

May 2009 Issue

PENNSTATE



Cooperative Extension  
Renewable and Alternative Energy



## ENERGY UPDATE

May, 2009

### IN THIS ISSUE

Performance of Laying Hens

Bioelectricity

Union Training

Wody Biomass

Farm Energy Efficiency Workshops. June 16 and 24

### UPCOMING EVENTS

Dairy Farm Energy Efficiency Training Workshop  
16 June, 2009 at Lancaster County Farm and Home Center, Lancaster PA. Contact Peggy Fogerty-Harnish at [muf17@psu.edu](mailto:muf17@psu.edu)

Greenhouse Energy Efficiency Training Workshop  
23 June, 2009 in Ephrata, PA. Contact Peggy Fogerty-Harnish at [muf17@psu.edu](mailto:muf17@psu.edu)

Community Scale Bioenergy Short Course  
27 July, 2009 at Penn Stater Hotel and Conference Center, State College, PA. Contact Dan Ciolkosz at [dec109@psu.edu](mailto:dec109@psu.edu)

### WELCOME!

Things continue to keep everyone busy on campus with a multitude of projects and activities happening on the energy front. In this month's newsletter, we address an array of activities that are going on in our extension programs. Troy Hottle shares some on his experiences with workforce training..an important part of the future for a new energy efficient society. Our Wood Products specialist, Chuck Ray, shares with us some estimates of the potential of Pennsylvania's forests to supply woody biomass. Feedstock supply estimates like this and the logistics associated with feedstock development are critical in the development of biomass based energy systems. Our poultry scientists share some of their work on the use of camelina meal in poultry diets. This is a an example of how adding value to a coproduct can help to add to the profitability of a biofuel enterprise and how biofuel crops and animal agriculture can be complementary. We also showcase some of our upcoming training in farm and greenhouse energy efficiency..something that is critical to address in the future.

Sincerely,

Greg Roth

Greg W. Roth  
Program Leader  
Renewable and Alternative Energy  
Penn State Cooperative Extension

## Performance of Laying Hens Fed Camelina Meal and Flaxseed Diets



**Performance of Laying Hens Fed Camelina Meal and Flaxseed Diets**

## LINKS

[PSU Renewable & Alternative Energy](#)

[Steel City Biofuels](#)

[Coping with High Energy Prices](#)

[Biomass Energy Center](#)

Camelina is a potential biofuel crop that can enhance our crop rotations but could also provide a valuable meal for poultry production. To better understand the potential value of camelina meal, an experiment was conducted at the Penn State Poultry Education and Research Center to determine the effect of different levels of camelina meal and flaxseed on egg production and body weight of two strains of laying hens. Two hundred and ninety four Hy-Line W36 (W36) and two hundred and ninety four Hy-Line Brown (Brown) hens were distributed among seven treatment diets for three consecutive laying periods (22-26, 26-30 and 30-34 wk). Treatments consisted of increasing levels of flaxseed (1, 2 and 3%) and camelina meal at 3 times more than the flaxseed (3, 6 and 9%) to equal the same dietary omega-3 levels as the flaxseed diets for period-1 (22-26wks). For periods-2 and -3, levels of both ingredients increased 2 and 3 times compared to period-1 to observe the cumulative diet effects. Hen body weight, egg production, feed consumption and feed conversion were measured at 26, 30 and 34 wk.

In the first period all parameters were equal to control fed birds except feed consumption was reduced about 7% among the W36 white hens fed the highest, 9% camelina diet. Also egg omega-3 levels were approximately 2.5, 3.7 and 4.1X greater than control eggs from diets with either camelina or flaxseed at low, medium and high levels.

Later in periods 2 and 3, when levels of camelina inclusion were increased, both W36 and Brown hens consuming the camelina (6 to 27%) respectively at 26-34 wk had decreased feed consumption while only W36 hens had decreased body weight. Brown hens fed camelina meal had decreased egg production compared to the corn-soybean diet in the 2nd and 3rd periods. White hens (W36) had reduced egg production when fed 12, 18 and 27% camelina diets. At the highest level of supplementation (27%) egg omega-3 enhancement was 9X greater than eggs from control fed hens. At the highest level of flaxseed supplementation (9%) egg omega-3 enhancement compared to control fed hens was approximately 18X greater.

