

# IQ - ISEE Quarterly

An update from the Institute for Sustainability, Energy, and Environment

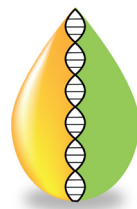
What's new in research ...

## iSEE, IGB Partner on \$104M DOE Bioenergy Research Center

On July 17, the U.S. Department of Energy (DOE) announced it intends to fund a five-year, \$104 million Bioenergy Research Center at the University of Illinois at Urbana-Champaign, pending Congressional appropriation.

The Center for Advanced Bioenergy and Bioproducts Innovation (CABBI) is a collaboration between Illinois' Institute for Sustainability, Energy, and Environment (iSEE) and the Carl R. Woese Institute for Genomic Biology (IGB), and it will include 16 partner institutions. Evan H. DeLucia, the G. William Arends Professor of Plant Biology and Baum Family Director of iSEE, will serve as CABBI Director.

"As the United States seeks energy independence, we need to look at the most efficient ways to grow, transform, and market biofuels," DeLucia said. "This grant is a game-changer, and CABBI will be at the forefront as we press toward a new bio-based economy. Our Center's holistic approach will generate new products di-



**CABBI**  
Center for Advanced Bioenergy  
and Bioproducts Innovation

rectly from biomass, reducing our nation's dependence on fossil fuels and making us more secure."

One of the major challenges the world faces is how to provide sustainable sources of energy that meet societal needs as the population continues to grow. DeLucia said Illinois is uniquely qualified to address the challenge with a world-class facility at IGB, which will oversee and integrate CABBI's core science team under one roof.

Said IGB Director Gene E. Robinson: "The IGB, now with over a decade of experience in successfully addressing grand challenges by transdisciplinary integration of the life sciences, physical sciences, social

sciences, and engineering, will provide an outstanding environment for the talented CABBI team. We are delighted to partner with iSEE to lead this important new Center."

DeLucia said iSEE will coordinate and integrate field work off campus and at the Illinois Energy Farm — "a globally unique, 320-acre site that enables researchers to trial promising biofuel feedstocks at scale. And we will use another state-of-the-art facility of national importance: the nearly complete, \$32 million Integrated Bioprocessing Research Laboratory (IBRL), which is a direct result of state investment in the future of bioenergy research."

CABBI researchers will develop fuels and products by integrating three highly interconnected DOE priority areas: Feedstock Development; Conversion; and Sustainability.

[Read the full news release about CABBI — including reactions from campus and beyond — on the iSEE website.](#)

What's inside ...

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# In the Spotlight: William Lubega

William Naggaga Lubega is a third-year Ph.D. student in the Department of Civil Engineering at Illinois, and is one of several student members of the Critical Infrastructure and Transportation project funded by iSEE. In his research, he's asking the question: What would it take to switch the majority of Illinois transportation to electrical power, given the limitations of the state's (and nation's) existing power infrastructure?

More electric vehicles means more demand for electricity, and that added load can have repercussions. Lubega works at the intersection of water, ecological, and energy concerns, studying how electricity production impacts natural waterways.

Water is a critical input to electric power generation in coal, natural gas, and nuclear power plants. The water of concern is not the steam that turns the turbines in these power plants, but is the water that is used for cooling. Thermal power plants currently withdraw more water than any other sector in the United States for cooling purposes.

Where does all this water come from? Usually rivers and cooling lakes, Lubega said. And that can create all kinds of environmental problems.

When water is drawn into a power plant, it goes in at one temperature, but it leaves the plant a lot warmer. The extra heat the water carries when it rejoins its source is a form of "thermal pollution," and it's a big concern for ecosystem health.

"Even small increases in ambient temperature — 5-10 degrees Celsius — can have significant impacts on the health of aquatic organisms like fish," Lubega said. "When you have a drought and a heat wave (at the same time), the temperature of the water is already higher than usual,



and the fish are experiencing thermal stress. You end up having to reduce the output of some of your power plants because you are trying to minimize the impact on the fish.

"What I am working on is given a certain severity of drought, how do you make decisions that ensure electricity reliability while minimizing impact on the aquatic ecosystems around thermal power plants?"

Using data from the U.S. EPA, the U.S. Geological Survey, and the U.S. Energy Information Administration, he builds models that connect the known inputs and outputs of power plants with measured conditions in rivers and lakes to create a picture of environmental impact at various power plant operation levels and climate conditions. By using past data, he can build models to predict future situations.

He hopes that plant operators may someday consult his models to make decisions that balance environmental health and electricity grid reliability.

