Aeronautics Professor Isaac Berzin during a recent interview with Scientific American.

While the idea of using algae to clean smoke is not new, GreenFuel has made two breakthroughs that it believes will make the concept viable. First, it developed techniques to tailor algal species to specific sites, increasing efficiency and reducing problems such as die-off that have plagued other attempts. “There are a lot of variables which go into selecting a given strain of algae, from basic environmental factors such as climate and light levels, to power-plant factors like the nature of output gases, to post-processing requirements.” explained Marty Goldenblatt, VP of Sales, in a recent interview with PhysOrg. “We use rapid adaptation devices which allows us to find what set of algae is best for different conditions.”

The company has also optimized the algal growth system itself, creating a triangular tubing arrangement which causes rising bubbles of smoke to mix the algae, ensuring all of it has adequate light levels. The geometry also simplifies harvesting, allowing gravity to sweep out heavily grown tubes.

“You can think of it as milking a cow.” Berzin has said.

Central to GreenFuel’s business proposition, harvested algae can then be converted to bio-diesel, Ethanol, or other products that customers can sell for profit. While captured $CO_2$ and $NO_x$ would be re-released in another combustion process, each molecule will have been used more

than once, greatly reducing overall emissions.

Somewhat ironically, GreenFuel's founder and MIT Aeronautics Professor Isaac Berzin got the idea to use algae to save the environment here at home while working on a project to help take humans to other worlds. Contracted to develop an advanced life-support system for NASA, Berzin worked with aquatic microbes like algae that could turn carbon dioxide from human breath and other waste sources back into oxygen. He soon realized algae's ability to capture carbon make it ideal for reducing pollution from pollution-generating plants on Earth.

With such promising technology, what impedes full-scale implementation? "Space." Says Goldenblatt, "Like all solar-based energy we need land over which to expose the algae. This can limit where we deploy." Another hurtle involves convincing often-conservative utility executives to invest in cutting edge technology.

These issues notwithstanding, GreenFuel is pressing forward and gaining steam. They received over $11 million in second round Venture Capitol funding this December and recently moving to a 13,000 square foot facility. Currently, they are in negotiations with the New York State Energy Research Group to conduct analyses and initial tests of power plants in that state.

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