

## Big Oil and Algae

### ExxonMobil's Investment Validates Algae's Promise

In a move that stunned the bio-fuels community, **ExxonMobil Corp.** [XOM] has formed an alliance with biotech firm **Synthetic Genomics Inc.** to develop algae based biofuels. Exxon will spend \$600 million over the next five to six years—and potentially billions more if its development milestones are met—to create a transportation fuel compatible with existing refining and distribution infrastructure.

In the view of Michael Melnick, principal with the venture capital firm **CMEA Capital**, “The Synthetic Genomics/Exxon deal means that another of a small handful of algae companies has found the strategic partner necessary in this industry to bring a novel algae production system to commercial scale.

“There are not going to be many such deals, and strategic partners are essential in this game; venture investors are unlikely to provide the capital investment necessary, leaving the government and strategic investors as the only other options.”

ALGAE COMPANIES IN THE MIX	
<b>Aurora Biofuels</b> , Alameda, Calif.	Algae are screened for top performers, then bred to maximize fuel production and cost effectiveness. Uses ponds at its Florida pilot plant with the algal oil destined for biodiesel production.
<b>Cellana</b> , Kona Coast, Hawaii	A <b>Shell</b> and <b>HR Biopetroleum</b> joint venture to develop a process for extracting algal oil without chemicals, drying or an oil press. Only marine algae indigenous to Hawaii are used.
<b>General Atomics</b> , San Diego	The nuclear energy development company has a three-year Dept. of Defense contract involving 18 university and industrial partners, to develop algae-to-jet-fuel production.
<b>Neptune Industries Inc.</b> [NPDI.OB], Boca Raton, Fla.	The firm uses fish waste from an integrated fish/algae operation. It is working under a Florida grant to develop an integrated algae production systems for use in marine biodiesel.
<b>OriginOil</b> [OOIL], Los Angeles	Helix BioReactors grow multiple layers of algae biomass around the clock with daily harvests. Rotating vertical shafts, arranged in helix or spiral pattern with LEDs, provide light and agitation.
<b>PetroAlgae</b> [PALG], Melbourne, Fla.	The company is working on green diesel produced from micro-crops, including algae, diatoms and cyanobacteria, grown in open ponds.
<b>PetroSun</b> [PSUD.PK], Scottsdale, Ariz.	The petroleum exploration firm is using open ponds in South Padre Island, Texas. It is offering Southern catfish farmers oil-lease-like system to convert ponds for algae.
<b>Seambiotic</b> , Tel Aviv, Israel	The company uses flue gases from coal burning power stations to feed algae grown in open ponds, located along the Mediterranean Coast.
<b>Solazyme</b> , South San Francisco	The synthetic biology company is working on perfecting algae strains for biofuels in conjunction with oil behemoth <b>Chevron</b> .
<b>Solix Biofuels</b> , Fort Collins, Colo.	This algal oil pioneer employs photobioreactors with closed-growth chambers, maximizing sunlight and photosynthetic activity on a two acre site in Colo. It counts refinery giant <b>Valero</b> as an investor.

Melnick adds that even with the deep-pocketed Exxon as its partner, Synthetic Genomics will need to hook up with smaller companies to put together the multidisciplinary solution necessary to grow, harvest and extract products from algae.

Exxon studied a range of biofuels before committing to algae. Spokesman Rob Young says algae “offered the best opportunity to commercialize a next generation biofuel,” but cautions that it will be at least 10 years before an algae based fuel hits the market.

Although oil majors **Chevron Corp.** [CVX] and **Royal Dutch**

**Shell** [RDSA] and refiner **Valero Energy** [VLO] are also funding algae research, Exxon’s stature and funding commitment stand out. “This will step up R&D in algae, so it’s a big thing for the long term,” says Jack Robinson, lead manager of the **Winslow Green Growth Fund** [WGGFX].

Some observers question the motivation behind Exxon’s investment. Robinson says Exxon is being pressured by its investors to support more carbon friendly fuel sources. He points out that \$100 million per

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year on algae represents just 1% of the company's R&D spending while it continues to plow billions into oil sands and other petroleum based projects.

