

2011

Illini Energy Dashboard:

In January 2011, a proposal for the development of an online energy dashboard was submitted and then funded from the Students Sustainability fees. The proposal included money for the development and launching of the dashboard ([HTTP://WWW.ILLINIENERGY.ILLINOIS.EDU/](http://www.illinienergy.illinois.edu/)) and the replacement of older, non-digital meters.

Dashboard Project has threefold effect:

- Provide real time information to develop awareness and cultural/behavioral changes in how energy is used (not only in the buildings featured but in all aspects of life).
- Provide information for faculty and students in research
- Provide details for building staff to better use resources and energy, and make plans for building adaption in ways that may decrease usage over time

History of the project

- November 2010: After a visit from Ron Dembo, Founder and CEO of Zerofootprint, project team established by ECI to discuss development, implementation and timeline of a dashboard for the University of Illinois campus to communicate to campus and beyond energy usage
- January 2011: ECI submitted proposal for funding for the dashboard project
- February 2011: Received dollars from SSC
- March 2011: Begin discussions with F & S staff about data management and software, Establish Instep, Inc. connections
- December 2011: Test Server Launch at ECI Fall Symposium
- January 2012: Beginning of year one with three campus buildings, adding 25 additional

Phase Two funds will replace older meters with digital read, for connection to the software dashboard

What is Illini Energy?

The Illini Energy provides clearly visible understandable information data and information to students and staff of selected University buildings describing energy consumption rate (electrical, chilled water and steam) so that users can make educated choices about the way they can affect energy consumption and conservation.

What is displayed?

- The gauges on the each building page displays real-time energy use data by building for heating, cooling and electricity
- Electricity - Electricity is used for lights, office and lab equipment, heating and air conditioning, appliances, and air quality equipment such as fume hoods in laboratories.
- Heating - Steam is used to heat campus buildings and power some equipment

Cooling - Chilled water is used to cool campus buildings and lab equipment

Catherine Blake, ECI Fellow, sponsored a full day workshop on February 28, 2012, entitled:
Innovation Summit on Building Bridges to Interdisciplinary Learning at Illinois

March 2, 21011: **Environmental Change Institute Fellow Seminar Series**

Andrew Leakey, ECI Fellow, sponsored:

Russell K. Monson, School of natural Research and Environment, University of AZ
 Isoprene emissions from plants and the likely influence on atmospheric chemistry in a changing world

April 4, 2011: **Environmental Change Institute Fellow Seminar Series**, Catherine Blake, ECI Fellow, sponsored:

Dr. Ila Cote, senior science advisor for EPA'S National Center for Environmental Assessment
 Assessment, Prevention and Mitigation of Complex Environmental Problems: An EPA Perspective

April 12, 2011: Dan Ferber, PhD, journalist and coauthor of *Changing Planet, Changing Health: How the Climate Crisis Threatens Our Health and What We Can Do about It*

The Climate Crisis as a Health Crisis:

Disease, Disasters, and a Path to Resilience

November 17, 2011: Food and Energy Sustainability Summit

There is a great interest and need for application of advanced technologies associated with renewable energy, energy efficiency, food production, food preservation and food processing. The goal of this summit is to establish linkages between researchers and technology developers that can work together to develop a more sustainable food system.

December 7, 2011:

Annual ECI Symposium: Interdisciplinary Response to Environmental Change

Each year, ECI has sponsored a research symposium; an opportunity for those funded with the money from the Alvin H. Baum Family Fund, to present a summary of progress and plans. Each presentation will only be about 5 minutes in length- so the afternoon session will be a delightful montage of diverse initiatives.