[Read the full profile of Lubega on the iSEE website.](#)

[More about the Critical Infrastructure and Transportation project.](#)

## Researchers Publish Paper on Water-Grid Relationship in Heat

Research published by iSEE's Critical Infrastructure and Transportation team recommends a new way to regulate how we deal with electricity generation during times when it's really hot and/or during an ongoing drought.



**STILLWELL**

Normally, power plants are capped at how much thermal pollution (hot water) they can emit into lakes and rivers. In times of prolonged heat, however, energy demand is high for air conditioning — and permission is usually given for plants to over-pollute to maintain a reliable energy grid.

In a paper published in *Applied Energy* in July, Illinois Ph.D. student William Lubega and advisor Ashlynn Stillwell, an Assistant Professor of Civil and Environmental Engineering, suggest that this isn't the best way to go about providing energy — especially because it jeopardizes the environment. Instead, the authors argue that power generation and grid reliability could be governed by a set of rules created using a model that optimizes power output and minimizes the number of allowances given to overpollute.

[Read more on the project page.](#)

## Sun Buckets Students Awarded \$100K at Clean Energy Trust Challenge

Team members from Sun Buckets, the startup company that began as iSEE's seed-funded Stored Solar Stove project, earned four awards totaling \$100,000 in May 2017 at the Clean Energy Trust Challenge in Chicago.

Sun Buckets was awarded the ComEd Female Founder award (\$20,000), the Hanley Family Foundation award (\$20,000), the Power Clean Cities award (\$20,000), and \$40,000 from the Clean Energy Trust's discretionary fund.

"Sam Lindgren was stellar delivering the pitch, and Joe Bradley expertly joined her for the Q&A," said Sun Buckets CEO and iSEE Principal Investigator Bruce Litchfield. "All contributed in various ways, including informal discussions with the investment committee and other attendees during the event in Chicago."

The Trust funds and grows early stage clean energy startups in the Midwest through direct investment and venture development.

[Read more on the iSEE project website.](#)

What's new in research (continued) ...

## Cis Researchers Earn Grant, Publish Paper

The Foundation for Food and Agriculture Research (FFAR) has awarded Principal Investigator Amy Marshall-Colón, Assistant Professor of Plant Biology at the University of Illinois at Urbana-Champaign, \$274,000 to continue her research in support of Crops *in silico* (Cis), a project to develop a suite of virtual plant models that may help resolve a growing gap between food supply and demand in the face of global climate change.

Marshall-Colón (pictured) will collaborate with Stephen P. Long, the Gutsell Endowed Professor of Crop Sciences and Plant Biology; Matthew Turk, Assistant Professor of Information Sciences, Assistant Research Professor of Astronomy and National Center for Supercomputing Applications (NCSA) Research Scientist (also pictured); Christine Kirkpatrick, Executive Director of the National Data Service; and Jonathan Lynch, University Distinguished Professor of Plant Science at Penn State University.

Team members will integrate above- and below-ground models of plants to create never-before-seen “whole views” of them. Then, they will subject these newly built virtual plants to computer-simulated extreme growing conditions — from flood to severe drought to increased ambient carbon dioxide — and compare the model's predicted plant reaction to observed responses from field studies. This will help “dial in” the model's accuracy.

This is the first FFAR grant awarded to a University of Illinois researcher.

[Read the complete news release.](#)

In another *Cis* development, a *Frontiers in Plant Science* perspective article published in May outlined the research team's vision for a modeling framework that reconstructs a virtual plant — from the gene upward — that can accurately predict crop responses to environmental disturbances.



*Cis*, as the envisioned tool is called, seeks a never-before-achieved level of detail, collaboration, and robustness in modeling. The goal is to create an open-source software to link individual plant models across biological scales — from a single cell to an entire ecosystem of plants.

The *Frontiers* article, by a group of 30 researchers from around the world, is a synthesis of thoughts from the keynote speeches and plenary sessions at a 2016 *Cis* symposium and workshop. The writers say that designing crops that yield more food with fewer resource inputs is critical for future food security and sustainability. This is a tricky task for most crop breeding and engineering programs because of complex interactions between a plant's genes, its growing environment, and farm management. New tools are needed — and soon — to help the global agricultural system meet the needs of a population climbing toward 9 billion in a climate that is rapidly changing.

[Read more about the paper on the iSEE project page.](#)

## Illinois Experts' Articles on Biofuels, Crop Planting Models Appear in Journals

An increased demand for biofuels has increased the profit for farmers who grow corn for fuel and not just food. To maximize farm earnings, they may convert grasslands and forests to cropland — a practice that releases all the carbon stored in the plants and soil into the atmosphere. To penalize the carbon emissions from this so-called indirect land use change, the U.S. EPA and California Air Resources Board include an indirect land use change factor when considering the carbon savings with biofuels for their compliance with the federal Renewable Fuel Standard or California's Low-Carbon Fuel Standard.

