

UCONN Sustainable Energy Symposium
March 31 and April 1, 2008
Program

Day 1 - March 31

7:30-8:25 Registration and Sign in

8:25 – 8:35 Welcoming Remarks by Michael Hogan, President – University of CT

8:35 -10:00 Federal Initiatives in Sustainable Energy

Moderator - Gregory Anderson, Vice Provost for Research

John Larson, Congressman, 1st US District

Joseph D. Courtney, Congressman, 2nd US District

Donald E. Williams, Jr. State Senate President Pro Tempore, 29th CT District

Denise W. Merrill, State House Chair, Appropriations Committee, 54th CT District

Rosa L. DeLauro, Congresswoman, 3rd US District

10:30-11:50 CT State Initiatives in Sustainable Energy

James A. Amann, Speaker of the House, 118th CT District

Gary LeBeau, Senate Deputy Majority Leader, 3rd CT Senate District

Lawrence F. Cafero, House Republican Leader, 142nd CT District

John Fonfara, Senate Co-chair of the Energy and Technology Committee.

1st Senate District

Sean Williams, Ranking Member, House Energy & Technology Committee

68th District

11:50-12:00 Lunch and the UCONN Biofuels Consortium

Richard S. Parnas, UCONN Institute for Materials Science

12:00- 1:30 Lunch break and laboratory tours

Tour 1 - Biodiesel Laboratories

Tour 2 - Plant Science Bioenergy Greenhouse

Tour 3 - CT Global Fuel Cell Center

1:30 - 3:00 Breakout Sessions

Session 1 – Biofuels. Co-Chairs, Richard Parnas & James Stuart

Second Generation Biofuel, Steven Henck, President Arbor Fuels

It's All About Scale: Biodiesel Production from Recycled Cooking Oils, Nat Harris, Newport Biodiesel

Microwaves for biodiesel production: Accelerating the biofuels Revolution, Nicholas Leadbeater, UConn

Critical Importance of Fuel Quality, Dan Walsh, Bently Tribology Services

Solar and Biofuel: Their Potential in Connecticut, Peter Gunther, CT Center for Economic Analysis

Session 2 - Solar Energy. Co-Chairs, Harris Marcus & Steven Suib

Solar Energy Progress in Connecticut, David Ljungquist, Connecticut Innovations, Clean Energy Fund

Passive Solar Opportunities, Martin Fox, UCONN

Catalysts in Solar Energy Devices, Steven Suib, UCONN

Nanomaterials Design For Increased Efficiency in Solar Collectors, Ramamurthy Ramprasad, UCONN

Organic Photovoltaic Devices, Fotios Papadimitrakopoulos, UCONN

Session 3 – Fuel Cells. Co-Chairs, Mehdi Anwar & Patricia Bergman

Fuel Cells for a Sustainable World, Ben Wilhite, UCONN

Fuel Cells, Sustainability thru Fuel Diversity and Efficiency, Frank Wolak, Vice President, FuelCell Energy, Inc.

Reducing Environmental Impact and Increasing Energy Security with Fuel Cells and Geothermal Solutions, Thomas Jarvi, Director of Technology, UTC Power

Comparative Fuel Cell Economics between Natural Gas and Biomass, Patrick O'Neill, CEF, Ct Innovations

Session 4 – Bioenergy Feedstock I: Development of Better Cellulosic and Oil Crops.

Chair: Harrison Yang

Om Parkash, UMass: Developing *Crambe abyssinica* as an Ideal Crop for Biofuels and Bioproducts

James LaMondia, CAES: Oilseed Crops in Connecticut, a Value-Added Approach

Jeremy Johnson, Agrivida: Cellulosic Biofuels: A Role for Agricultural Biotechnology

Wolf-Dieter Reiter, UConn: Genetic Modifications of Hemicelluloses and Their Influence on Cellulose Content

Yi Li, UConn: Gene-Deletor Technology and Its Potential Applications in Cellulosi and Oil Seed Energy Crops

Session 5 – Posters. Monoswita Saha

1.)Monitoring Biodiesel Reactors by Raman Spectroscopy

Michael Donahue and Stuart Farquharson

Biodiesel has become the foremost alternative fuel to those refined from petroleum products. It can be produced from renewable sources, such as vegetable and animal oils, as well as from wastes, such as used cooking oil. Transesterification is the primary method of converting these oils to biodiesel. However, due to the variability in the starting materials, both type and composition, it is highly desirable to monitor the reaction as it proceeds to optimize yield. For this reason we have been examining the ability of Raman spectroscopy to monitor the esterification reaction, the disappearance of the triglyceride raw material and the appearance of the methyl ester and glycerin products, with the goal of controlling yield. This poster will present our preliminary measurements performed on a small scale reactor.

Dr. Stuart Farquharson

President & CEO

Real-Time Analyzers, Inc.

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2) "Modification of Hemicellulose increased cellulose content in Arabidopsis". The authors are: Lijuan Wang, Xuemei Li, Maria Pena, Israel Condero, Amy Amin, Nick Carpita, Malcolm O'Neill, William York, Wolf-Dieter Reiter.

