

V(A). Planned Program (Summary)

Program # 14

1. Name of the Planned Program

Sustainable Energy

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	10%			
133	Pollution Prevention and Mitigation	10%			
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	10%			
403	Waste Disposal, Recycling, and Reuse	10%			
601	Economics of Agricultural Production and Farm Management	10%			
602	Business Management, Finance, and Taxation	10%			
605	Natural Resource and Environmental Economics	20%			
608	Community Resource Planning and Development	20%			
Total		100%			

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890

Actual Paid Professional	3.7	0.0	0.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
165118	0	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
165118	0	0	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The new Wisconsin Cooperative Extension BioEnergy and the BioEconomy Team is a cross-program area effort. More than 20 active team members are conducting integrated research and extension programs, building capacity for sustainable energy among extension colleagues and communities. UW-Madison Environmental Resources Center sustainability studies scientist Sharon Lezberg is collaborating with 50 North Central Region colleagues to develop the BioEnergy and Renewable Energy Community Assessment Toolkit and Energy Independence, BioEnergy Generation and Environmental Sustainability curricula. Curriculum development teams are working on three courses: BioEnergy and Sustainability, On-Farm Energy Conservation and Efficiency, and Anaerobic Digestion.

Building regional capacity for sustainable energy: Southwest Wisconsin has an opportunity to develop renewable energy both for use within the 9-county region as well as to supply nearby urban areas. Wisconsin Cooperative Extension community development agent Ela Kakde engaged graduate students and key stakeholders with ties to communities, government and industry, campus and county colleagues and UW-Madison Urban and Regional Planning (URPL) as project partners to create a 3-year Renewable Energy Opportunity Plan for Southwest Wisconsin. Kakde secured nearly \$45,000 in startup funds. For the URPL graduate workshop, she coordinated educational partners and resources for 18 students to inventory renewable energy sources of solar, wind and biomass, assess energy demand, infrastructure, potential for growth and jobs creation. The students' report of the first phase developing a regional sustainable energy economic development plan is valued at about \$80,000 of consultant time. Project partners have committed funding toward the next phase. Results also led to partnerships that include support in securing a \$132,305 USDA NIFA Hatch Grant for the project titled Bioenergy feedstock supply in Southwest Wisconsin: A network approach to research and extension.

Anaerobic digestion research and training: Since large-scale implementation is relatively recent, training is needed for safe production and use of biogas. While multi-million dollar systems only run economically on the waste from 500 or more cows, hundreds of thousands of very small farms worldwide use small-scale biodigesters costing only a few hundred dollars in climates as harsh as Wisconsin's. UW-Madison Cooperative Extension biowaste specialist Rebecca Larson works with USDA, campus, county and Michigan State University colleagues, industry partners and farmers assessing on-farm economic and environmental benefits of small-scale anaerobic digesters, building a mobile dry biodigester to compare with wet biodigestion, and comparing 9 on-farm solid-liquid separation systems coupled with digesters. In 2011, they presented the nation's first Small-Scale Anaerobic Digester Conference for more than 60 dairy producers and agency staff on technology processes and value-added products. Their 3-day Anaerobic Digester Operator Training for 40 large-scale dairy producers, operators and agency staff incorporated an

on-farm digester tour to demonstrate safety protocols and system components.

2. Brief description of the target audience

The new interdisciplinary BioEnergy and the BioEconomy Team is addressing statewide emerging bioenergy education needs. Farmers and foresters are interested in supplying feedstocks to the bioenergy industry as a potential alternative market and source of revenue. Communities are interested in developing renewable energy industries for energy independence, job creation, and economic development. At the onset of the bioenergy industry, policy makers, as well as entrepreneurial businesses, encouraged the rapid development of new energy sources using biomass as a renewable feedstock.

In 2011, the Wisconsin Cooperative Extension Municipal Leadership Renewable Energy Professional Development Program also leveraged established relationships with private sector participants in the renewable energy arena, including paper manufacturers, forest product firms, professional engineering companies, legal and financial service firms, technology vendors, agricultural producers, utilities and others. Of 4,372 adults reached through direct teaching methods by the BioEnergy and the BioEconomy Team in 2011, 94% were white, 3.6% were American Indian, 1.2% were Asian American, 0.5% were African American, and 0.6% were of other identity; 80.7% were male and 19.3% female. Of these, 3% (129) identified as Latino/a, who may be of any race. Community partners and trained volunteers made additional teaching contacts.

Given Wisconsin's wealth of resources in forests and agricultural production, there is great interest among state businesses and communities in producing alternative fuels and feedstocks from biomass. The audience includes municipalities, regional planning commissions, regulated and unregulated utilities, liquid biofuels, anaerobic digester and biomass conversion technology firms, biomass producers and aggregators, food processors, food services, school districts, loggers, procurement foresters, wood products professionals, haulers, farmers, business owners, woodland owners, recycling volunteers, public and private agencies, government and tribal officials.