ECI-Supported Courses

Bill Sullivan: *Landscapes, Sustainability & Human Health*

With support from the ECI, two versions of *Landscapes, Sustainability, and Human Health* were taught during the 2010-2011 academic year. The first version was taught in collaboration with Professor David Buchner from Kinesiology and Community Health and included participants from Urban and Regional Planning, Geography, Landscape Architecture, Community Health, and Architecture. The second version was taught in the spring and included students from Landscape Architecture, Agricultural and Consumer Economics, English, and the School of Earth, Society, and Environment. These courses engage students with a broad-range of readings and exercises that designed to provide them with the analytical skills, knowledge, and where-with-all to address the challenges of producing sustainable, healthy places.

Bruce Litchfield & Katherine Halm: *Grab-a-Bike @ Illinois*

Grab-a-Bike Illinois aims to bring enhanced bicycle sharing to the Champaign-Urbana campus and community. Initially the project aimed to be the first solar powered and cost efficient bike sharing system in the community. Totally wireless, a terminal station can be installed anywhere - then unmounted and stored during hard winter months.

Grab-a-Bike is also a section of the LINC-Learning in Community course (ENG 315), and as such, teams of students work each semester on the project. During Spring 2011 the class designed and built a prototype locking mechanism with automated security for a bike, successfully securing and checking out a single bike via card swipe. Next steps include testing, developing a cost-effective weatherproof control panel system, and exploring further specific customer and infrastructure needs.

Fall 2011 – we made significant strides by partnering the ENG 315 LINC class with Facilities and Services here at the Illinois campus, working with the *Sustainability and Transportation Demand Coordinator*. That F&S office had an intern do an extensive study during summer 2011, and now we have new energy, new personnel, and some new directions for the Grab-a-Bike program. Some of the primary work currently in progress includes (1) expanding the departmental bike sharing program started by the Department of Kinesiology, (2) finding ways to improve the biker/ pedestrian relationship on campus, and (3) assessing the specific needs for biking in the community with an eye toward an informed decision about and selection of a shared bike program. **Grab-a-Bike** continues to be one of the more popular sections of the LINC course with 18 students working on the project this fall.

Scott Willenbrock: *Science and Sustainability*

Discuss the physics underlying climate change in nontechnical language and give the audience the tools to make their own judgments about whether climate change is a serious threat or if the dangers are overblown.

Jesse Ribot & Poonam Jusrut: *Democracy and Environment*

With ECI funds we successfully developed and tested a syllabus and wrote up a banner course proposal for “Democracy and Environment: Representation in Natural Resource Management.” The course proposal has not been submitted since we felt that it needs more background work on

the literature to be used in the course. The course was taught in the Fall of 2010 and was very well reviewed. The course draws on the theoretical and case-based literature to explore effects of institutional choices and recognition in natural resource decentralizations on three dimensions of democracy: 1) representation, 2) citizenship, and 3) the public domain. 'Environment' and 'natural resources' are explored as points of struggle and bases of power, sources resources and revenues in relations of representation. The course will explore democratic decentralization as it interacts with environmental policy in multiple arenas.

Brian Deal: *Sustainability and the Built Environment*

The primary activity for this proposal was development of an interdisciplinary course on energy and built environment. This course was offered in Spring 2011, and has now been assigned a permanent number (UP 466), named as "Energy, Planning and the Built Environment". Efforts are underway to update the course (reorient toward serving a larger, undergraduate enrollment) and arrange for cross-listing with the School of Earth Systems, Society and the Environment.

Over Fall 2010, a syllabus for the course was developed and teaching resources collected for the course. Data regarding overall campus energy use and specific building energy use was obtained from Facilities and Services, and candidate buildings were identified for the course: the Art and Design Building, Temple Buell Hall, the Architecture Building and Smith Memorial Hall. The course utilized guest lectures from the Smart Energy Design Assistance Center, Illinois Sustainable Technology Center and from Facilities and Services Retro-Commissioning. Tours of the 2009 Solar Decathlon House and the Chemistry and Life Sciences Building retrofit were also arranged. Campus data (such as power plant energy use and efficiencies and the climate action plan) were utilized as readings and for analysis in homework assignments.