3) "Gene-Deletor:' A Newly Developed Technology to Address Invasive and Gene Flow Problems of Bioenergy Crops Yi Li. New England Invasive Plant Center and UConn Plant Science.

We have recently developed the "gene-deletor' technology that addresses the environmental and food safety concerns over genetically improved crops. With the technology, all of the introduced genes will be automatically deleted when the functional of these genes are no longer needed or their presence may cause concerns. The technology is of particularly useful to prevent invasive and gene flow problems of genetically improved bioenergy crops. The technology we published last year has been well received worldwide. Thousands of websites, newspapers, and magazines worldwide have reported or commended the technology. Two examples are Dr. Savidan, the Chairman of the International Agriculture Center in France in his commentary article states: "The 'gene-deletor' technology constitutes a true revolution in the modern biotechnology." Social Technologies <<http://socialtechnologies.com>> , a DC-based global research and consulting firm specializing in the integration of foresight, strategy, and innovation, recently "released a series of 12 briefs that shed light on the top areas for technology innovation through 2025." In one of the 12 briefs entitled "The Future of Engineered Agriculture," the 'gene-deletor' technology is highly praised and takes 50% the length of the entire brief.

Development of Faster Growing Poplar Trees for Bioenergy Applications in Connecticut

Yi Li. UConn Dept of Plant Science.

Our estimate indicates that energy (heat, electricity, gas & liquid fuels) from fast-growing trees planted on 10% - 20% of the total CT land that is currently idle, marginal agricultural and forest land: 1) Can provide 10-30% of the energy need in CT; 2) Is sustainable, environmentally friendly and economically feasible; and 3) Can be optimized through the UConn's bioenergy R &D initiative. Because poplar trees, a non-food crop, are one of the most suitable bioenergy crops for CT and the Northeast US, we have recently developed a gene technology to optimize growth rate of poplar, resulting in a 50 to 80% increase in biomass production. The technology also produces several other desirable traits such as easy propagation and high survival rate of poplar stem cuttings under field conditions. The growth promoting technology we developed should be

useful in other cellulosic energy crops and therefore make heat, electricity, gas- or liquid fuels from bioenergy crops price-competitive.

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- 5.) Wheat gluten as a viable plastic
- 6.) Present and Future State Regulations related to Biofuel
- 7.) Biomass for Energy: Global development of a short-rotation willow crop, by Julia Kuzovkina
- 8.) Kinetics of Potassium Hydroxide-Catalyzed Transesterification of Soybean Oil, by Matthew B. Boucher, Clifford Weed, Si-Yu Li, James Stuart, Richard Parnas, and Benjamin Wilhite.
- 9.) Biodiesel Processing from Hemp Oil Feed Stock, by Si-Yu Li, and Richard Parnas.
- 10.) Selectivity of Free Fatty Acid Esterification with Homogenous Catalysts, by Matthew B. Boucher, Steven Unker, Kyle Hawley, Benjamin Wilhite, and Richard Parnas.
- 11.) Analytical Techniques for Monitoring Competing Esterification and Transesterification, by Alyssa Midgette and Firadous Chalhaoui.
- 12.) "Thiophene Based Materials: Towards High Efficiency Printable Solar Cells"
by Jayesh G. Bokria, Zeki Buyukmumcu, Tanmoy Dey, and Gregory A. Sotzing.
- 13.) Setting up at UConn a Biodiesel Testing Laboratory Following ASTM methods, by James D. Stuart, Richard Parnas and Matthew Boucher
- 14.) Modification of Carbon Aerogel Supports for PEMFC Catalysts.
The authors are, Alevtina Smirnova, Taylor Wender, Yan-Ling Hu, John McCartney, Mark Aindow, Pete Menard, Daniel Goberman, Xing Dong, Wendell Rhine.

3:00 - 3:30 Break

3:30 - 5:00 Breakout Sessions

Session 1 – Investment Opportunities in Sustainable Energy. Moderator, Vincent Caprio,
Founder & Executive Director, New York NanoBusiness Alliance

Panelists:

Mark Barnett, Co-Chair, Energy Technology & Renewable Practice, Foley Hoag, LLP

Mark Modzelewski, Managing Director & Co-Founder, Bang Ventures

Pauline Murphy, Managing Director, Connecticut Innovations

Andrew Ziolkowski, Partner, MidPoint Food & Ag Fund

Session 2 – Public Policy. Co-Chairs, William Leahy, ECSU & Richard Miller

Panelists:

Elliot Ginsberg, President & CEO, CT Center for Advanced Technology

Don Downes, Chairman, Dept. of Public Utility Control

Paul Michaud, Regulatory Director, CT Clean Energy Fund

Ray Wilson, Office of Policy Management

Session 3 – Bioenergy Feedstock II: Plantation, Utilization, Economic and Environmental Prospects Chair: Yi Li

Peter Miniutti, UConn: Environmental Design for Bioenergy Crop Plantation

Julia Kuzovkina, UConn: Development of Production Systems of Cellulosic and Oil Bioenergy Crops

