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Algal Biofuel, [Jan. 21, 2010]

Harry Reid Center, University of Nevada, Las Vegas

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Algal Biofuel

News in Brief (click link to read more)

1. [UVa engineers find significant environmental impacts with algae-based biofuel](#) (Jan-21, 2010)
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News in Details

1. UVa engineers find significant environmental impacts with algae-based biofuel.

With many companies investing heavily in algae-based biofuels, researchers from the University of Virginia's Department of Civil and Environmental Engineering have found there are significant environmental hurdles to overcome before fuel production ramps up. They propose using wastewater as a solution to some of these challenges.

These findings come after ExxonMobil invested \$600 million last summer and the U.S. Department of Energy announced last week that it is awarding \$78 million in stimulus money for research and development of the biofuel.

The U.Va. research, just published in the journal *Environmental Science & Technology*, demonstrates that algae production consumes more energy, has higher greenhouse gas emissions and uses more water than other biofuel sources, such as switchgrass, canola and corn.

"Given what we know about algae production pilot projects over the past 10 to 15 years, we've found that algae's environmental footprint is larger than other terrestrial crops," said Andres Clarens, an assistant professor in U.Va.'s Civil and Environmental Department and lead author on the paper. Clarens collaborated on the paper with Lisa M. Colosi, also an assistant professor in the Civil and Environmental Engineering Department; Eleazar P. Resurreccion, a graduate student in the department; and Mark A. White, a professor in U.Va.'s McIntire School of Commerce.

As an environmentally sustainable alternative to current algae production methods, the researchers propose situating algae production ponds behind wastewater treatment facilities to capture phosphorous and nitrogen – essential nutrients for growing algae that would otherwise need to be produced from petroleum. Those same nutrients are discharged to local waterways, damaging the Chesapeake Bay and other water bodies, and current technology to remove them is prohibitively expensive.

While the researchers found algae production to have a greater environmental impact than other sources, it remains an attractive source for energy. Algae, which are grown in water, don't compete with food crops grown on land and also tend to have higher energy yields than sources such as corn or switchgrass. Additionally, algae's high lipid content makes for efficient refinement to liquid fuels that could be used to power vehicles, according to the research.

"Before we make major investments in algae production, we should really know the environmental impact of this technology," Clarens said. "If we do decide to move forward with algae as a fuel source, it's important we understand the ways we can produce it with the least impact, and that's where combining production with wastewater treatment operations comes in."

As an example of the importance of completing the environmental life cycle study, Clarens points to the 2008 ethanol boom which created a spike in corn prices worldwide and raised complex ethical issues that could have been avoided by producing separate crops for food and fuel.

"People were investing in ethanol refineries, but then we realized that it takes a lot of petroleum to grow corn and convert it to ethanol," Clarens said. "By the time you get done, you've used almost as much petroleum to make ethanol that you would have if you just put the oil straight into your car."

The research group's plans include conducting demonstration projects for the wastewater production methods. They are also pursuing complementary research on the economic lifecycle of algae compared to other bionenergy feedstocks.

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The research paper is available online at <http://pubs.acs.org/doi/abs/10.1021/es902838n>.

Source: http://www.eurekaalert.org/pub_releases/2010-01/uov-uef012110.php



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2. Clean Energy Research on Algae Biofuels Included in Final Version of Spending Bill

Murray worked to include this funding, which will create jobs and position Washington state as a leader in clean energy technology

(Washington, D.C.) – Today, U.S. Senator Patty Murray (D-WA) announced that the \$2 million she included for clean energy algae biofuels research at Washington State University in the fiscal year 2010 Senate Energy and Water Development appropriations bill has been included in the final version of the spending bill. The bill has now been approved by both houses of Congress after passing the Senate today by a vote of 80-17 and will now head to the President who is expected to sign it into law.

“This funding will support cutting-edge research that will create jobs and continue to position Washington state as a leader in the clean energy economy,” said Senator Patty Murray. “It provides a shot in the arm for Washington state biofuels research, and will help our country move toward cleaner and more efficient energy use.”

The WSU Algae Biofuels project is a partnership between WSU and the Seattle-based Targeted Growth Inc. It will create high-skill jobs in both Pullman and the Puget Sound area and provide researchers with the resources they need to develop new, energy-efficient algal fuel sources. Algae is a particularly promising candidate for fuel use, as its efficiency in capturing solar energy results in higher productivity per unit area than a traditional biofuel energy crop.

