

Biobased Products and Renewable Energy Issue Group

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Introduction

We are on the cusp of a new era of increased reliance on agriculture and natural resources. The U.S. has been blessed with rich agricultural and forest lands that for decades have produced an abundance of food and fiber for both domestic and export markets. But changes in the 21st century are creating new demands on our resources, encouraging ingenuity and adoption of new technologies. The advent of these new technologies, economic pressures and policy imperatives are transforming societal expectations in new and unprecedented ways. These changes are driving us to a new type of bio-based economy – one that relies on agricultural crops and trees not just for food and fiber, but also for energy and materials to replace some of our dependence on petroleum. This can increase sustainable economic development while also improving air quality. Given the scale of this increased demand and the limits of plant productivity, we are rapidly transitioning from a natural resource economy of excess supply to one of scarcity. This transition has broad implications – both positive ones for rural economic development, but also risks of socio-economic dislocation and environmental disruption. It is the responsibility of Penn State University and other land grant universities to help guide implementation, build awareness of impacts, and help channel this transition in positive and effective ways.

Goal: Penn State will be a national leader in addressing the challenges of building a sustainable bio-based economy. To achieve this goal, we need to:

- Assess and improve bio-resource sufficiency and sustainability from the landscape
 - Forest resources
 - Crops on marginal, abandoned, and environmentally sensitive land
 - Integration of food, energy, and material feedstocks from productive ag. land
 - Organics recycling
- Create new products for a bio-based economy
 - Bio-based materials
 - Next generation energy technologies
 - Cellulosic and waste biomass
 - Wind and solar
- Investigate and optimize conversion and manufacturing technologies at appropriate scales
- Develop and apply expertise in integrated technology assessment
- Educate the public about resources, environment, technology and consumption choices
- Identify and address perception, motivation, economic and policy challenges

Strategies

Residential Education.

There is a pressing need to give students knowledge about the new opportunities in natural resources management being created by bio-based and renewable products and technologies and their potential impacts on society.

Recommendations:

- 1) Develop a new minor in Biorenewable Systems
- 2) Provide incentives such as graduate assistantships to encourage existing faculty to teach new courses to support the minor.
- 3) Integrate additional bio-based materials coursework into the curriculum, and transform existing courses to support this area.
- 4) Develop a new graduate course in Sustainable Bioresources Systems Analysis.
- 5) Consider a certificate program at the graduate level in Biorenewable Systems.

A new minor in Biorenewable Systems would be attractive to students from many departments in the college. The minor could include required courses in several areas: renewable energy, bio-based materials, agroecology, forest sustainability and production, socio-economic analysis, and entrepreneurship. Many existing courses could contribute to this minor, but least one new course in bio-based materials is needed.

An experiential education component could be a very valuable component of this minor. This could take the form of a problem based learning requirement, connecting with county extension, NGOs, and businesses. Other options include project-based courses such as CEED, the Learning Factory, or capstone courses.

Outreach. Build on and expand the relationships of Extension Educators and specialists within communities. We need to expand our ability to help clients transition to more sustainable managed landscapes, emerging renewable technologies, and energy efficiency. Work in this area may capture the attention of youth and their families, given the current focus on environment, energy and employment.

Youth education is a critical need and a tremendous opportunity. The next generation needs knowledge of systems and their interactions to understand these challenges, and experiential education and service learning opportunities to help implement sustainable solutions.

One means to encourage interaction will be to build better linkages between researchers (especially in other colleges) and communities, businesses, etc. to transfer implement new business models and appropriate technologies. Penn State campuses and extension offices around the state can serve as nuclei for regional technology transfer and implementation. Penn State's green initiatives in building design, renewable energy and efficiency, purchasing, and recycling provides a platform for technology demonstrations and outreach. State and local public officials can become aware of the policy needs through publication of technology and situation assessment briefs and educational

exchange. There is a pressing need to develop technology and policy briefs and educational exchanges with government officials.

