Portfolio Annual Report 2009: Processing, Engineering and Technology for Food and Bioproducts

United States Department of Agriculture
National Institute of Food and Agriculture

December 2009

Table of Contents

Section I: Portfolio Overview 4
Portfolio Background 4
Portfolio Planning 5
Portfolio Mission 5
Portfolio Vision 5
Portfolio Introduction 5
Linkage to CSREES Strategic Plan 6
Portfolio Performance Measures 8
Processing, Engineering, and Technology for Food and Bioproducts Logic Model 10
Portfolio Inputs 11
Portfolio Level Funding Table and Bar Chart 11
Portfolio Results 15
Portfolio Outcomes 15
Portfolio Considerations 16
Portfolio Leadership and Management 16
Programmatic or Management Shortcomings 17
Key Future Activities and Changes in Direction 17
What are Others Doing 20
Section II: Primary Knowledge Areas 21
Knowledge Area 401: Structures, Facilities, and General Purpose Farm Supplies 21
Knowledge Area 402: Engineering Systems and Equipment 25
Knowledge Area 404: Instrumentation and Control Systems 30
Knowledge Area 501: New and Improved Food Processing Technologies 35
Knowledge Area 502: New and Improved Food Products 41
Knowledge Area 503: Quality Maintenance in Storing and Marketing Food Products 45
Knowledge Area 504: Home and Commercial Food Service 50
Knowledge Area 511: New and Improved Non-Food Products and Processes and Knowledge Area 512: Quality Maintenance in Storing and Marketing Non-Food Products 53
Section IV: External Panel Recommendations to the Portfolio and Portfolio Responses 57
Relevance 57
Quality 59
Performance 60
Section V: Self-Assessment 63
Portfolio Scoring 63
Appendix A - Detailed Funding Tables for Primary KAs – CSREES Funding 64
Appendix B - Detailed Funding Tables for Primary KAs – All Known Funding 71
Appendix C - List of Supporting Programs 75
Appendix D - Partnering Agencies and Other Organizations 77
Appendix E - Documentation of Previous Score Changes 78
2008 Portfolio Score Change Discussion 78
2007 Portfolio Score Change Discussion 80
Appendix F – Past Portfolio Responses to the External Panel's Recommendations 84

Relevance 84
Quality 92
Performance 95

Portfolio Annual Review

Section I: Portfolio Overview

Portfolio Background

This portfolio is made up of the 9 following KAs that are not all compatible with each other:

- KA 401 – Structures, Facilities, and General Purpose Farm Supplies
- KA 402 – Engineering Systems and Equipment
- KA 404 – Instrumentation and Control Systems
- KA 501 – New and Improved Food Processing Technologies
- KA 502 – New and Improved Food Products
- KA 503 – Quality Maintenance in Storing and Marketing Food Products
- KA 504 – Home and Commercial Food Service
- KA 511 – New and Improved Non-Food Products and Processes
- KA 512 – Quality Maintenance in Storing and Marketing Non-Food Products

Three of the KAs (401, 402 and 404) are strongly engineering and technology oriented. Four of the KAs (501, 502, 503 and 504) are food processing oriented. Two of the KAs (511 and 512) are non-food products and processes oriented. This grouping of KAs more nearly aligns with the NPLs who make up the Processing, Engineering and Technology (PET) Section of the current Plant and Animal Systems unit of NIFA, formerly CSREES. This group of NPLs interacts on a regular basis as part of the PET section, therefore for communications it is very efficient. The grouping of the 9 KAs was made in 2008 because the previous Portfolio grouping was also not compatible as pointed out by the external review team. The previous Portfolio grouping had the engineering and technology KAs together with the economics of agricultural production and farm management KA.

In July of 2004 an external review team assessed three portfolios (Ag Markets and Trade), (International Economic Development) and (Structure of the Ag Sector and Farm Management). Over a period of four hours on July 20, 2004 these portfolios were presented to the external review team. They had received the hard copy reports prior to their on-site assessment. They provided feedback orally and in writing for each of the portfolios. The team had a wide variety of topics they were presented with so it was not possible to get an in-depth evaluation of each of the portfolios.

Since 2004 there has been continuing discussion on how to best group the KAs for the benefit of planning, accountability, and assessment. In 2007 suggestions by the NPLs were made to group the KAs (9) of the current configuration into themes. No action was taken to carry out the theme approach. It will be addressed again in the proposed Portfolio Considerations section of this report.

Portfolio Planning

Portfolio Mission
Support world-class research, education, and extension programs to commercialize new processes and new or improved food and bioproducts for a sustainable agriculture through engineering, new technology and biological science.

Portfolio Vision
Food and bioproducts through sustainable agriculture production and processing systems using new and improved technology.

Portfolio Introduction
In the U.S. during the past several decades the research, education and extension focus has been on improving the efficiency of agricultural production systems. Over the years, the CSREES and its partners have made use of cutting edge technologies to make steady progress in this area. Significant research has been undertaken to develop biosensor technologies and rapid identification systems assure food supply chain security, quality and safety. While it is important that this effort must continue, it is equally important that other areas such as finding new uses for agricultural products must be explored because it has the potential to increase agricultural profitability and sustainability by creating new markets for U.S. agricultural products. Past studies have shown that many industrial, pharmaceutical, nutraceutical and other products can be produced from agricultural commodities. Studies have also concluded that industrial products from biological materials have the potential to replace industrial products derived from petroleum.

Processing, Engineering and Technology for Food and Bioproducts (PETFB) is designed particularly to encourage research, education and extension (outreach) programs to develop engineering and technology for agricultural production and food and bioproducts processing that results in commercialization of new processes and new or improved food and bio-based products. More specifically, this portfolio addresses issues dealing with the engineering aspects of agricultural production, processing and storage of foods, food services, new and improved food products, and new nonfood products and storage. An analysis of the PETFB is provided in this section of the report.

Specific details pertaining to different knowledge areas within the portfolio are included in the following sections describing the individual knowledge areas.

Food Science and Technology component of Food and Non-Food Processing and Production (F&NFPP) provides national leadership in consultation with the partners and stakeholders; and administers grants in a fair and efficient manner in the area food science and technology. Leadership roles include identification, development and implementation of priority areas of research, education and extension; reviewing programs and providing direction; and active participation in multi-state research and extension activities. Administration of grants encompasses several mechanisms (National Research Initiative, Small Business Innovation Research, Formula funds, Presidential

Initiatives and special Congressional appropriations). The goal of this program is to improve the quality of foods for improving human health and well-being, increase the markets for the producer of foods and prepare future work force. CSREES has been maintaining a data base of funded research through its Current Research Information System (CRIS). Recently, we have started maintaining data base on extension and education also. Knowledge Areas (KAs) 501, 502, 503 and 504 include the food science and technology portfolio. Food Safety Portfolio which is reviewed separately has different KAs.

Linkage to *CSREES Strategic Plan

**On October 1, 2009, Cooperative State Research, Education and Extension Service (CSREES) became the National Institute of Food and Agriculture (NIFA). Even though CSREES no longer exists, NIFA has not installed a strategic plan. Therefore, this portfolio continues to align itself with CSREES' strategic plan.*

Supported CSREES Strategic Goal: This portfolio supports strategic goal "Enhance the Competitiveness and Sustainability of Rural and Farm Economies." CSREES supports numerous research and extension activities to enhance the competitiveness and sustainability of rural and farm economies, ranging from the development of new products to improvements in productivity and financial management. Education programs strengthen the foundation for this goal by building capacity in the agricultural research and extension system and training the next generation of scientists and educators.

Supported CSREES Objective: This portfolio supports objective, "Provide Research, Education, and Extension to Expand Domestic Market Opportunities." CSREES sponsors vital research and development contributions for new food and non-food products and technologies, quality improvements, new uses, and value-added processes that enhance market opportunities for agricultural and forest products. Through extension, CSREES and its partners effectively demonstrate and transfer this knowledge to users.

CSREES Strategic Plan Performance Measures Progress Table The following key long-term outcomes and performance measures coordinate with the strategic goal and objective that are both supported by this portfolio and its areas of focus. This portfolio's primary areas of focus are processes, engineering, technology, foods and bioproducts. The key long-term outcome and performance measure presented in the following table only cover bioproducts, yet performance criteria and actionable strategies supported by this portfolio cover all areas of this portfolio's focus.