Final enrollment in the class was 16 students, from Urban Planning, Architecture, Civil Engineering and Earth Systems, Society and the Environment, with a mix of graduate and undergraduate students. The vastly different backgrounds amongst our student made content delivery very challenging. Students were split into interdisciplinary teams and assigned to review information and perform an energy audit of a campus building. As part of this, they conducted several site visits, performed occupant surveys, and developed building models using eQuest software. Finally, the students participated in a planning charette, using information from their team reports and extrapolating across the College of Fine and Applied Arts to develop a report submitted to the Dean of the College of FAA."

ECI-Partnerships

Emily Cross: *Reflections from COP 16*

ECI supported and completed funded the travel for Ms. Cross to attend COP 16 in Cancun

Michelle Wander: *Change and the Heartland*

Change and the Heartland is a publication of the Environmental Change Institute that seeks to bring the complex science of Climate Change challenges and address it in a understandable and yet meaningful manner. Researchers at the University collaborated across disciplines and

shared research insights on 16 topics pertaining to Climate Change.

Karen Decker: *Curriculum for Change and the Heartland*

A collaboration is being developed between the Environmental Change Institute and the European Union Center of Excellence at the University of Illinois at Urbana-Champaign and our first endeavor is to develop a curriculum, based on the topics published in the *Change and the Heartland* (<http://eci.illinois.edu/publications/change-and-the-heartland/>) that would easily connect our Heartland and the agricultural areas of the countries of the European Union. The Environmental Change Institute is a small and primarily privately funded institute whose moniker is *Think Change: Turning White Pages into Green Solutions*. The European Union Center, founded in 1998, serves as the focal point for teaching, research, and outreach on the European Union at the University of Illinois.

The proposed curriculum will offer implementable modules of in class activities for the community college level course either as stand-alone modules embedded into existing coursework or developed into an entire course, helping to prepare a new generation of “green” citizens, truly “building community”.

Funding has been provided by the European Union Center to host an on campus faculty writing retreat (held in the summer of 2012, with 10 participants from community colleges around the state of Illinois), developing a robust curriculum for four to six of the topics included in the *Change and the Heartland* publication.

The writing retreat will be two full days of writing, collaborating and editing curricular modules with problem based/real world situations as basis for activities by teams of faculty invited from the Community College and University communities. Travel, lodging, food, supplies and a small honorarium is offered.

Willie Dong & Nick Glumac: *Effects of Soil Water and Bulk Density on Laser-Induced Breakdown Spectroscopy of Soil Organic Carbon*

Jonathan Tomkin & Eric Snodgrass: *Sustainability: A Comprehensive Foundation*

Funding from ECI assisted in the support and development of this online book, "Sustainability: A Comprehensive Foundation" is a free, open-source textbook available for viewing online or as a download for use on e-readers or printing. First and second-year college students are introduced to this expanding new field, comprehensively exploring the essential concepts from every branch of knowledge – including engineering and the applied arts, natural and social sciences, and the humanities. As sustainability is a multi-disciplinary area of study, the text is the product of multiple authors drawn from the diverse faculty of the University of Illinois: each chapter is written by a recognized expert in the field. Designed for the new generation of e-readers, the book can also be viewed in a browser, saved as a pdf, or printed.

Karen Decker: *Illini Energy Dashboard* – see description above.

ECI Fellows

Catherine Blake: *Text Mining Environmental Change Literature*

The original goal of Dr. Blake's fellowship titled "Text Mining Environmental Change Literature" was to explore ways in which text mining methods could be brought to bear on environmental change research. After attending the symposium and learning more about the research issues being addressed by ECI faculty, it became increasingly clear that several active areas of information science (in addition to text mining) would help positively impact environmental change. Thus, Dr. Blake spent her time as a fellow exploring new ways that text mining can have the most impact (the original plan) and bringing together faculty in the Graduate School of Library and Information Science to develop a large externally funded research proposal.