A research paper on the subject by University of Illinois agricultural economist (and iSEE Associate Director for Education and Outreach) Madhu Khanna and her colleagues (among them iSEE Baum Family Director Evan H. DeLucia, a plant



**KHANNA**      **DeLUCIA**      **LONG**

biologist) was published in June in *Nature Communications*. The team asks: By how much would carbon emissions be reduced as a result of regulating indirect land use change like California is attempting to do? At what cost? And, who bears those costs?

[Read the complete news release from the College of ACES.](#)

In another paper published by an iSEE-affiliated researcher, a new computer model developed by the Long Lab at the University of Illinois and researchers at the Institute for Computational Biology in

Shanghai can help farmers decide on best planting practices by predicting the yield of different crop cultivars in a multitude of planting conditions. Published in *BioEnergy Research*, the model depicts the growth of 3-D plants, incorporating models of the biochemical and biophysical processes that underlie productivity.

Most recently, it was used by the University of São Paulo in Brazil to address a question for sugarcane producers: How much yield might be sacrificed to take advantage of a possible conservation planting technique?

This project stems from the Realizing Increased Photosynthetic Efficiency (RIPE) project, led by iSEE Affiliate Professor Stephen P. Long, the Gutsell Endowed Professor of Crop Sciences and Plant Biology.

[Read the full story.](#)

## What's new in outreach ...

The Institute for Sustainability, Energy, and Environment at the University of Illinois presents:

THE CASE FOR

# INVESTING IN CLIMATE CHANGE RESILIENCE

INSIGHTS FROM SCIENCE, ENGINEERING & ECONOMICS



An iSEE Congress Keynote Address by

**JOHN P. HOLDREN**

Former Director of the White House  
Office of Science and Technology Policy

Monday, Sept. 18, 2017

5 p.m.

Alice Campbell Alumni Center

150  
ILLINOIS  
1867-2017

iSEE  
INSTITUTE FOR SUSTAINABILITY,  
ENERGY AND ENVIRONMENT

## Mark your Calendars: Upcoming iSEE Events this Fall

### • Sustainability Kickoff for Students:

**Aug. 27.** As Quad Day wraps up, iSEE will host an open house welcome event at the Illini Grove to get both new and returning students excited for a new school year — and all the opportunities it holds to get involved with campus sustainability efforts and educational events and programs. We will have plenty of food and encourage you to get to know others in the Illinois sustainability community.

### • iSEE Congress 2017:

**Sept. 18-20.** “Building Resilience to Climate Change” will feature keynotes from John Holdren, former Director of the White House Office of Science and Technology Policy; Justin Gillis, environmental science reporter for The New York Times;



**GILLIS**



**KAHN**

and Matthew E. Kahn, Professor of Economics at the University of Southern California.

See more about Holdren’s talk above. Gillis will discuss “Climate Change: Where Do We Stand in 2017?” And Kahn’s presentation will be titled “A Microeconomic Perspective on the Adaptation Challenge.”

In addition, experts from different disciplines will participate in this forum to advance scientific understanding on the impacts of climate change on the agricultural sector, on ecosystem services, and on human livelihoods and wellbeing,

particularly among the most vulnerable sections of society. A panel of climate specialists from academia and industry will address public-private actions to adapt to

climate change.

The goal of iSEE Congress 2017 is a discussion of the near- and medium-term options for building resilience to climate change and policy directions for long-term solutions. [Schedule, speakers, and more details on the iSEE webpage.](#)

• **Sustainability Week: October.** To draw attention to the actions we all need to take daily to help campus achieve its sustainability goals, iSEE will lead a Pledge Drive to spur students to develop sustainable habits. A social media campaign will let students share photos of their sustainable activities with a broader campus audience. Our second annual Campus Sustainability Celebration will feature a display of Pledges submitted, progress updates from the SWATeams, and a healthy dose of cake! [Schedule and more details coming soon on our website.](#)

What's new in campus sustainability ...

# Illinois Recertified as STARS Gold

The University of Illinois at Urbana-Champaign is continuing its legacy of environmental and sustainability leadership by earning its third consecutive Gold ranking from the Association for the Advancement of Sustainability in Higher Education (AASHE).