Key Long-Term Outcome: Expanded science-based knowledge and technologies to generate high-quality products and processes by: 1. increasing knowledge of bioenergy and biomass conversion and 2. creating new commercially viable and marketable alternative markets for non-food products from existing crops

Performance Measure: Cumulative number of expanded commercially adaptable processes that convert biomass to fuels through the development of cost effective biochemical or thermochemical technologies, and used commercially

Performance Criteria

Performance Criterion for Bio Products:

- Develop new and improved non-food products and processing technologies (KA 511)
- Improve quality maintenance in storing and marketing non-food products (KA 512)

Performance Criterion for Engineering and Systems:

- Improve the design, construction, and cost effectiveness of facilities for animals, agricultural products, agricultural inputs, equipment and other material products (KA 401)
- Improve mechanization, including nanotechnology, to increase efficiency and decrease labor requirements in agricultural and forestry production (KA 402)
- Develop and improve instrumentation and information systems and sensors for improved control of the production and processing of biological materials and biohazards (KA 404)

Performance Criteria for Food Products:

- Develop new and improved food products and processing technologies (KA 501)
- Develop new and improved food products (KA 502)
- Improve quality maintenance in storing and marketing food products (KA 503)
- Improve home and commercial food service (KA 504)

Actionable Strategies:

- Expand research to assess the effectiveness of developing profitable alternative crops and on – or near – farm processing that add value to agricultural products and enhance the economic viability of rural communities and families, particularly socially disadvantaged farm operators
- Focus existing research, and education programs to encourage new, innovative, and alternative uses for agricultural products, including increasing the use of biomass, biofuels, and bioproducts
- Provide research, education, and extension to enable an increase in the amount of ethanol produced through cellulosic conversion technology
- Expand research, education, and extension to help producers, processors, and distributors address changing consumer needs, tastes, and preferences
- Support research to understand the relationships between chemical composition, molecular and physical structure, and end-use quality and function of bioproducts
- Sponsor development of food products with improved nutritional and health-related characteristics
- Strengthen working relationships with other Federal agencies and departments, including the Department of Energy, the Environmental Protection Agency, the Department of the Interior, the Department of Defense and the Office of Federal

Procurement Policy, to coordinate programs related to development of new markets for agricultural products and activities

- Use grant programs to provide research, education, and extension that enables an increase energy production from the Nation's farms, ranches, and forests

Portfolio Performance Measures

This portfolio has 3 performance measures that indicate the portfolio's progress toward its mission. These performance measures were carefully developed by portfolio team members. These performance measures were not developed for the purpose of aligning with the strategic plan, but these measures along with those identified in the strategic plan broadly support the mission of the Agency and the portfolio. The first two performance measures are reported to the Office of Management and Budget annually, as well as other portfolio performance measures, to indicate the Agency's progress to its mission.

Performance Measure Description: Cumulative number of expanded commercially adaptable processes that convert biomass to fuels through the development of cost effective biochemical or thermochemical technologies, and used commercially.

Explanation of Measure: Commercially adaptable processes to convert cellulose to sugars, fermentation of cellulosic sugars to Ethanol, chemical transesterification of oils from oilseed crops, and the thermal pyrolysis and gasification of biomass will have been increased by 2009. These will increase the biofuel conversion and utilization for the US consumers. This measure captures the goal to increase the use of biomass-based transportation fuels 8 fold over the next 5 years. Data from the Renewable Fuel Association shows the use of fuel ethanol increasing from 174M gallons in 1980 to 2.8B gallons in 2003, 6.5B gallons in 2007. Current data show that 3.4B gallons were produced in 2004 and the Association reported that there is capacity to produce 4.4B gallons in 2005. The National Biodiesel Board estimates biodiesel usage has increased from 500,000 gallons in 1999 to 75M gallons in 2005, to approximately 500M gallons in 2007.

Baseline (FY 2005): 2	**Target**	**Actual**
Fiscal Year 2006	3	3
Fiscal Year 2007	3	3
Fiscal Year 2008	4	4
Fiscal Year 2009	4	
Fiscal Year 2010	5	
Fiscal Year 2011	5	
Fiscal Year 2012	6	

Performance Measure Description: Cumulative number of new crops that have been developed and used commercially.		
Explanation of Measure: New crops provide agricultural diversity, new sources of revenue and can be grown sustainably with reduced inputs.		
Baseline (FY 2005): 6	**Target**	**Actual**
Fiscal Year 2006	6	6
Fiscal Year 2007	6	6
Fiscal Year 2008	6	6
Fiscal Year 2009	7	
Fiscal Year 2010	7	
Fiscal Year 2011	7	
Fiscal Year 2012	8	

Performance Measure Description: Expand the number of biobased industrial products that have been developed to the precommercialization stage or have been commercialized. Biobased products fall under a variety of broad categories		
Explanation of Measure: Products are biodegradable, as appropriate and utilize oils, proteins, starches, or environmentally preferable products for US consumers.		
Baseline (FY 2005): 45	**Target**	**Actual**
Fiscal Year 2006	1	1
Fiscal Year 2007	1	2
Fiscal Year 2008	1	1

Processing, Engineering, and Technology for Food and Bioproducts Logic Model

Situation	Inputs	Activities	Outputs	Outcomes		
				Knowledge	Actions	Conditions
There are a number of needs that should be addressed concerning food processing and preservation, as well as farm structures, facilities and supplies. The following issues are addressed by this portfolio: - New products, new uses and value added processes must have consumer acceptance to create effective demand. - Need for advanced design, construction, and cost effectiveness of physical facilities for agriculture - Need for technological advance of mechanization including nanotechnology to increase efficiency and decrease labor in agricultural and forestry production	**Funding Sources:** - Federal - State - Others provide funding that contributes to research, extension and education. **Human Capital:** - CSREES NPLs - Researchers - Faculty - Extension Practitioners - Teachers - Para-professionals - Stakeholders - Volunteers	- Develop new cooking methods, understand factors that promote lipid oxidation - Develop & improve measurement techniques during thermal processing of foods - Develop market acceptance of U.S. grown ag-based industrial lubricants & greases - Design and evaluate utility and efficiency of physical structures - Develop and evaluate agricultural mechanical tools - Develop biomass crops for energy and products.	- New fundamental or applied knowledge - Scientific publications - Patents - New methods & technology - New food and non-food products and processes - Practical knowledge for policy and decision-makers - Information, skills & technology for individuals, communities and programs - Participants reached - Students graduated in agricultural sciences	Better Understanding of… - Flow and heat transfer in foods - Effective models to simulate air impingement freezing & study the effect of external thermal boundaries & time dependence - Design time temperature indicators for use in food distribution and retail - Design of efficient facilities - Beneficial use of agricultural mechanical tools - Useful farm management practices - Sustainable biomass production and conversion technologies	- Improved process efficiency and heat transfer in foods - Model widely used by frozen food operators - Developed a desktop version - Improved production efficiency - Reduced labor costs - Improved control of production - Changes the way producers managed their operations - Environmental, economic and social impacts are incorporated into project implementation	- Energy efficiency in processing - More nutritious processed foods - Improved economic opportunities for producers - Increased production and labor efficiency - Increased net value added by agriculture - Sustainable practices become economically viable

ASSUMPTIONS - These practices will improve the overall quality of food and ensure food safety, these practices will be accepted by consumers and are environmentally safe

EXTERNAL FACTORS - Variable funding; scientific advancements; changing priorities; producers' and consumers' attitudes; natural disasters; economic conditions; coordination and cooperation with other government entities; public policy

Portfolio Inputs

Portfolio Level Funding Table and Bar Chart

Agency funding data for fiscal year 2008 were collected from the Current Research Information System (CRIS) and the Plan of Work Annual Report (POW-AR). Smith-Lever 3(b) and (c) and 1890 extension funding data were first collected in FY 2007, institute funding data for fiscal years 2003 through 2006 were collected from CRIS only.

Table 1: Processing, Engineering and Technology for Food and Bioproducts Portfolio Summary Funding Table
Combined Research and Extension Funding in Actual Dollars
($ in the Thousands)

Funding Sources	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	Grand Total
NIFA Funding Reported in CRIS	51,064	60,882	60,055	35,221	68,257	275,479
NIFA Funding Reported in POW Annual Report	*NA*	*NA*	*NA*	7,720	7,523	15,243
All non-NIFA Funding	123,484	122,200	127,819	182,750	150,286	706,539
Total Funding	174,548	183,082	187,874	225,691	226,066	997,261
Percentage of NIFA Funding	29%	33%	32%	19%	34%	29%

NA = data aren't available

Table 1 depicts portfolio level funding for fiscal years 2004 – 2008 in actual dollars. In Table 1, portfolio dollars are aggregated by NIFA and non-NIFA dollars, and NIFA dollars are aggregated by reporting sources (CRIS and POW –AR).