Thus, the key outcomes of the fellowship at this point are:

- 1) A grant proposal is complete and ready to be submitted to the Institute of Museum and Library Services in December (IMLS, 500K)
- 2) Four GSLIS faculty are meeting regularly to prepare a grant proposal that will include text mining, social media and community engagement. This "working group" has submitted two public engagement proposals to collect the preliminary data required for a larger external proposal.
 - a. "Energizing Anchor Institutions", which emphasizes data visualization of environmental data in the community (PI: Dr. Jon Gant, 20K).
 - b. "Saving the World – One Tweet at a Time" (PI: Dr. Michael Twidale, 20K), which explores social media and an incentives mechanism to amplify environmental change information at a personal level.
- 3) The invited speaker Ron Dembo who was funded from the fellowship, inspired UIUC facilities and management to monitor energy usage in buildings across campus which will provide data for subsequent grants.
- 4) A pilot study on mining agricultural literature (with ECI Fellow Andrew Leakey) has been started that will use text mining as a way to target plants that have changed over time.

Andrew Leakey: *Basic Research to Enable Adaptations of Rice Production to Rising Temperature*

In Nov 2010, I submitted a proposal to NSF's BREAD program with the objective of generating new knowledge needed to adapt tropical rice to tolerate the range of warming predicted this century. These goals will be achieved by combining an integrated genomic, biochemical, physiological and agronomic analysis of heat sensitive and heat tolerant rice genotypes, transgenic plants, and a state-of-the-art facility generating a gradient of temperatures from ambient to +5 °C under field conditions in a tropical growing area. Rice is a compelling model system in which to address yield loss in a warming world. There is evidence that rice yields across tropical/subtropical Asia are currently being reduced by at least 30% for every degree of increase in night temperature during seed filling. In addition, high daytime temperatures are causing reproductive failure of rice at local scales. Temperature increases associated with climate change will exacerbate the mechanisms currently driving yield loss, while also potentially exceeding the temperature thresholds of additional physiological processes that are important in determining yield. It appears observed reductions in yield resulting from high nighttime temperatures can be explained, at least in part, by greater respiratory loss of carbon. Meanwhile,

current-day yield losses to high daytime temperatures are most commonly ascribed to reproductive failure, with inhibition of photosynthesis expected to cause further yield loss as daytime temperatures rise in the future. This project will address key knowledge gaps in the mechanistic understanding of respiratory, reproductive and photosynthetic responses to temperature. This is knowledge that can be used to inform strategies for crop improvement. The proposal received good scores but was not funded in 2010. I am currently working with my co-PIs to address the constructive criticism of reviewers and will re-submit the proposal in November 2011.

During the spring semester of 2011 I invited Prof. Russ Monson and Prof. Keith Mott to give ECI seminars on plant biology and global change. Prof Monson gave an excellent and very well attended seminar and spent two days on campus meeting with numerous faculty and students. Prof. Mott's visit unfortunately had to be canceled due to bad weather, but I am currently trying to reschedule him.

ECI Funded Research Reports

Andrew Leakey: *Environmental Change-induced Alterations in Crop Rooting*

We are approaching the half-way point of our 3-year project titled, "Environmental change impacts on crop rooting, food production and ecosystem production". This project addressed the interactive effects of drought and elevated CO₂ on crop rooting, with consequences for soil carbon, water storage and crop yields. We have completed sampling and processing of our baseline soil cores to assess carbon storage and will send them to our collaborator for analysis in the near future. We have discovered that contrary to current thinking, growth of soybean at elevated [CO₂] does not always lead to reduced crop water use and amelioration of drought stress. Rather, as growing conditions become more stressful soybean grown at elevated [CO₂] expected in the future uses as much, or even more water, than soybean grown under today's [CO₂]. As a consequence it can experience greater late-stress, with negative consequences for crop yield. This result formed the basis of 10 lectures and poster presentations at conferences in the U.S., UK, Australia, Panama and South Africa – as well as manuscripts currently being prepared for submission to scientific journals.