“Washington State University is committed to partnering with the clean-technology sector to find innovative solutions for supplying energy and improving environmental quality,” said Howard Grimes, the WSU Vice President for Research and Dean of the Graduate School. “This funding will allow our scholars and partners to apply their knowledge to solve problems and create economic opportunity in the Pacific Northwest and throughout the world.”



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3. Innovation summit. Washington DC. March 1-3.

U.S. Energy Secretary Steven Chu has said:

- “I am especially excited about the first ever ARPA-E Energy Innovation Summit ...”
- “This conference will bring together the nation’s top energy leaders and members of the scientific community to begin building the next Industrial Revolution in clean energy technologies, which will create new jobs and help reduce our carbon footprint”

More from a Release dated January 7, sourced from DOE/US Department of Energy:

Department of Energy Announces Inaugural ARPA-E Energy Innovation Summit

Secretary Chu to Give Keynote Address

WASHINGTON, D.C. – U.S. Secretary of Energy Steven Chu announced today the inaugural “ARPA-E Energy Innovation Summit” to take place March 1-3, 2010 at the Gaylord National Hotel & Convention Center in Washington, DC. The event, hosted by the U.S. Department of Energy’s Advanced Research Projects Agency – Energy (ARPA-E) and organized by the Clean Technology and Sustainable Industries Organization (CTSI), with key support from the National Venture Capital Association (NVCA) and the Kauffman Foundation, will serve as a forum for the nation’s energy leaders to share ideas, collaborate, and identify key technology opportunities and challenges.

Summit participants will include members of the scientific and research communities, investors, technology entrepreneurs, corporations with an interest in clean energy technologies, policymakers and government officials.

“I am especially excited about the first ever ARPA-E Energy Innovation Summit,” said Secretary Chu. “This conference will bring together the nation’s top energy leaders and members of the scientific community to begin building the next Industrial Revolution in clean energy technologies, which will create new jobs and help reduce our carbon footprint,” said Secretary Chu.

The summit will spotlight some of ARPA-E’s first round of 37 winning research projects and will for the first time showcase many of the more than 250 highly-rated research projects – out of the nearly 3,700 concept papers submitted – from the organization’s first \$150 million solicitation. Participants will hear from distinguished speakers such as Secretary Chu, ARPA-E Director Dr. Arun Majumdar, and a number of the nation’s leading energy innovators. Panel topics will include: identifying game-changing technologies, building regional energy innovation clusters, the role of energy in our national security, and successfully developing and commercializing

energy technology breakthroughs. In addition, the conference will be preceded by a one-day program of workshops where researchers, entrepreneurs and investors can meet ARPA-E's Program Directors, discuss the goals and directions for ARPA-E's technology program areas, and learn the outcomes of previous workshops on these topics. The pre-conference day also will offer tutorials on topics such as best practices for commercializing breakthrough energy technologies and taking advantage of the SBIR program. Read more information and register for the ARPA-E Energy Innovation Summit.

About ARPA-E

The Advanced Research Projects Agency – Energy (ARPA-E), an organization within the U.S. Department of Energy, is the country's first organization dedicated exclusively to supporting high risk, high reward energy research projects. ARPA-E's mission is to support nimble and inventive technological approaches that can deliver transformative new solutions for climate change and energy security while advancing America's technology leadership. Learn more about on ARPA-E's website.



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4. Department of Energy to Invest \$366M in Energy Innovation Hubs

Funding Opportunity Announcement for Fuels from Sunlight Hub is Issued

Fuels from sunlight. "... accelerate the development of a sustainable commercial process for the conversion of sunlight directly into energy-rich chemical fuels ..."

U.S. Energy Secretary Steven Chu has said:

- "Given the urgency of our challenges in both energy and climate, we need to do everything we can to mobilize our Nation's scientific and technological talent to accelerate the pace of innovation ..."
- "The DOE Energy Innovation Hubs represent a new, more proactive approach to managing and conducting research."
- "We are taking a page from America's great industrial laboratories in their heyday."
- "Their achievements—from the transistor to the information theory that makes modern telecommunications possible—are evidence that we can build creative, highly-integrated research teams that can accomplish more, faster, than researchers working separately."