Table 2: Processing, Engineering and Technology for Food and Bioproducts Portfolio Summary Funding Table
Combined Research and Extension Funding in Constant Dollars
($ in the Thousands)

Funding Sources	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	Grand Total
NIFA Funding Reported in CRIS	58,201	67,118	64,137	36,573	68,257	294,287
NIFA Funding Reported in POW Annual Report	*NA*	*NA*	*NA*	8,016	7,523	15,539
All non-NIFA Funding	140,744	134,716	136,507	189,767	150,286	752,019
Total Funding	198,945	201,834	200,644	234,356	226,066	1,061,845

NA = data aren't available

Table 2 shows portfolio level funding in constant dollars. These figures were configured to show changes in funding while controlling for inflation using the Consumer Price Index (CPI) calculator, which is located at http://data.bls.gov/cgi-bin/cpicalc.pl. For accurate calculations, the

inflation calculator uses the average Consumer Price Index for a selected calendar year. This data represents changes in prices of all goods and services purchased for consumption by urban households. Table 2's figures were calculated using 2008 as the base comparative year.

Figure 1:

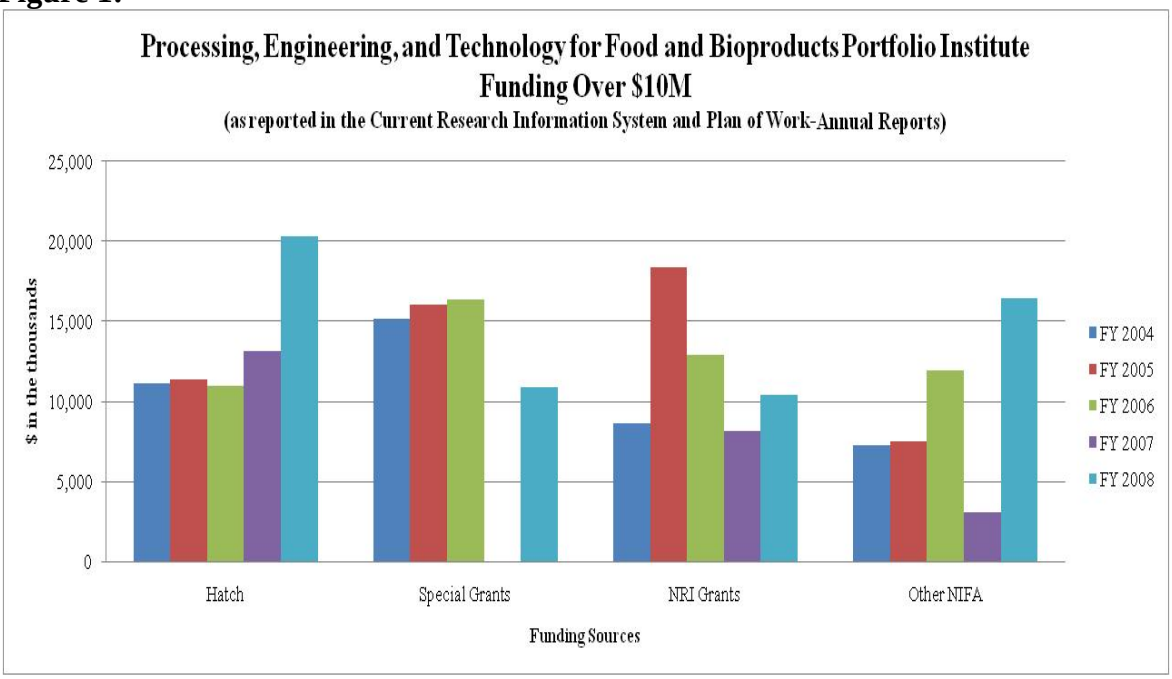


Figure 1 illustrates Institute funding over $10M. Hatch, Special Grants, NRI Grants and Other NIFA grants are collectively responsible for 79% of this portfolio's Institute funding (over $230M) during the reporting years.

Hatch funding shows an increase in FY 2007 while Special Grants did not receive any funding in FY 2007. Funds normally allocated to Special Grants were allocated to Hatch, at the same time earmarks were not funded. Hatch funding in FY 2008 increased by $7.1M, the majority of the increase in funding may be found in KA 501 and in KA 511with a combined increase of $3.6M.

National Research Initiative grants program had an increase of $2.3 between FY 2007 and FY 2008. The NRI grants program was not reauthorized in the Food, Conservation, and Energy Act of 2008, but the Agriculture and Food Research Initiative (AFRI) Competitive Grants Program was authorized in 2009 in place of the NRI. This funding chart identified NRI obligated dollars because dollars received were under this funding category during the reporting timeframe. Information regarding the AFRI program may be found on the Agency's website at http://www.NIFA.usda.gov/funding/afri/afri_synopsis.html.

The number of programs reporting funding and activities into CRIS has increased, which resulted in an increase in "Other NIFA" in FY 2008. This portfolio had an increase of $13.4M within this funding category.

Figure 2:

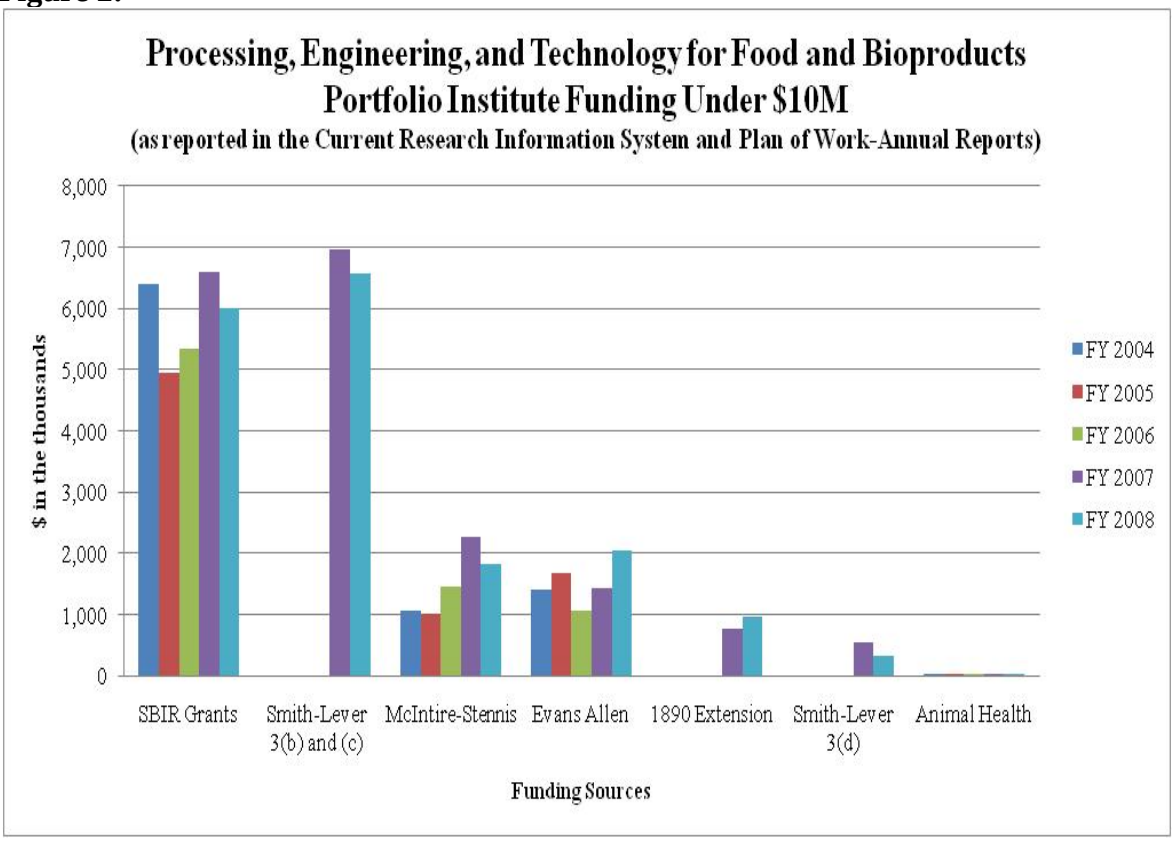


Figure 2 illustrates Institute funding for this portfolio, under $10M. Combined, these funding sources contributed just under $60.8M during FY 2004 through FY 2008. Over the 5 year span, the Small Business Innovation Research Program (SBIR) contributed just over $29M. *Smith-Lever 3(b) and (c) program contributed $13.5M to this portfolio during FY 2007 and FY 2008. Animal Health program contributed the least amount of portfolio funding; this program contributed a total of $29,000 for the five-year reporting span.