Recommendations:

- 1) Develop a coordinated outreach and technology transfer strategy that leverages Cooperative Extension, Continuing Education, PennTap, and the regional Ben Franklin and Sustainable Energy Funds to assist communities and businesses evaluate opportunities.
- 2) Hire additional technical and economic development specialists in all six regions to implement this strategy. Adjust hiring constraints to allow competitive offers for technical specialists.
- 3) Articulate with other colleges to access expertise in solar and wind energy in departments across the university. Develop incentives and rewards to encourage such collaborative activity
- 4) Develop reward structures to encourage innovative and interdisciplinary work. Options include annual bonuses, team awards, and other mechanisms to reward and redirect human resources for this effort.
- 5) Take advantage of state and national workforce development resources for innovative youth education and experiential learning programs. Develop continuing education and certificate programs in cooperation with vocational technical schools, contractors, and professional associations. E-learning and World Campus provide mechanisms to reach adult learners. One youth education model is the NSF informal science education center
- 6) Expand engineering expertise to assist with concept feasibility studies, conversion of legacy industrial facilities, and other early stage technology assessment.
- 7) Develop a Governor's School for Agricultural Sciences track in energy and the environment, and leverage that to other youth education program, camps, curricula, etc.
- 8) Collaborate with the Energy and Environment Outreach task force to develop video and other mass media material.
- 9) Develop a website dedicated to alternative and renewable energy along with a series of one page factsheets that could be used to drive clientele to the website. Use these factsheets at events as part of displays and demonstrations.

Research. Penn State is well positioned for world class leadership in bio-based materials, renewable energy research and resource sustainability. The university is making strategic investments in energy, but has not made corollary investments in bio-based materials. A productive bio-based economy will require integration of materials and energy production, and leadership from the College of Agricultural Sciences. This technical strength must be complemented by integrated technology assessment and engagement with stakeholder communities for planning and development.

Funding from state and federal agencies and foundations increasingly targets systems level questions, of which renewable energy and bio-based materials have received increasing emphasis. Examples of such systems level research include linkages between biomass production and conversion technologies, social and economic impacts of renewable energy development, and policy implications of renewable energy standards.

The college should encourage cross function projects that document measurable economic impact through translational research and technology transfer.

- 1) Hire new faculty in sustainable biomass cropping systems, bio-based materials, environmental and economic risks, and landscape planning and analysis.
- 2) Restructure the college seed grant program to encourage strong interdisciplinary teams. Proposals could increase funding cap with the number of different departments represented (e.g. \$15K cap for single investigator grants, \$40K for PIs from two departments and \$75K with representatives from three or more departments). Multi-college proposals should also leverage funds from institutes such as PSIEE, MRI, Huck, and SSRI.
- 3) Seed research centers of excellence in emerging areas such as Cellulose (building on wood products and plant science strengths); Biopolymers (building on food science and materials strengths); Integrated Biorefineries (building on bioprocessing strengths) and Sustainable Bioproduction Systems (building on agroecology, forestry, and ecology strengths). Strong collaborations with social science expertise in AERS, Business, Law, and other colleges should be encouraged.
- 4) Build long-term relationships with industry partners. Enhance linkages between Cooperative Extension, PennTap, the Industrial Research Office, and economic development organizations.

Effective implementation of these recommendations will require effective communication and organization networking. The following recommendations would provide multi-functional benefits for research, outreach, and education.

- 1) Host an annual conference on bio-based materials and renewable energy. CrossOver 2007:Fields-to-Wheels and the 2008 Northeast Renewable Energy Conference provide useful prototypes for this effort.
- 2) Hold an annual workshop within the university community that includes panels, break-out groups, and poster sessions. Include Cooperative Extension Educators as an in-service activity. Invite back a few former students now working in this area to participate. It would also be helpful to have a traveling panel that discusses this initiative at faculty meetings across the college.