Since the omega-3 concentration was almost 3 times greater for the flaxseed vs. the camelina we would have anticipated similar egg omega-3 levels.

However, since feed consumption was reduced at the highest levels of camelina, that most likely reduced egg levels of these important fatty acids. Thus far in our study supplementation of hen diets with camelina meal up to 9% between 22-34 wk of age did not have any detrimental effects on performance of the hens regardless of the strain, and resulted in eggs of similar levels of omega-3 fatty acids as did the flaxseed diets. However, more than 12% dietary camelina reduced performance of the birds compared with the corn-soybean and flaxseed diets. Flaxseed diets with 9% inclusion had no negative impacts on hen performance early in the study to 34wks. Based on this study, while there are negative effects at very high inclusion rates, camelina has potential to be used as a byproduct supplement of broilers and layers and can significantly increase egg omega-3 levels.

[A. Y. Pekel, P. H. Patterson, R. M. Hulet, N. Acar, T. L. Cravener, D. B. Dowler, J. M. Hunter, Department of Poultry Science and Penn State Extension](#)

## Bioelectricity

### [Biomass Electricity More Efficient Than Biofuels, Study Finds.](#)

California's Mercury News reports that "Ethanol from plants can fill up drivers' gas tanks, but people could drive 80 percent farther if we converted those crops into electricity, according to a new study by Stanford and University of California researchers." In terms of converting plants into energy, the scientists considered conversion "into ethanol through fermentation" and converting the plants into electricity by burning biomass to power electrical generators. The researchers "compared the energy costs and output of the electricity and ethanol produced from the same patch of land," and concluded "that an acre of switchgrass could power a small SUV for 15,000 miles if converted into electricity, but 8,000 miles if turned into ethanol." Biofuel advocates counter that "battery technology is still developing," while ethanol uses technology that "is currently cheaper and more accessible." The researchers conceded "that their calculations do not account for every factor in comparing the two energies."

The Financial Times adds that "bioelectricity was a clear winner over bioethanol, whether the energy came from corn or switchgrass. A car powered by bioelectricity could travel almost 14,000 miles on the net energy from an acre of switchgrass, while a car powered by bioethanol from the same crop would go only 9,000 miles." Bloomberg News reports that the researchers studied "land-use efficiency, or how much transportation can be achieved per acre of cropland that's being used to produce plants for energy."

The study also found "the electricity option would be twice as effective at reducing greenhouse-gas emissions," Technology Review reports "there's also the potential, according to the study, of capturing and storing the carbon dioxide emissions from power plants that use switchgrass, wood chips, and other biomass materials as fuel -- an option that doesn't exist for burning ethanol." The findings are said to "imply that investment in an ethanol infrastructure, even if based on more efficient cellulosic processes, may prove misguided."

[Dennis Buffington, Ag & Biological Engineering](#)

# Union Training

## Biodiesel Short Course for Operators and Mechanics

At Steel City Biofuels, a project of Cooperative Extension in Pittsburgh, we try to provide what I like to call "full spectrum education". The past couple of weeks I have worked in partnership with Fossil Free Fuel, a business out of Braddock, PA, to provide The International Union of Operating Engineers, Local 66 with their first ever course on biofuels. The three-hour short courses supplemented the training their mechanics and operators received to include information on handling and use of biodiesel with heavy equipment. The training Troy provided included:



- Fuel Standards
- Basic Properties of Biodiesel
- Health Benefits of Biodiesel as Opposed to Petro-Diesel
- The Use of Biodiesel
- Potential Pitfalls
- Equipment Manufacturers' Policy

These three-hour training sessions reached more than 40 union apprentices and members and are the first steps towards a standard training program that we will be helping Local 66 develop.