** The Smith-Lever 3(b) and (c) and 1890 Extension programs began reporting into the Plan of Work-Annual Report in FY 2007.*

Figure 3:

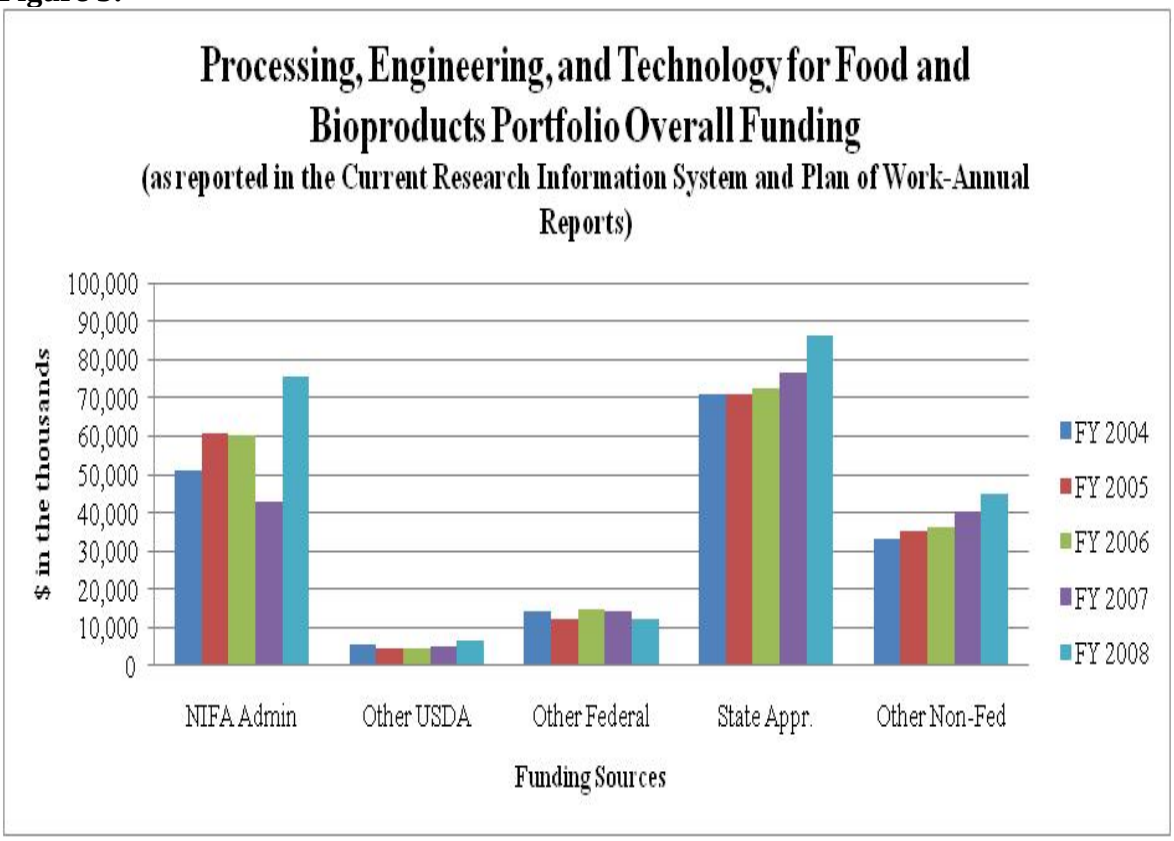


Figure 3 illustrates all portfolio funding, which includes NIFA funding, other USDA and other Federal funding, as well as other sources of funding. NIFA funding represents 29% of this portfolio's funding, the majority of funding comes from "State Appropriations," a little over $314M for FY 2004-FY 2008. "Other Non-Federal" funding total over $287M, included in this funding category are the following funding sources:

- Self-Generated - Expenditures of funds by the SAES and other cooperating institutions that were self-generated through specific activities at the reporting institution.
- Industry Grants and Agreements - Expenditures of funds by the SAES and other cooperating institutions received from industry grants and agreements.
- Other Non-Federal - Expenditures of funds by the SAES and other cooperating institutions received from sources such as local governments, producer groups, professional societies, private individuals, or other miscellaneous sources not classifiable elsewhere.

Figure 4:

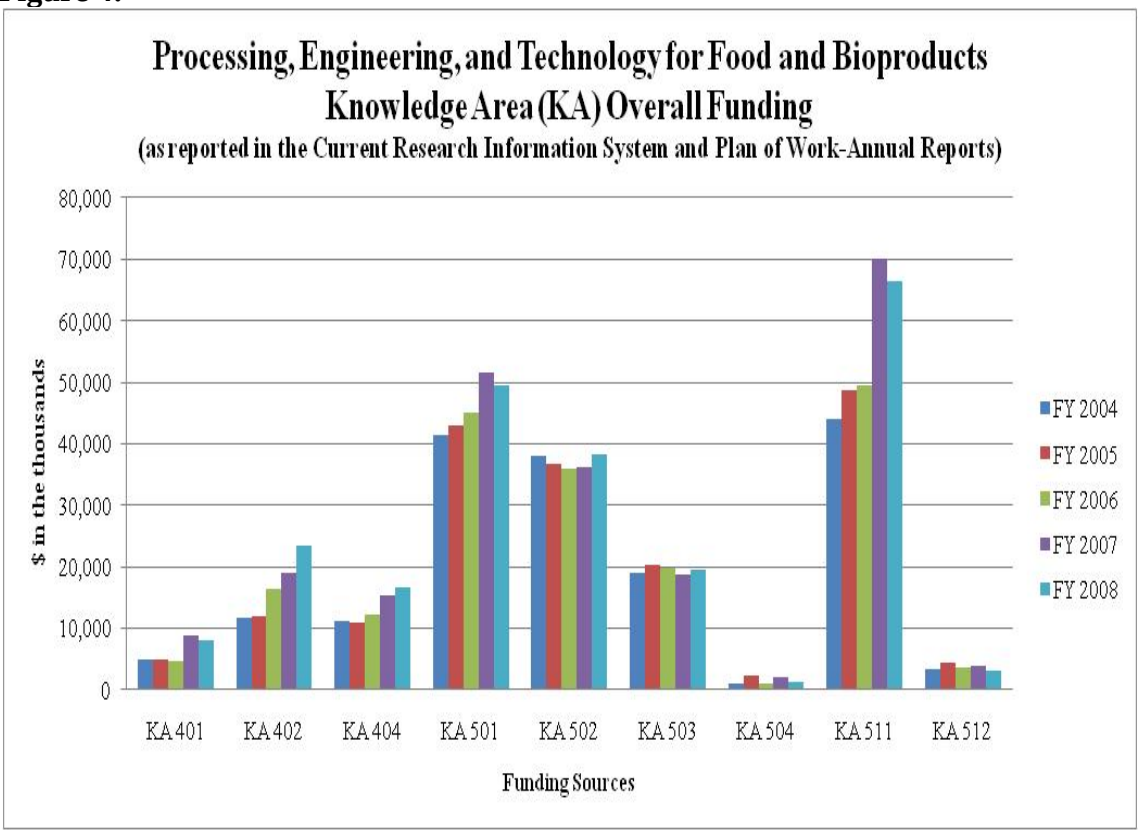


Figure 4 illustrates the portfolio's overall funding by knowledge area (KA). The majority of FY 2004- FY 2008 funding comes from KAs 501($230.7M), 502 ($185M) and 511 ($278.5). Overall the portfolio saw a slight increase in funding in FY 2008, KAs 402, 404, 502, and 503 received increases in funding while the other KAs experienced decrease funding.

Portfolio Results

<u>Portfolio Outcomes Reported in 2009</u>
The Specialty Crop Research Initiative (SCRI) Request for Applications in 2009 included the same mandated focus areas as in FY 2008. However, priority topics were included for each focus area. Some of the topics apropos this KA include: post-harvest handling, transportation, and distribution systems, automation and sensing, and new tools and technology for alternative source of water.