Illinois is one of 25 schools — and one of two in the Big Ten Conference — to achieve Gold in the latest, most stringent

version of the Sustainability Tracking, Assessment, and Rating System (STARS) tool. The program has ranked 67 schools with its STARS 2.1 program; 827 overall have registered to use STARS reporting.

“Achieving Gold certification, particularly for a campus this size, is testimony to Illinois’ commitment to sus-

tainability — and to dramatically reducing our carbon footprint. Between now and our next recertification, I look forward to even greater progress toward Platinum certification, AASHE’s highest recognition,” said Evan H. DeLucia, Baum Family Director of iSEE.

[Read the full news release on the iSEE website.](#)



Illinois Biodiesel Initiative Vice President Dan Mace works with Chemistry Professor and iSEE Assistant Director for Special Projects Ben McCall at IBI's station in Noyes Laboratory.

## Students Convert Used Cooking Oil into Fuel, Soap

The Illinois Biodiesel Initiative (IBI) trains students to process waste cooking oil from University Housing and Dining Services into usable fuel. Funded in part by the Student Sustainability Committee (SSC), the club uses a bioreactor housed in Noyes Laboratory to combine the waste oil with methanol to yield two products: biodiesel fuel and glycerin.

Beyond the valuable green products being recirculated to the campus fleet, perhaps the biggest benefit of a program like IBI is the opportunity for students to apply their classroom knowledge in biochemistry to a real-world problem — and see the impacts of their work.

“The cool thing about (it) is that you get to solve a problem and see if what you did works,”

said Daniel Mace, Illinois senior and incoming President of the IBI student organization. “It’s preparation for the real world.

“I love talking about IBI in interviews because companies really value when you have scientific experience that extends beyond the classroom.”

This past spring semester, students produced 100 gallons of biodiesel fuel and 2 gallons of soap from waste vegetable oil. The soap-making subgroup is refining its soap recipe for use at campus dining halls, and the diesel subgroup is improving the production process to make higher-quality fuels.

[Read iSEE Communications Intern Katie Watson's full feature story on IBI.](#)

[Visit the program page.](#)

## Five Earn Awards in Institute's Green Office Program

iSEE has added five Gold-level awards this spring and summer to its Certified Green Office Program after its spring 2017 relaunch.

The offices: University Library Collection Management Services; Facilities & Services (F&S) Capital Programs; F&S Engineering and Construction Services; the School of Integrative Biology; and iSEE itself.

[Read more about the Certified Green Office Program.](#)

## Business Brisk for Styrecycle

During the spring 2017 semester, Styrecycle student volunteers collected more than 500 pounds of expanded polystyrene for recycling — bringing their total collected to nearly 900 pounds.

[Read more about the program.](#)

# What's new with the Student Sustainability Committee (SSC) and iSEE ...



## Biomass Boiler Open House

On June 21, the Energy Farm at Illinois celebrated the successful installation of a 198kW Heizomat biomass boiler with an open house and ribbon-cutting ceremony. Visitors from campus, Heizomat representatives, and even a few biomass enthusiasts from Louisiana gathered for congratulatory remarks from iSEE Director Evan H. DeLucia and Scott Willenbrock, the Provost Fellow for Sustainability, as well as a question-and-answer panel with the Heizomat reps and Energy Farm Director Tim Mies. The purchase of the boiler and its installation were supported by grants from the Illinois Clean Energy Community Foundation (ICECF), the Student Sustainability Committee (SSC), the Dudley Smith Initiative, and proceeds from the 2015 campus sale of verified carbon credits to Chevrolet.

## Staff Change at iSEE; New Coordinator at SSC

The Institute is pleased to welcome Micah Kenfield as its new Sustainability Programs Coordinator. In this role, Micah will guide iSEE's many programs that engage students, faculty, and staff in the campus' overall goals for a zero-carbon future — like the Certified Green Office Program and the SEE Fellows Program, a campuswide undergraduate minor in sustainability.



**KENFIELD**

Before joining the iSEE team, Ken-

field served as the Student Sustainability Committee (SSC) Coordinator for two years, facilitating Illinois students' efforts to identify and finance impactful projects.



**LIEBOWITZ**

Meantime, SSC has hired Cathy Liebowitz to guide students as they allocate more than \$1.1 million of student fee-generated revenue to support campus sustainability projects.

Prior to joining the staff on July 16 as SSC Coordinator, she worked with Greek

undergraduate student communities at the University of Maryland in College Park, Md. Finding a niche at the intersection of higher education and sustainability, she advised and supported her residents on sustainability projects to better the campus community. She also co-designed a Green Chapter program for the Greek community there and managed two Greek chapter houses.

[Read more about iSEE and SSC personnel.](#)