To read more about Steel City Biofuels' educational programs please visit Troy's Blog here: [http://www.personal.psu.edu/tah27/blogs/scb\\_education\\_blog/](http://www.personal.psu.edu/tah27/blogs/scb_education_blog/)

Troy Hottle, Allegheny County Cooperative Extension



## Woody Biomass

### Energy Potential in Pennsylvania and the Northeastern US

A key question in the development of woody biomass for energy in Pennsylvania is..."How much wood can be sustainably harvested from our forests?" Based on our estimates, the total wood biomass on Pennsylvania's timberland is about 1,146 million tons. Fifty-seven percent of the total biomass, or 658 million tons, is classified as "low-use wood", that is, low-grade wood material that is often not harvested due to various market factors. Applying management constraints that support sustainable harvesting of this resource yields an estimate of available low-use wood of 469 million tons. US Forest Service estimates clearly indicate that growth of the Pennsylvania forest clearly exceeds utilization by a significant margin. Further, unconstrained buildup of low-use biomass is a forest health issue that needs to be addressed to mitigate future risk to the Commonwealth's forestland. A major portion of this excess growth is in additional low-use wood, and the percentage of this non-economic natural resource will continue to grow as a percentage of the forest. [The Pennsylvania Hardwoods Task Force](#) estimated in 2008 that 6 million dry tons of "low use wood" could be harvested annually without depleting the forest from which it comes. In the 1990s, roughly 3 million dry tons were being used by industry, and current use has dropped to barely more than 1 million dry tons.

"Bio-refineries" and a complementary biomass energy industry of [district energy projects](#), wood pellet and firewood production, and initiatives such as "[Fuels for Schools and Beyond](#)" would seem to be a potential significant industry for utilization of low-use wood, especially considering that most existing pulp operations have the facilities to convert to the bio-refinery concept. The only apparent way to significantly and controllably reverse the trend of increasing forest inventory of low-use wood is through the expansion of wood-based energy production and development of a Pennsylvania regional hub in bio-refinery competency and production. Wood consumed for energy is clearly accepted as a carbon neutral concept when based on harvesting from well-managed forests, as is done in Pennsylvania. [Governor Rendell's announced goal of one billion gallons a year of bio-based transportation fuels](#) bio-based transportation fuels is certainly a major step in projecting an economic basis for developing our internal energy-wood based ethanol production facilities. If this step is followed by supportive legislative action in the near term, the private sector will step up to the plate with additional research and investment. However, without clear and firm state and/or federal cellulosic ethanol requirements, the development of a viable wood to cellulosic ethanol market and production capacity will not develop nearly fast enough to have the environmental and economic effects that otherwise could be enjoyed in Pennsylvania within the next decade.

As an alternative or complement to cellulosic ethanol production, the available woody biomass could fuel 600 district energy projects replacing 475 - 500 million gallons of #2 fuel oil annually, or 300 million 40 lb. bags of wood pellets for pellet-burning heaters, enough to heat about 3 million homes each winter in Pennsylvania.

Current wood producers in the state worry about the impact of government subsidization of these new "bio-energy" industries on the cost and availability of Pennsylvania's wood resource. But the likelihood is that wood costs will not significantly increase due to demand until the number of woody biomass projects reaches critical mass to start impacting the market. In [Austria](#), with 2/3 the land mass and timber base of PA, that didn't occur until around 1,000 wood-based district energy projects had been commissioned. In Pennsylvania, we have a ways to go yet...and the market will send us clear signals when that is beginning to occur, so that subsidies and incentives can be cut back as prudent. The real factors that will cause an increase in wood costs are not related directly to number of projects, but to the marginal cost increase associated with harvesting smaller timber and certifying [sustainable forestry standards](#).

Others in the commonwealth worry about the sustainability of harvesting additional wood that is typically left in the forest. However, the involvement of local stakeholders in the conception and planning of many of the proposed facilities tends to ensure a strong emphasis on sustainability. In [Smethport, Pennsylvania](#), for instance, the sustainability issue was a primary consideration...when local stakeholders got together, the sustainability questions were asked early and often, and project facilitator and Penn State extension educator Tim Pierson addressed those concerns with the formation of a "Woody Biomass Forest Sustainability Leadership

Team." This team of 20-30 people has met once already and is tasked with the conception and delivery of a sustainable supply of the 40,000 tons of wood per year that the project will require. At the initial meeting there was much discussion about how local lands could be certified, managed, and monitored for targeted harvest and delivery of sustainable wood.