Biomass such as livestock waste, processing waste, and crop residue can cause degradation of the environment. However, biomass can produce bio-gas that can be converted to electrical energy, but an economic analysis is needed to document its operational farm impact. Research has been conducted to develop alternative means of producing electrical energy from bio-gas and develop specifications for installation and economic analysis of alternative systems to convert bio-gas to electrical energy. (Hatch)

Faster cooking with improved quality needed at home and in industry, can only be achieved through combination of heating modes such as microwave, infrared and hot air that by themselves have limitations. Rational guidelines for combining heating modes, based on fundamentals, were developed. (NRI)

Nonfood uses of agricultural and forestry materials offer the best opportunities to realize the full economic potential which agriculture and forestry can play, beyond the traditional food and fiber markets. Research and development in nonfood products can have a positive impact in many ways: 1) value-added products from new uses of conventional crops, forestry materials and wastes, 2) diversified agriculture through new crop development and expanded growing areas with modified crops, 3) new business opportunities, 4) economic development in rural areas through new farming and processing opportunities, and 5) development of sustainable, renewable resources for the U.S. industrial base.

The Oklahoma State University project to convert low cost biomass to ethanol continues to be a success story for NIFA. In 2008, biology based renewable energy company Coskata Inc. and automotive giant General Motors announced their cooperative plans to reduce fossil fuel consumption thanks in part to Coskata's next generation ethanol process based on research and technology developed by the OSU Biofuels Team and licensed exclusively to Coskata. (Special Research Grant)

National Program Leaders leading NIFA's competitively funded grants work with their NIFA colleagues to find and recommend faculty from the LGU that have knowledge and expertise in specific areas to serve on review panels. This provides a more accurate review of proposals and provides professional development for the faculty members at the LGU.

NPL's lead departmental reviews of engineering, food science and related department as part of the post award management and review of integrated research education and extension functions.

Portfolio Considerations

Portfolio Leadership and Management

The portfolio team consists of the following NPLs:

Carmela Bailey
Daniel Cassidy
Hongda Chen
William Goldner
Ramkishan Rao
Bradley Rein
Daniel Schmoldt
Dionne Toombs
Richard Hegg, leader

The team met monthly beginning in August 2009 after planning sessions with Planning and Accountability (OPA) personnel. KA assignments were made to individual NPLs to update the KA input from the 2008 report. PA recommended a timeline for completing the 2009 report.

Programmatic or Management Shortcomings
OPA has asked the team to propose new directions for the portfolio and recommend changes for the organization of the portfolio because of the diverse KAs that are presently assigned to this portfolio. The present portfolio probably has the greatest diversity among the KAs of any of the portfolios. This diversity makes it impossible to draw overall conclusions or summaries from the content of the separate KAs.

The NPLs are actively in participating in conferences, workshops, professional society meetings, multi-state committees, liaisons to designated state universities, serving on USDA and federal agency committees and serving as competitive grant program managers. These activities provide the NPLs with opportunities to interact with a variety of stakeholder groups (scientists, industry representatives and other federal agencies) regarding emerging issues that should be addressed in the portfolio. Two examples of this are the Specialty Crop Research Initiative and the Biomass Research and Development Initiative where stakeholders and public policy efforts have led to new programs administered by NIFA.

Key Future Activities and Changes in Direction

As stated in the Portfolio Background section the present set of KAs (9) assigned to this portfolio are not all closely aligned. The NPLs taking leadership roles for the portfolio have had several discussions on how the portfolio makeup could be better aligned or configured that would serve not only for assessment and evaluation but also be used for planning and programming. It is realized that using the KAs is a very convenient way to get information from the CRIS system for tracking expenditures and effort. There are several scenarios that could achieve this. One scenario is to reassign each KA to a more appropriate Portfolio. This would result in dropping the present portfolio. A second scenario could be not using the KA grouping but coming up with something else that would involve an issue or theme that could be a report from the agency for assessment and accountability. This scenario would be developed to match the NIFA organization and the four sub-institutes. A third scenario could be using themes and keeping the present KAs together. The portfolio report could then be built around the themes.

There are strengths and weaknesses for each of the scenarios listed below and there are probably other scenarios.

1. Scenario one is to reassign each KA of the present PETFB to a more appropriate Portfolio. This would result in no longer having a PETFB portfolio.
    a. There is not a logical alternative portfolio for 401, 402 or 404, which are the engineering KAs. KA 401 does have some compatibility with the following KAs as listed in the CRIS Manual of Classification; 723, safe handling and use of materials and equip and 306, facilities that reduce environmental stress in animals, although 723 and 306 have very little in common with each other. KA 402 does have some compatibility with; 723, safety of humans 306, facilities that reduce environmental stress in animals and 501, food bioengineering and food process engineering, although 723, 501 and 306 have very little in common with each other.

b. The KAs related to food processing (501-504) could be linked with the food safety (711-712) human nutrition (701-704) KAs.
c. There is not a logical alternative portfolio for 511 and 512. There is actually not an adequate KA to include all the aspects of renewable energy from agriculture.

Advantages:

- This would reduce the number of portfolios for NIFA
- This would make the food related portfolios more aligned with the other portfolio that addresses food safety and nutrition (KAs 701, 704, 711 and 712).

Disadvantages:

- The engineering KAs are not adequately reflected in any of the other portfolios. There is no logical portfolio for them to be merged with.
- The KA 401 does not align well with the KA 301.
- There is a lack of KAs that adequately represent the scope and breadth of the current engineering issues.

2. Scenario two could be using something besides the KA grouping that would involve an issue or theme that could be a report from the agency for assessment and accountability. One of the logical ways to do this is to realign the present KAs with one of the sub-institutes in the new NIFA configuration.
   a. Institute of Food Production and Sustainability
   b. Institute of Bio-energy, Climate and Environment
   c. Institute of Food Safety and Nutrition
   d. Institute of Youth and Community Development
   e. Center for International Programs

   The present food processing KAs (501-504) could be placed in the Institute of Food Safety and Nutrition. This would place nearly all of the food related KAs together. This would be an advantage because this sub-institute is the smallest of the four.

   The bio-energy and bio-products KAs (511 and 512) could be placed in the Institute of Bioenergy, Climate and Environment. This would place all the bio-energy and bio-products efforts of the agency together with competitive grant programs on these topics.

   It would be more difficult to place the engineering related KAs (401, 402 and 404) in one of the sub-institutes. Engineering is the use of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems. Engineering is process that enables a topic to go from a goal to an outcome in contrast to most of the other KAs that focus on a particular application that result in a specific outcome. Economics would have a similar role in the agency in that it is a part of most all programs but it is not the focus of the

program. Engineering, like economics, is embedded into the programs of all the sub-institutes.

Advantages:

- The present food KAs would align well with the Institute of Food Safety and Nutrition.
- KAs 711 and 712 would align well with the Institute of Bioenergy, Climate and Environment.
- This scenario makes a better alignment with the current themes and institutes.

Disadvantages:

- This scenario does not have a logical alignment of the engineering KAs into one of the four institutes.

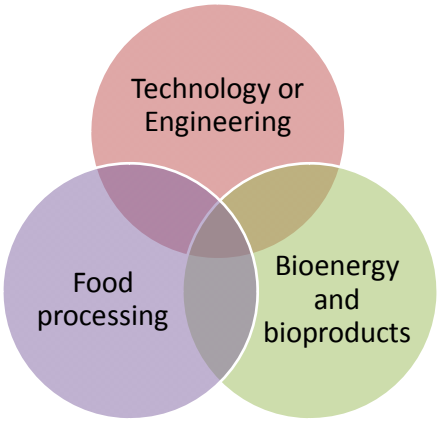
3. Scenario three would be using some appropriate themes and keeping the present KAs together. The graphical display shown is one way the present KAs could be packaged into a portfolio. This would be similar to the present portfolio.

   Advantages:

   a. This would match with the present NPLs in the PET section.

   Disadvantages:

   a. It is unlikely that the PET section will continue in its present structure when the new NIFA organization structure is in place after 2009.



What are Others Doing:

- Joint effort between DOE Office of Science and CSREES to support the Joint Energy Feedstock Genomics Program
- NPL participation on Biomass R&D Board interagency working groups including: feedstock development, biomass handling and logistics, conversion technologies, environment/health/safety, sustainable biofuels production.
- USDA Office of Administration is implementing the Biopreferred Program, which creates a pull for research, education and extension projects focused on biobased industrial products.

- USDA Agricultural Research Service (ARS) -- Food Processing and Sensory Quality Unit
  http://www.ars.usda.gov/main/site_main.htm?modecode=64-35-56-00

  The mission of the Food Processing and Sensory Quality Unit is to invent, design, and develop cost-effective, environmentally acceptable processing systems that yield value-added products of enhanced quality from food crops. A multi-disciplined team of scientists is meeting these challenges by (1) obtaining a basic biochemical understanding of the interactions of food components attributing to flavor (development and deterioration) and functionality of the food and its individual components; (2) scientifically defining and measuring sensory quality in foods before and after processing (3) designing cost-effective, environmentally-acceptable processes for converting foods and their separated components into value-added products; and (4) developing technologies for predicting and assessing the nutritional, sensory and processing quality attributes of foods.