3. How was eXtension used?

Wisconsin Cooperative Extension campus and county faculty and staff participate in various communities of practice, engaging with colleagues around the country to improve the educational content of research-based programs and assistance delivered to residents across the state. Extension colleagues are connected by email ListServ, blogs and online newsletters, and shared resources such as teleconferences and webinars, eXtension Communities of Practice, and the national Extension Disaster Education Network (EDEN) to quickly address critical and emerging issues.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	4372	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	2	0	2

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- {No Data Entered}

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Build regional capacity for developing biomass use for biofuels
2	Build capacity to create, refine and implement scalable conversion technologies

Outcome #1

1. Outcome Measures

Build regional capacity for developing biomass use for biofuels

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	132305

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

As a region rich in renewable resources, rural Southwest Wisconsin has an opportunity to develop renewable energy both for use within the 9-county region as well as to supply nearby urban areas. Regional organizations are collaborating to develop partnerships among industry, higher education and school districts. While there have been attempts at small-scale initiatives, little has been done to identify regional resources and create a unified vision and roadmap. To develop community infrastructure that meets local demand and grows markets for sustainable energy enterprises, research is needed to show demand and economic development potential that encourages renewable energy startup companies to locate or grow in this area, generating new energy jobs in Southwest Wisconsin.

What has been done

Wisconsin Cooperative Extension community development agent Ela Kakde engaged graduate students and key stakeholders with ties to communities, government and industry such as the Wisconsin Bioenergy Initiative, campus and county colleagues, Biomass Consulting, Wisconsin Department of Agriculture, Trade and Consumer Protection, New North, Virent Energy, Energy Law Wisconsin, Southwest Wisconsin Regional Planning Commission, Southwest Badger Resource Conservation and Development, and UW-Madison Urban and Regional Planning (URPL) as project partners to create a 3-year Renewable Energy Opportunity Plan for Southwest Wisconsin. Kakde secured nearly \$45,000 in startup funds. For the fall 2011 URPL graduate workshop, she facilitated class meetings, coordinated educational partners and resources for 18 students to inventory renewable energy sources of solar, wind and biomass in the nine counties, assess energy demand, infrastructure, potential for growth and jobs creation, inventory other energy plans to compare, assess public perception and engagement through surveys and focus groups, and develop a report.

Results

Building regional capacity for sustainable energy: With guidance from Cooperative Extension, URPL students produced a report of the first phase developing a regional sustainable energy economic development plan valued at about \$80,000 of consultant time. Students presented their findings to project partners including local officials in the nine counties, who expressed enthusiastic support. While additional research still needs to be done, project partners have committed funding toward the next phase creating plans for pilot communities identified in year one and finally, implementing sustainable energy economic development plans within those communities. Subsequent results have also led to partnerships that include support in securing a \$132,305 USDA NIFA Hatch Grant for the project titled Bioenergy feedstock supply in Southwest Wisconsin: A network approach to research and extension.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development

Outcome #2

1. Outcome Measures

Build capacity to create, refine and implement scalable conversion technologies

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Anaerobic digestion is a proven waste-to-energy technology. Wisconsin is the leading state for on-farm anaerobic digestion with more than 35 operational systems. The last decade created demand for knowledge of system components, processes and mechanisms, and operation skills. Since large-scale implementation is relatively recent, training is needed for safe production and use of biogas. While these multi-million dollar systems only run economically on the waste from 500 or more cows, hundreds of thousands of very small farms worldwide using very small-scale biodigesters costing only a few hundred dollars in climates as harsh as Wisconsin's. The bulk of Wisconsin dairy farms with fewer than 200 cows lack information on small-scale biodigesters.

What has been done

UW-Madison Cooperative Extension biowaste specialist Rebecca Larson works with USDA, campus, county and Michigan State University colleagues, industry partners and farmers assessing on-farm economic and environmental benefits of small-scale anaerobic digesters, building a mobile dry biodigester to compare with wet biodigestion, and comparing 9 on-farm solid-liquid separation systems coupled with digesters. In 2011, they presented the nation's first Small-Scale Anaerobic Digester Conference for more than 60 dairy producers and agency staff on technology processes and value-added products. Since the conference, Larson and colleagues are addressing areas that require attention for small-scale adoption. Their 3-day Anaerobic Digester Operator Training for 40 large-scale dairy producers, operators and agency staff incorporated an on-farm digester tour to demonstrate safety protocols and system components. Larson is conducting life cycle assessment to share with digester operators and add to the Anaerobic Digester Operator Training Program curriculum.

Results

Anaerobic digestion research and training: Results are critical to developing more profitable nutrient management strategies with reduced environmental impact and increased safety.

Small-scale biodigestion: Increased efficiencies can decrease system size, increase biogas production and the value of asset streams to produce an economically viable option reducing costs and increasing revenues for smaller operations.

Increasing dry anaerobic digestion: Dry AD systems are able to handle solid waste streams without pretreatment, reduce solid waste volume requiring disposal up to 40%, and decrease reactor size in comparison to wet digestion systems.

Solid-liquid separation: Liquids can be land applied as fertilizer, improving nutrient management. Solids are used on-farm as bedding or sold as a value-added product. With detailed herd management, milk quality and pathogen data, best practices recommendations can improve herd health in dairies using recovered manure solids as bedding.

Small-Scale Digester Conference: As a result of the conference, the only small-scale operator in Wisconsin has begun to make changes to his operation, and a second producer is installing a small-scale digester.

Anaerobic Digester Operator Training: Many large-scale operators now have a greater understanding of their systems, can implement strategies outlined in the training, and are connected with their peers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
403	Waste Disposal, Recycling, and Reuse
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
608	Community Resource Planning and Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Public Policy changes
- Competing Public priorities

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}