"It's probably not that they're truly embracing alternatives, but instead are aware of freshening global trends towards greener energy," says Dr. Robert Wilder, founder and CEO of the Wilder Hill Clean Energy Index.

Smaller algae developers stand to benefit from Exxon's endorsement of algae. "This will encourage investors that there is a future for algal applications for fuels and chemicals," says Bill Lese, a managing director of venture capital firm **Braemar Energy Ventures**.

Riggs Eckelberry, CEO of algae start-up **OriginOil** [OOIL], says he welcomes large scale research into new algae strains. Gerry Jardine, a director for crop developer **Valcent Products Inc.** [VCTZF], adds that Exxon's move establishes credibility for the algae industry.

For Exxon shareholders, the biofuels program may signal the oil giant's willingness to transform itself for a lower carbon world. To reduce its carbon output by 50% by 2050, Winslow's Robinson estimates Exxon will need to trim fossil fuel volumes by an average of 1.25% per year and develop alternative fuels. "If they stick with fossil fuels, they could become the GM of 2020 or 2030," he says. "They have to get really serious about a strategy that will be sustainable."

Exxon has the financial strength to make the transformation. Though net income is expected to drop sharply this year because of lower oil prices—Standard & Poor's estimates earnings per share will fall to \$4 in 2009 from \$8.69 last year—the company has churned out annual profits of more than \$35 billion for the past four years and held \$25 billion in cash at the end of its first quarter. Of course, the oil behemoth will continue to spend money on fossil fuel exploration and production projects in addition to its new green thrust.

Shares of Exxon recently changed hands at \$72.75 per share, about the midpoint of their trading range over the past year. Encouraged by growth opportunities in its exploration and production business, S&P rates the stock a strong buy with a 12-month price target of \$84. ■

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### Algae's Red Flags

**ExxonMobil's** plunge into algae technology raises concerns among environmentalists and others about the effects of genetically modifying some of the fastest growing organisms on earth.

ExxonMobil and its partner, **Synthetic Genomics Inc.**, plan to work with algae that excrete lipids, or oils, eliminating the need for harvesting the algae itself, sources say. Since oil floats to the surface, the aim is to simply skim it off for processing, leaving the algae undisturbed.

One worry: What if algae run amok—escape handlers and begin to multiply rapidly in, say, the Great Lakes, covering them in oil?

Craig Venter, CEO of Synthetic Genomics, has an answer—a suicide gene implanted into the algae species. A Dept. of Energy scientist working with the organisms explains that the algae would be able to grow only "in the presence of a certain compound," a rare amino acid, for example, that isn't readily found in nature.

But while a government scientist tells us that "there are lots of safeguards in place," he concedes that algae/fuel researchers are working with largely "unknown biology" that spans agriculture and biotechnology. "Containment, if required, is going to be a challenge."

Moreover, he suggests that more government regulation may be needed. But, as is usually the case, the development of the science will far outpace the actions of lawmakers and regulators.

Two other aspects largely overlooked in all of the excitement are land use and water demand. ExxonMobil touts how algae derived fuels increase the productivity of land by an order of magnitude over ethanol, in that an acre of land can produce thousands of gallons of fuel compared with hundreds of gallons from an acre of corn.

Nevertheless, if algal oils are ever to make a significant dent in petroleum demand, millions of acres will have to be devoted to growing algae. Moreover, the land will likely have been previously uncultivated. Algae developers have their eye on vast desert tracts in the U.S. Southwest. But while they consider such land to be wasteland, environmentalists do not.

Algae also need huge amounts of water to grow, though they're not picky about how clean it is. In fact, one strategy is to grow algae at sewage treatment plants. (See "Algae a Boon to Wastewater Treatment and Fuel Supply," *KBMA*, April 22, 2009, Page 1.)

Another approach under consideration: Grow algae in huge floating "lagoons" in the ocean. That would take both land and water use concerns off the table. ■

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