Section II: Primary Knowledge Areas

Knowledge Area 401: Structures, Facilities, and General Purpose Farm Supplies

KA 401: Structures, Facilities, and General Purpose Farm Supplies' Introduction:

This KA is focused on extension and research for the design, construction, and cost of facilities for animals, agricultural products, agricultural inputs, equipment, and other materials. The properties and behavior of the animals, products, equipment, and materials while in various facilities and during transport or processing is a part of this KA. This KA is the only one that addresses the above topics in this portfolio. The applicability of this KA to the portfolio objectives is to supporting the research and extension needs for specialized facilities for preconditioning or preservation of biomass and food crops prior to processing.

This KA is applicable to other portfolios, especially those that deal with on-farm production of animal and crops. The structures and facilities for each farm require major investments but these investments are necessary to protect the products (crops, equipment, feed, animals, fuel, chemicals, etc.). New designs and technologies for structures and facilities continue to be developed as older on-farm structures and facilities become outdated and need to be replaced.

KA 401: Structures, Facilities, and General Purpose Farm Supplies' Logic Model

Situation	Inputs	Activities	Outputs	Outcomes		
				Knowledge	Actions	Conditions
The large farms, whether they are large greenhouse operations or large livestock and poultry operations will require specialized structures that provide consistent high quality products that are efficiently produced. The overall effort for extension and research towards these structural related activities has declined over the past decades. The design and construction of new facilities such as: confinement livestock and poultry structures, greenhouses, milking parlors, grain storage, and machinery storage are carried out by commercial engineering design companies with little input from the Land Grant system.	**Financial Resources:** - Federal - State - Some provide funding that contributes to research, extension and education. **Human Capital:** - CSREES NPLs - Researchers - Faculty - Extension Practitioners - Teachers - Para-professionals - Stakeholders - Volunteers	- Develop a comprehensive design procedure for diaphragm design of post frame buildings to prevent failure but not overdesign so that the building will not be too expensive. The study established the limitations of diaphragm action of post frame buildings. - The purpose of this study is to improve understanding of animal interactions with the interior building environment, and to improve control of air emissions from animal facilities. The purpose of this project was be to provide greenhouse cooling designers with appropriate procedures for designing cooling systems for different climate regions, nationally and internationally.	- New fundamental or applied knowledge - Scientific publications - Patents - New methods & technology - Practical knowledge for policy and decision-makers - Information, skills & technology for individuals, communities and programs - Participants reached - Students graduated in agricultural sciences	- project generated data and information about diaphragm design of metal-clad timber framed rectangular buildings. - increased knowledge of ideal growing conditions for confinement raised livestock and poultry. - increased knowledge of the factors affecting the cooling of greenhouses. -	- developed a comprehensive design procedure for diaphragm design of post frame buildings. - controlled interior livestock and poultry environmental conditions for increased productivity. - provided greenhouse cooling designers with appropriate procedures for designing cooling systems for different parts of the world.	- more economical and appropriate farm building designs. - improved growing conditions for livestock and poultry buildings. - improve productivity of livestock and poultry to provide less expensive food and fiber. - improve efficiency of greenhouse cooling thereby saving financial and energy resources.

ASSUMPTIONS - The U.S. agricultural sector must be able to quickly respond to changing political, economic, technological, environmental, and consumer-driven market forces.

EXTERNAL FACTORS - Agricultural production and marketing are constantly affected by external factors such as weather and growing conditions, diseases and pests, financial conditions, cultural practices, and consumer demand. New and emerging risks associated with domestic and international policy, genetic technology, exotic invasive species, and complex agricultural diseases that can affect humans defy conventional means of identification, quantification, and management.

KA 401: Structures, Facilities, and General Purpose Farm Supplies' Key Activities:

Key Activities in 2009:
Some of the key activities include: energy efficiency, energy conservation, energy reduction, greenhouse facilities and use, air quality in livestock buildings, and components of typical farm structures (trusses, framing, materials, post-framing, and fasteners).

- This project at Cornell University developed a comprehensive design procedure for diaphragm design of post frame buildings to prevent failure but not overdesign so that the building will not be too expensive. The study established the limitations of diaphragm action of post frame buildings.
- The purpose of this study at the University of Kentucky is to improve understanding of animal interactions with the interior building environment, and to improve control of air emissions from animal facilities.
- The purpose of this project at North Carolina State University was be to provide greenhouse cooling designers with appropriate procedures for designing cooling systems for different climate regions, nationally and internationally.

KA 401: Structures, Facilities, and General Purpose Farm Supplies' Key Outputs and Outcomes:

Key Outputs and Outcomes Reported in 2009:

At Cornell University diaphragm action (a term to describe a building structure analysis procedure) provides a systems approach to design of post frame buildings. Current design procedure underestimates the capacity of buildings. This project generated data and information about diaphragm design of metal-clad timber framed rectangular buildings and developed a comprehensive design procedure for diaphragm design of post frame buildings. Results from the project were presented through invited seminars at the annual meetings of the National Frame Builders Association (NFBA), paper presentations at the annual meetings of the American Society of Agricultural and Biological Engineers (ASABE), paper presentations at the World Conferences on Timber Engineering (WCTE), through peer reviewed publications in the Practice Periodical on Structural Design and Construction Journal, The diaphragm design has become the basis for an ASABE standard, and is being used by post-frame building design engineers, architects, builders, contractors and code officials. Materials from this study have been incorporated into lectures of courses on timber engineering to educate students about the state-of-the art on diaphragm design. (Hatch)

At the University of Kentucky research was conducted to develop and improve sustainable technologies and systems to measure, model and control indoor air quality and reduce air pollution emissions from poultry and livestock buildings. They quantified animal response to thermal environments and developed improved methods for providing productive thermal environments without degrading air quality or sustainability. They developed and improved methods of optimizing energy and resource utilization in poultry and livestock facilities to increase profitability without degrading air quality or animal well being. (Hatch)

At North Carolina State University greenhouse experiments were conducted to determine the discrepancies between the performances of shade cloths on shade frame vs. that observed when

shade frames were mounted on greenhouses filled with plants. It was speculated that the plants were the primary difference so the shade cloths were mounted over empty greenhouses and data similar to that collected in previous years was collected. (Hatch)

Knowledge Area 402: Engineering Systems and Equipment

KA 402: Engineering Systems and Equipment' Introduction:

Knowledge Area 402, *Engineering Systems and Equipment*, concentrates on increasing production efficiency while decreasing dependence on labor through mechanization of agricultural and forestry production and processing tasks. New processes, machines, devices, and other technology are crucial to systems that produce and process bioproducts. By merging biological sciences with engineering design principles, this KA provides necessary biological engineering research capacity and helps train the next generation of professionals. The scope of this problem area, though broad, does have important limitations. KA 402 includes:

- Tillage, planting, nutrient and chemical application, and harvesting systems including geographical information systems, sensors, and robotics but not including irrigation and drainage systems; and,
- Handling means for animals, plants, animal products and plant products, but not food and non-food product processing, storage, and marketing.

There exists some overlap between KA 402 and KA 404. Whereas 404 deals primarily with instrumentation, control, and information systems, 402 involves the embedding and application of those system into other devices and equipment.

According to data collected by the National Agricultural Statistics Service (NASS), in 2002 United States farms spent at least $48.3 billion (25.4percent of all farm expenditures) on labor related expenses. This sum does not include the equivalent of the principal operator or his families' hourly wage, i.e. profit. In sharp comparison, NASS estimates that U.S. farms spent $26.2 billion (13.6percent) on farm machinery and equipment including maintenance and fuel. This figure also includes farm building renovations and repairs, so the actual amount spent on machinery and equipment is somewhat lower. Given that the average farm spends at least twice as much on labor as it does on machinery and equipment, agriculture's research and outreach community has a responsibility to develop novel and improved systems to reduce labor costs and increase farm production efficiencies.

The above data also does not account for lost time due to farm work related injuries, illnesses, and fatalities. Even conservative estimates of the cost of farm-related fatalities, injuries, and disease suggests that the agricultural safety and health problem is a $4.5 billion annual issue (National Safety Council, 2001) with substantial potential for large returns on investments made to reduce or eliminate the losses.

New engineering systems, especially equipment and machinery designed to reduce labor demands while preserving product and environmental quality, hold great potential to reduce labor costs while increasing machinery related costs less than a commensurate amount, which is expected to result in increased profits (or at least reduced debts) for producers and processors.