A recent study for the US Forest Service conducted by the PSU School of Forest Resources Wood Operations Lab analyzed the potential impact of the apparent increase in demand for woody biomass resources across the thirteen Northeastern United States. The conclusions of the study included:

- Small-scale bioenergy projects pose no real threat of significantly reducing the general supply of woody biomass in the Northeast, but areas of heavily-concentrated projects could experience local demand pressure.
- The ongoing decline in pulp and paper production in the Northeast, together with the apparent decline in other traditional woody biomass-using industries, will work to relieve the pressure on the region's woody biomass resource.
- Assuming a normal and expected evolution of events, woody biomass consumption in the Northeastern United States will increase by roughly 25% over the next decade.
- The variable with by far the highest potential impact on the level of forest utilization is the future direction of electricity production from wood and co-firing of wood in coal power plants.

The harvesting of our low-use wood can be both sustainable in perpetuity and environmentally sound from a standpoint of carbon neutrality. Conversion of the commonwealth's stocks of low-use wood to energy and bio-refinery products at a sustainable rate is a socially responsible and ecologically sensible strategy for this vast, yet vastly underutilized, natural forest resource.

For additional information, see:

[http://woodpro.cas.psu.edu/Wood\\_Energy.htm](http://woodpro.cas.psu.edu/Wood_Energy.htm)

[http://woodpro.cas.psu.edu/Goddard\\_Forum.htm](http://woodpro.cas.psu.edu/Goddard_Forum.htm)

Chuck Ray, Wood Operations Extension Specialist

## Farm Energy Efficiency Workshops

### Farm Energy Efficiency Workshops, June 16 and 24

Energy efficiency more important than ever if farms in Pennsylvania hope to remain competitive and profitable. However, very few people really know how to assess and recommend energy efficiency measures that make sense both economically and practically.

Penn State Cooperative Extension is holding two single-day workshops to train farm professionals and farmers in the skills needed to make farms more efficient. The workshops will cover the basics of analyzing the farm's current status, finding opportunities for improving energy performance, and predicting which opportunities actually pay off.

These workshops are ideal for the agricultural professional who is interested in energy issues, or for energy professionals who would like to better understand farm energy. Farmers who are interested in energy will also stand to gain a great deal from these events.

The first workshop, on 16 June, is devoted to Dairy Farm Efficiency, and will feature expert instruction in the various energy-using systems typically found on a farm, plus ways to make them more efficient. The day will end with a hands on visit to a dairy farm, in which participants are able to see and take part in an analysis of the farm. The main speaker for the event will be Dr David Ludington, nationally renowned expert in farm energy and author of the Dairy Farm Energy Management Guidebook.

The second workshop, on 24 June, will focus on Greenhouse Energy Efficiency and the unique energy aspects of intensive controlled environment production. This workshop will also include a site visit to a nearby commercial greenhouse to see and participate in the assessment of the facility's energy use patterns. Speakers for the event will include Robert Berghage and Jay Holcomb, horticulturalists and greenhouse energy specialists at Penn State.

Both workshops will be held at the Lancaster County Farm and Home Center, in Lancaster, PA. Thanks to the generous support of the Lancaster County Workforce Development Council, Pennsylvania residents are able to attend for a reduced rate of \$50. Lunch, coffee, and handouts are included in the fee for this all-day event.

The program brochure, including the registration form, are available online at <http://downloads.cas.psu.edu/RenewableEnergy/events08/Farmenergyworkshops609.pdf>

For more information, contact Peggy Fogarty-Hamish at [pfogham@psu.edu](mailto:pfogham@psu.edu), 717-394-6851.

Daniel Ciolkosz, Ag and Biological Engineering

## About Renewable & Alternative Energy

For more information on Cooperative Extension's Renewable and Alternative Energy Resources at Penn State visit our home page at <http://energy.extension.psu.edu/>

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