More from a Release dated December 22, sourced from DOE/US Department of Energy:

Washington, DC – U.S. Department of Energy Secretary Steven Chu today outlined the Department’s plans to invest up to \$366 million to establish and operate three new Energy Innovation Hubs focused on accelerating research and development in three key energy areas. Each Hub, to be funded at up to \$122 million over five years, will bring together a multidisciplinary team of researchers in an effort to speed research and shorten the path from scientific discovery to technological development and commercial deployment of highly promising energy-related technologies.

“Given the urgency of our challenges in both energy and climate, we need to do everything we can to mobilize our Nation’s scientific and technological talent to accelerate the pace of innovation,” said Secretary Chu. “The DOE Energy Innovation Hubs represent a new, more proactive approach to managing and conducting research. We are taking a page from America’s great industrial laboratories in their heyday. Their achievements—from the transistor to the information theory that makes modern telecommunications possible—are evidence that we can build creative, highly-integrated research teams that can accomplish more, faster, than researchers working separately.”

The Hubs are part of a broad-based clean energy research strategy by the Obama Administration that will harness America’s innovation machine to achieve the breakthroughs we need.

This strategy includes three new initiatives which are designed to complement each other:

1. The first approach is the Energy Frontier Research Centers launched by the Department’s Office of Science to support multi-year, multi-investigator scientific collaborations focused on overcoming hurdles in basic science that block transformational discoveries.
2. The second approach is spearheaded by the Department’s recently-formed Advanced Research Projects Agency-Energy (“ARPA-E”), which uses a highly entrepreneurial funding model that supports America’s passionate energy innovators to explore high-risk, high-reward potentially transformative technologies that are too risky for industry to fund.
3. The third novel funding model, Energy Innovation Hubs, will establish larger, highly integrated teams ideally working under one roof, conducting high-risk, high-reward research and working to solve priority technology challenges that span work from basic research to engineering development to commercialization readiness.

The three DOE Energy Innovation Hubs will focus on:

- production of fuels directly from sunlight;
- improving energy-efficient building systems design; and
- computer modeling and simulation for the development of advanced nuclear reactors.

The Department will provide \$22 million in the first year for the establishment of each Hub and up to \$25 million per year for the following four years to support the operations of each Hub—for a total award of up to \$122 million per Hub. Important information on the DOE's Hub implementation plan and strategy for managing the Hubs can be found on the Energy Innovation Hubs website: <http://hubs.energy.gov>.

Fuels from Sunlight Energy Innovation Hub

The objective of this Hub is to accelerate the development of a sustainable commercial process for the conversion of sunlight directly into energy-rich chemical fuels, likely using mechanisms based on photosynthesis, the method used by plants to convert sunlight, carbon dioxide, and water into sugar. The Fuels from Sunlight Energy Innovation Hub will provide researchers with significant new resources to accelerate basic and applied research in the drive toward a potentially transformative new energy technology. Achievement of an efficient, cost-effective means to convert solar energy directly to fuel could have significant impact on U.S. energy security and on energy production globally.

Modeling and Simulation for Nuclear Reactors Energy Innovation Hub

This Hub is intended to produce a multi-physics computational environment that will be used by engineers to create improved understanding of issues with current and future nuclear energy technologies. The Department's Office of Nuclear Energy hosted a workshop on the Modeling and Simulation for Nuclear Reactors Energy Innovation Hub on December 7, 2009 to provide an opportunity for those interested in this Hub and its upcoming FOA to fully understand the Hub vision, program objectives, and the procurement process for the establishment and operation of the Hub.

Energy Efficient Building Systems Design Energy Innovation Hub

The objective of the Energy Efficient Building Systems Design Energy Innovation Hub is to develop highly efficient buildings components, systems, and models. Achieving the Hub's main goal of reducing energy use for indoor space conditioning will require a focus on advances in core technologies, such as advanced refrigeration cycles, as well as on development of fully instrumented infrastructure aided by buildings system design and modeling. Such solutions could have a major impact on national electricity consumption, as the nation's buildings consume approximately 70 percent of all electric power.

A Funding Opportunity Announcement (FOA) inviting proposals for the Fuels from Sunlight Energy Innovation Hub has been issued, and a link to the FOA is available at the Energy Innovation Hubs website. The deadline for proposals for the Fuels from Sunlight Energy Innovation Hub is March 29, 2010. Funding opportunity announcements for the other two Energy Innovation Hubs are expected to be issued early next year. The Energy Efficient Building Systems Design Hub will also be the

central component of a regional innovation cluster funding opportunity which will include coordinated grant opportunities from other agencies.