KA 402: Engineering Systems and Equipment's Logic Model

Situation	Inputs	Activities	Outputs	Outcomes		
				Knowledge	Actions	Conditions
According to a National Agricultural Statistical Service (NASS) report, United States farms spent at least $48.3 billion on labor related expenses and only $26.2 billion on farm machinery and equipment including maintenance and fuel. There is a growing need to develop novel and improved systems to reduce labor costs and increase farm production efficiencies. New engineering systems designed to reduce labor demands while preserving product and environmental quality, hold great potential to reduce labor costs while increasing machinery related costs less than a commensurate amount which would hopefully result in increased profits for producers.	**Financial Resources:** - Federal - State - Some provide funding that contributes to research, extension and education. **Human Capital:** - CSREES NPLs - Researchers - Faculty - Extension Practitioners - Teachers - Para-professionals - Stakeholders - Volunteers	- Integrate new soil sensor technologies with farm input application actuation components while developing an automatic guidance system for vehicles - Create and supply producers with tools that both contribute to agricultural productivity and address environmental quality and regulatory requirements - Developed equipment modification and evaluated equipment effectiveness by measuring crop yield, quality, and production efficiencies following implementation of experimental modifications - Developed automated growing systems that are adaptable with advanced life support systems that are capable of supporting human life for long-duration space missions - Developed farm dosing systems that are responsive to field needs	- New fundamental or applied knowledge - Scientific publications - Patents - New methods & technology - Practical knowledge for policy and decision-makers - Information, skills & technology for individuals, communities and programs - Participants reached - Students graduated in agricultural sciences	- Increased knowledge regarding the benefits of using GPS systems in farming and other agriculture related work - Increased producers knowledge about selecting equipment for purchase, maintenance activities, farm task assignments, and later sale - Increased producers' knowledge about the benefits of equipment modifications - Increased knowledge regarding the use of automated growing systems for human life support for long-duration space missions - Increased producers' knowledge about the efficient application of fertilizers, pesticides, and other chemicals	- Reduced minimum skills required to successfully navigate a tractor - Reduced time required to prepare fields - Assisted producers to adopt a rational basis for selecting equipment for purchase, maintenance activities, farm task assignments, and later sale or salvage - Provided a common framework for factoring equipment and machinery business decisions into the farm's greater economic outlook - Adapted commercially produced equipment systems to minor use crops and specialized applications to make such ventures more profitable	- Increased agricultural profits - Increased crop yields - Helped crop producers minimize soil erosion in some fields and improve crop performance when using no-till and other high-residue planting methods - Reduce labor costs - Encouraged broader user participation and effective information integration within the scientific and engineering communities - Protects natural resources through the introduction of less nutrients, hormones, and pesticides

:

ASSUMPTIONS - The U.S. agricultural sector must be able to quickly respond to changing political, economic, technological, environmental, and consumer-driven market forces.

EXTERNAL FACTORS - Agricultural production and marketing are constantly affected by external factors such as weather and growing conditions, diseases and pests, financial conditions, cultural practices, and consumer demand. New and emerging risks associated with domestic and international policy, genetic technology, exotic invasive species, and complex agricultural diseases that can affect humans defy conventional means of identification, quantification, and management.

KA 402: Engineering Systems and Equipment's Key Activities

Key Activities in 2009:
The SCRI Request for Applications in 2009 included the same mandated focus areas as in FY 2008. However, priority topics were included for each focus area. Some of the topics apropos this KA include: post-harvest handling, transportation, and distribution systems, automation and sensing, and new tools and technology for alternative source of water.

KA 402: Engineering Systems and Equipment's Key Outputs and Outcomes:

Key Outputs and Outcomes Reported in 2009:

Bio-energy based electrical systems and their safe, efficient applications
HATCH project CRIS accession no. 0176677
Mission Area: Research and Extension

Biomass such as livestock waste, processing waste, and crop residue can cause degradation of the environment. However, biomass can produce bio-gas that can be converted to electrical energy, but an economic analysis is needed to document its operational farm impact. This project examines alternative means of producing electrical energy from bio-gas and develops specifications for installation and economic analysis of alternative systems to convert bio-gas to electrical energy.

Outputs

- A complete energy audit technical manual (322 pages) was completed, including calculators to determine present energy use, energy and cost savings for making various energy saving improvements, and prediction of payback time periods for making improvements.
- A training program for farm energy auditors in Michigan was developed and conducted twice with 18 energy auditors completing the training and becoming certified according to USDA standards.
- The web site developed the previous year (web5.anr.msu.edu/fa/) was given considerable revision with calculators generalized to provide specific assistance for farms.

Outcomes

- Since the beginning of the project, eighteen dairy farms have been audited ranging in size from 30 cows to 800 cows with energy savings ranging from 30 percent to as high as 40 percent. Minimum cost savings range from $5000.
- A farm energy audit brochure was developed for use by organizations that intend to offer farm energy audits, and two organizations with certified farm energy auditors have printed and distributed the brochures and are offering the service to their members.

Developing and integrating components for commercial greenhouse production system
Hatch project CRIS accession no. 0198492
Mission Area: Research and Extension

Greenhouse crop production is a high-cost system for high-value crop production locally and year round. It is very dependent on advanced technologies and high energy inputs. Detailed understanding of the interaction between physical and biological components of a greenhouse system is essential to implement advanced technologies. This study advances greenhouse production by improving the use of water, nutrients, and energy resources while reducing environmental impacts.

Outputs

- The most important output has been the development of a control algorithm that can be used to coordinate supplemental greenhouse lighting and carbon dioxide addition in an optimum way.
- Control algorithm results show nearly half the electricity needed for lighting in climates such as in Ithaca, NY, can be saved by suitable CO_2 addition and optimization based on total cost, with lettuce as the greenhouse crop.
- The work has also lead to further expansion of the basic supplemental light control algorithm to situations of day-ahead electricity markets, and possible adoption as a decision tool for combined heat and power operations, where the decision must be made hourly, or more often, of whether to use the locally-produced electricity on site, or sell it to the grid.

Outcomes

- The algorithm has been patented and licensed by Cornell University to a private sector entity for extension to the greenhouse industry. Activities are currently underway to make the algorithm available and usable for the manufacturers of greenhouse environmental control computers.

Enhance the competitiveness and sustainability of rural and farm economies
State Plan of Work
Mission Area: Research and Extension

By 2010, Virginia is committed to making significant reductions of sediment, nitrogen, and phosphorus to the Chesapeake Bay waters. The tributary strategies developed for each major watershed are counting on agriculture to provide the largest share of reductions because pound for pound agriculture can do it more efficiently.

Outputs

- Agents and specialists throughout VCE are advocating for the use of no-till crop production where feasible.
- Studies have shown that compared to conventionally tilled fields, losses of sediment can be reduced by 99%, nitrogen by 94%, and phosphorus by 92%.

- A number of demonstrations detailing appropriate techniques and methods of no-till crop production have been conducted.

Outcomes

- In 2000, the Northeast Extension District had less than 10,000 acres in continuous no-till crops. By 2007, a survey showed the District had increased to over 280,000 acres (83%) of total grain cropland in continuous no-till.
- During the same time period, the statewide continuous no-till crop acreage increased from 5% to 41% (440,000 acres).

Knowledge Area 404: Instrumentation and Control Systems

KA 404: Instrumentation and Control Systems' Introduction:

The knowledge area, Instrumentation and Control Systems (404), aims to create the scientific and technological knowledge base that will enable producers, processors, and land managers to collect, analyze, and apply precise and timely information. Throughout production and processing of food and non-food products, new devices and instruments are needed to help end users understand and respond to constantly changing production and processing environments.

Technological advances will enable agricultural production, processing, and distribution to be more efficient, use fewer resources, and improve economic viability. Agency-wide programmatic direction supports three, sequentially dependent activity areas: (1) data collection, (2) analysis and interpretation, and (3) decision support for application to management or policy making. This includes sensing devices, information and decision support systems, simulation models, controllers and actuators, communications, and new agricultural practices and infrastructures that are compatible with increasingly data-rich environments. Because these systems create entirely new agricultural and natural resource capabilities, training new professionals and outreach to end-users are essential companion objectives.

Instrumentation and information systems are important elements in all aspects of pre- and post-production agriculture. Sensors for detecting and monitoring and processing of the collected data can provide improved control of the production and processing of biological and non-biological materials.
Areas of research include but are not limited to:

- Development of instruments, research technologies, and procedures that enhance agricultural efforts.
- Determining accurate and precise standards of measurement.
- Development of sensors, image processing techniques, automation, decision support systems, controls, and models.