Andrea Martens: *The Impact of Gasoline Prices on Internet Purchases*

The proposition of a carbon tax has reinvigorated the discussion about the price and income elasticity of gasoline demand. This paper analyzes how consumers react to higher gas prices in a new setting, studying their choice between making purchases driving to a store or clicking on their keyboard.

"To go shopping these days, more Americans are trading in their car keys for a keyboard. Online shopping is gaining at a time when simply filling up a gas tank to head to the mall can seem like a spending spree." (New York Times, July 19 2008, "To Save Gas, Shoppers Stay Home and Click")

This project analyzes the validity of the statement above studying 155,000 households across the U.S. from 2008 to 2009. Prior studies of Internet purchases have focused mainly on local sales tax rates, traditional retail options, and household computer usage. This paper accounts for the

aforementioned factors, but is the first study to incorporate transportation costs for the individual decision-maker. I account for the latter using retail gas prices at the zip code level and detailed vehicle fleet information and demographic characteristics at the household level. This study analyzes both grocery and other online purchases.

This research is related to two strands of literature. The first one analyzes how gas prices affect consumer behavior, both in terms of their driving and spending patterns. The second strand of literature studies the determinants of online shopping

Estimating a negative binomial count model of the number of Internet purchases during the last month, I find that higher gas prices do not influence the propensity of consumers to make purchases online. Overall, individual characteristics that relate to the value of time, such as working full-time and having small children, influence the probability of buying online the most. I do not find evidence for the sales tax avoidance hypothesis.

The contributions of this paper are three-fold. First, it analyzes the incidence of higher gas prices on consumers' behavior in a novel setting. Particularly, it studies the impact of transportation costs on consumers' decision to drive or to "click" to make purchases, using detailed measures of car fuel efficiency, gas prices, and traditional shopping options. Second, it sheds light on how individual and household characteristics influence online purchases. Third, it contributes to the discussion of the environmental impact of online purchases. Weber et al. (2009) find that online purchases have approximately 30% lower energy consumption and carbon dioxide emissions than traditional retailing. They conclude that consumer transport accounts for approximately 65% of the traditional retail primary energy expenditures and carbon dioxide equivalent emissions on average. For electronic commerce, packaging and last mile delivery are responsible for approximately 22% and 32% of the e-commerce energy usage, respectively.

References:

Weber, C.L., C.T. Hendrickson, H.S. Matthews, A. Nagengast, R. Nealer, and P. Jaramillo (2008) "Life cycle Comparison of Traditional Retail and e-commerce Logistics for Electronic Products: A Case Study of buy.com, Working Paper, Green institute, Carnegie Mellon University

PROJECT PROGRESS & PRESENTATIONS

I obtained better estimations and results. The paper was selected for presentation at two conferences in the summer of 2011:

"Using National Household Travel Survey Data for Transportation Decision Making: A Workshop", organized by the Transportation Research Board of the U.S. Department of Transportation

"Association of Environmental and Resource Economists Annual Meeting"

I also presented this paper at the pERE workshop of the Department of ACE at UIUC.

Jennifer Fraterrigo: *Terrestrial Carbon Loss to Aquatic Ecosystems*

Courtney Flint: *Agricultural Landscapes and Decision Making in the Context of Climate and Policy Change*

Fall 2011 – Spring 2012 IGEN Partnership

The **Illinois Green Economy Network (IGEN)** is a partnership of all 39 Illinois community college districts and 48 campuses working with businesses and local communities to grow Illinois' green economy, providing new employment opportunities and healthy communities for all.

Karen Decker initiated connections across the state with community college faculty and sustainability coordinators for the dissemination of University of Illinois research projects and publications.

October 28, 2011 GGCC 2011 Sustainable Universities & Colleges Symposium

Heartland Community College

Karen Decker, ECI, presenter

What is the Environmental Changer Institute: A Highlight of programs