Universities, national laboratories, nonprofit organizations, and private firms are eligible to compete for an award to establish and operate a Hub and are encouraged to form partnerships. Awards, based on evaluation by scientific peer review, will be announced next summer. The Hubs are expected to begin work in 2010 and will be fully operational by 2011.

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5. Catilin Contributes Key Extraction, Sequestration and Conversion Technologies to NAABB Consortium Developing Algal Biofuels.

Algal biofuels. "... pioneering algal oil extraction technology using mesoporous nanoparticles to selectively extract and sequester targeted fuel-relevant and high value compounds within the algal lipid mixture."

Catilin Inc has reported "... that it will embark a \$5.3 million project over the next three years as part of the \$44 million DOE Investment for Advanced Biofuels Research and Fueling Infrastructure award made to the Catilin's consortium, National Alliance for Advanced Biofuels and Bioproducts (NAABB)."

More from a Release dated January 14, sourced from Catilin Inc:

Catilin Contributes Key Extraction, Sequestration and Conversion Technologies to NAABB Consortium Developing Algal Biofuels

AMES, Iowa, Jan. 14 /PRNewswire/ — Catilin, Inc., a leading biofuels catalyst technology company, announced that it will embark a \$5.3 million project over the next three years as part of the \$44 million DOE Investment for Advanced Biofuels Research and Fueling Infrastructure award made to the Catilin's consortium, National Alliance for Advanced Biofuels and Bioproducts (NAABB). Catilin and its partner, Iowa State University – Center for Catalysis (ISU-CCAT), will provide key extraction, sequestration and conversion technologies. The NAABB consortium is made up of 26 groups from both the private and public sector and is led by the Donald Danforth Plant Science Center.

Catilin and ISU-CCAT, members of the NAABB, will build on their pioneering algal oil extraction technology using mesoporous nanoparticles to selectively extract and

sequester targeted fuel-relevant and high value compounds within the algal lipid mixture. The balance of the algal oil, which contains free fatty acids (FFA) and triglycerides, will be converted to biodiesel using Catilin's commercially available T300 catalyst. The pilot scale work will be completed at Catilin's currently operating 300,000 gallon per year pilot plant.

"This award solidifies Catilin's position as a leading provider of extraction and catalyst technology for biomass conversion," said Larry Lenhart, Catilin's CEO. "We are enthusiastic participants in the NAABB consortium and believe that this unique consortium will bring cross discipline knowledge working together to advance the reality of biofuel from algae. As the largest private sector participant we will make a direct impact on the ability to demonstrate the scalable and economic conversion of algal oil to biofuels while capturing and monetizing valuable co-products."

Catilin has been closely aligned with ISU-CCAT since 2007 when Professor Victor Lin of Iowa State University founded Catilin with financial support from Mohr Davidow Ventures of Menlo Park, CA. "Our technology is instrumental in several key steps of the algae to biofuels supply chain as the efficient oil-extraction and solid catalyst provides a cost effective conversion route," said Prof. Lin, who is also the Director of ISU-CCAT and the Director of the Chemical and Biological Sciences Program at DOE Ames Laboratory.

About Catilin

Catilin, Inc. is a catalyst technology company that is revolutionizing biofuels production. Catilin has a unique, new technology for biodiesel production that greatly reduces the cost of producing a gallon of biodiesel while creating a superior quality biodiesel and glycerin co-product. The pioneering research of Catilin, in conjunction with Ames Laboratory and Iowa State University, continues to focus on the future of biofuels including award-winning research on algal oil extraction and sequestration. For more information, please visit our website <http://www.catilin.com>.

About ISU – Center for Catalysis

The Center for Catalysis, or CCAT, at Iowa State University is dedicated to the development of useful, practical catalysts and sustainable green chemistry methods for agricultural, industrial and environmental applications. CCAT is a member of the Institute for Physical Research and Technology of Iowa State University. It draws on researchers and staff of the U.S. Department of Energy's Ames Laboratory and faculty and scientists at Iowa State University. (<http://www.iprt.iastate.edu/ccat/>)



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