James Potter, Clearview: Renewable Energy Solutions Providing Economic, Environmental and Rate Payer Benefits to Connecticut

Rigoberto Lopez, UConn: Economic Prospects of Bioenergy Crops

Harrison (Xiusheng) Yang, UConn: Environmental Issues in Bioenergy Crop Production

Day 2 - April 1

9:00 -12:00 Morning Workshops

Workshop 1 - Biodiesel Production, Richard Parnas & Matthew Boucher
Room 114B, Engineering 2

The basic chemistry and safety issues will be covered for producing biodiesel while producing a 50 gallon batch of the fuel. We will make use of the Chemical Engineering Undergraduate Laboratory where a simple batch reactor and associated equipment is located. While producing the 50 gallon batch of biodiesel in the batch reactor, the theory and operation of a more advanced continuous flow reactor will be discussed and demonstrated.

Workshop 2 – Fuel Cell Basics, Ugur Pasaogullari
Connecticut Global Fuel Cell Center, Depot Campus

Fuel Cell Fundamentals and Applications:

In this course, fuel cells will be introduced, along with theory, operating principles, materials, design and operation. Several fuel cell types will be discussed, and the fundamental electrochemistry and thermodynamics of fuel cell operation will be investigated. Special focus will be given to low temperature fuel cells based on polymer based electrolytes, along with contemporary issues in design, operation, performance and reliability/durability of these systems.

Workshop 3 – Development of a Connecticut Biofuels Industry, William Leahy
Room 134, Center for Undergraduate Education

An interactive workshop on steps needed to build a successful Biodiesel Industry in Connecticut

Presentations:

1. CT's Biodiesel Initiatives - David Kalafa, Office of Policy and Management
2. CT Biodiesel Association - Gus Kellogg, President of GreenLeaf Biofuels LLC and the CT Biofuel Assoc.
3. State Fire and Building Codes Governing Biofuel - John Doucette and Bob Upton, State Fire Marshal's Office
4. Incentives for growing, producing, distributing and using Biofuel – Paul Hoar, AgriFuel LLC

Discussion:

Where do we go from here?..the 2009 Legislative Session - Discussion led by William Leahy, Director of Institute for Sustainable Energy, ECSU

12:00- 1:00 Lunch

1:00 - 4:00 Afternoon Workshops

Workshop 1 - Biodiesel fuel quality testing, James Stuart & Paul Hoar
Room 114B, Engineering 2

Biodiesel quality is paramount in order to expand the usage of this alternative fuel in the United States. The objective of this workshop is to explore the numerous standards this fuel must meet and the techniques and test equipment available in the marketplace to insure its quality. A brief classroom description of various services and laboratory test equipment will be followed by hands on testing demonstrations in the UCONN laboratory.

Paul Hoar of AgriFuels LLC will discuss the ASTM D 6751 standard and the need for surveillance testing of biodiesel in the supply chain.

Dan Walsh will describe Bently Tribology Services' (BTS) capabilities as a commercial biodiesel laboratory and the importance of testing certain properties to ASTM standards throughout the supply chain.

Jim Stuart will describe the setting up of certain key tests in UCONN's Biodiesel Laboratory of the Dept. of Chemical Engineering and results of his participation in ASTM's Biodiesel Cross Check Program.

William Goodman of PerkinElmer in Shelton, CT will be describing a novel, dual purpose gas chromatograph that allows for both the testing of free and total glycerin as well as methanol.

Dylan Wilks of Wilks Enterprise, Inc will describe a VFA-IR Spectrometer with a spectral range analyzer capable of monitoring % biodiesel in diesel, total glycerides, and free fatty acid (FFA) in feedstock.

**Workshop 2 - Hydrogen/Air Polymer Electrolyte Membrane Fuel Cell (PEMFC):
Manufacturing and Testing**, Alevtina Smirnova
Connecticut Global Fuel Cell Center, Depot Campus

The objective of this laboratory is to implement basic experimental and analysis techniques to manufacture, demonstrate and characterize performance of hydrogen PEMFC as a function of temperature and /or gas relative humidity. Demonstration of experimental procedures include deposition of catalyst layers on the surface of the Teflon substrate using screen-printing technique, hot-pressing of MEAs, fuel cell assembly and testing.

Workshop 3 – Financing Sustainable Energy Ventures, Konstantine Drakonakis
Room Monteith Room 119

Workshop: "Financing Sustainable Energy Ventures"

1:00 pm - The Array of Capital Sources - David Sturgess, CVG Executive Director

1:30 pm - Grants - Merrie London, CCAT/SBIR Office

2:00 pm - Equity Capital (Angel and VC Financing) - David Sturgess, Updike Kelly & Spellacy

2:30 pm - BREAK

2:40 pm - Pitching Investors - Mike Roer, Connecticut Venture Group

3:00 pm - How Investors Will Evaluate Your Proposal – Konstantine Drakonakis, Connecticut Innovations Inc.

3:30 pm - Q&A. Discussion panel with an Investor, an Entrepreneur, and an Attorney

4:00 – Conclude