Exclude research on:

- Experimental design and statistics (Use KA 901)

Because of the broad applicability of instrumentation and control systems, inputs, outputs, and outcomes are diffused throughout the agency efforts on many national issues
The following logical organization of Knowledge Area 404 depicts three broad emphases along with several subordinate topics.

Biophysical sciences and chemistry

- Basic research
- Materials & processes
- Proof of concept

Engineering and technology development, testing, and validation

- New devices and/or systems
- Laboratory, and in situ, testing
- Application development

Adoption, economics, and decision support
- Aides & barriers for adoption
- Applications & economics
- Information management & decision support

Nearly all other programmatic areas within the agency benefit from the research and application capabilities afforded by developments in this problem area. These include, but are not limited to, agricultural & food safety/security, air, soil & water quality, inspection & monitoring, nutrient management, carbon management, agricultural & forest production, water management, pest management, invasive species, forest management, ecosystem studies, wildlife management, and animal & plant health. Because of the broad applicability of instrumentation and control systems, inputs, outputs, and outcomes are diffused throughout the agency efforts on many national issues

Direct, human observations can provide only general and unreliable qualitative information about crop development and health, food safety, and environmental quality. Furthermore, such observations are extremely limited in time and location. We often need more exact quantitative measurements with greater frequency and at many locations. Measurement needs cover a broad range of spatial scales (from landscape-level assessments to bacteria counts on individual food products) and vastly different time frames (from decadal climate change to continuous air monitoring near livestock operations). Sensor systems can make these needed measurements at high spatial and temporal frequencies. Engineered sensors and companion instrumentation and software extend human observational capabilities to help ensure that our crops are healthy and productive, our food is safe and nutritious, and our indoor and outdoor environments remain uncontaminated. Advances in biometrology and information technologies are required to address our need for timely and reliable information that has temporal and spatial relevance.

Collecting data from one instrument, or many instruments, is only the first step in the overall decision-making process, which might be inspection, monitoring, tracking, etc. Often, many other components, e.g., data bases, simulation models, mathematical optimization, must be combined to form a fully developed decision support system (DSS). The final output of a DSS is a recommendation, interpretation, or prediction regarding the situation of interest, such as crop treatment, food safety, or water quality. DSSs may also incorporate economic models or calculations to determine which courses of action are reasonable. Other exogenous factors that might need to be considered include operational cultures within the organization or the industry or current financial markets.

KA 404: Instrumentation and Control Systems' Logic Model:

Situation	Inputs	Activities	Outputs	Outcomes		
				Knowledge	Actions	Conditions
Direct human observation can provide only general, unreliable qualitative information about crop development and health, food safety, and environmental quality. We often need more exact quantitative measurement with greater frequency at more locations. Advances in biometrology (including chemical, biological, electrical, and materials engineering: and information technology are required to address our need for timely and reliable information that has temporal and spatial relevance.	**Financial Resources:** - Federal - State - Some provide funding that contributes to research, extension and education. **Human Capital:** - CSREES NPLs CSREES administrative support - Researchers - Faculty - Extension Practitioners - Engineers - Teachers - Para-professionals - Stakeholders - Volunteers	- Fundamental investigations in the biological, physical, and chemical sciences lead to new or improved sensors - Develop new materials with sensing characteristics - Engineer new devices and systems and support commercialization of technologies - Sponsor academic and public outreach programs to deliver new production methods and technologies to agricultural producers and land managers - Integrate new science-based knowledge and technologies to optimize efficient, economically and environmentally sustainable agriculture production systems that are appropriate in size and scale - Curricula are designed to provided students with the scientific and technical bases to develop and implement better production technologies and methods and to better manage natural resources	- New fundamental or applied knowledge - Scientific publications - Patents - New methods & technology - Practical knowledge for policy and decision-makers - Information, skills & technology for individuals, communities and programs - Participants reached - Students graduated in agricultural sciences	- Training in geospatial technologies leads to greater adoption and effective application by farmers, communities, and land managers - Scientific development lead to new sensor prototypes with improved sensitivity and specificity - Academic programs expand their instrumentation and sensor curricula - Developed an understanding of the integration of these technologies into existing economic, social, and production systems	- New sensors, and companion information systems, are commercially available - A new cadre of agricultural and natural resource professionals is skilled in sensors and information technologies. - Smaller, faster, smarter sensors greatly expand the range of applications that can readily benefit from the technology - Adoption rates of advanced sensing systems increase	- Adoption of new technologies creates significant economic and environmental benefits for producers and land managers - New technology sales and support and development of companion industries, infuses rural communities with high-paying jobs and a strong economic base - Food products are safer, ag production and processing systems are more efficient and controllable, and environmental quality improves - The increasingly high-technology aspect of food production attracts more youth with greater technical skills

ASSUMPTIONS – Engineered sensors and companion instruments and software will extend human observational capabilities to help ensure our crops are healthy and productive, our food is safe and nutritious and our outdoor environments remain uncontaminated

EXTERNAL FACTORS - Demand for instruments and sensors will depend on the need for increased date quantity and quality by agricultural producers and land managers. Decision support and information systems must satisfy the complexities of biophysical and socioeconomic environments and must support policy making

KA 404: Instrumentation and Control Systems' Key Activities:

Key Activities in 2009:
The SCRI Request for Applications in 2009 included the same mandated focus areas as in FY 2008. However, in 2009 priority topics were included for each focus area. Some of the topics apropos this KA include: post-harvest handling, transportation, and distribution systems, automation and sensing, and methods to identify and quantify food borne pathogens, chemical residues, and tree nut allergens.

KA 404: Instrumentation and Control Systems' Key Outputs and Outcomes:

Key Outputs and Outcomes Reported in 2009:

Syneresis sensor technology development for curd moisture content control
NRI project CRIS accession no. 0201390
Mission Area: Research

Cheese quality and shelf life are decreased by excess curd moisture content. The purpose of this project is to develop an optical sensor technology for monitoring curd syneresis and controlling curd moisture content during cheese making.

Outputs
- A novel optical sensor technology has been developed to monitor both milk coagulation and curd syneresis in a stirred cheese vat.
- Curd moisture as a function of processing time can be predicted with a standard error of prediction value of 1.72% over the range of 50 to 90% curd moisture content.

Outcomes
- This technology should provide more consistent and efficient production capability. The technology also would save energy by avoiding unnecessary syneresis processing and allow cheese maker to shift curd size as milk solids change during the year.
- This technology is may offer the potential for a comprehensive process control of cheese making in the vat and for predicting curd moisture.
- Several cheese making facilities (Brewster Cheese Inc., and Kraft Foods Inc.) and a food processing engineering firm (ESEInc.) have expressed an interest in testing the implementation of this technology for cheese manufacture.

Enhance the competitiveness and sustainability of rural and farm economies
Arkansas State Plan of Work
Mission Area: Research and Extension
Funding Source: Smith-Lever 3(b) and (c)

Ground water for irrigation is becoming less available in some areas of the Arkansas Delta and the cost of pumping the water is a significant part of crop production. Growers need help with irrigation water management options that can increase irrigation efficiency and conserve water

while decreasing irrigation pumping cost. The 'Phaucet' Computer Program (PCP) was developed by a Missouri Natural Resource Conservation Service (NRCS) team to assist with the design of furrow irrigation systems.

Outputs

- In the 2008 growing season, one producer used the PCP on 155 different fields that involved 4300 acres of corn, cotton and soybeans that were irrigated with 42 different irrigation wells.

Outcomes

- The grower indicated that in comparison to previous years, he reduced the irrigation pumping time on the fields by an average of 25% and that the savings was almost 50% on a few of the fields. He also commented that this caused the $4 per gallon diesel to become $3 per gallon which resulted in a pumping cost savings of $100,000.
- The reduced pumping time resulted in saving just over 665 million gallons of ground water from having to be pumped from the irrigation wells. To put this in perspective, the water saved is equivalent to 5.7 inches of water covering all of the 4300 acres.
- A much greater impact is expected when this is expanded to more growers through the efforts of University of Arkansas Division of Agriculture staff. This effort will hopefully result in similar results on a large percentage of the almost 2 million acres that are furrow irrigated in Arkansas.

Knowledge Area 501: New and Improved Food Processing Technologies

KA 501: New and Improved Food Processing Technologies' Introduction

The long term goal of this knowledge area is to establish a world class research and extension programs and expertise to continuously advance scientific frontiers, including emerging nanoscale sciences, and develops processes and technologies for improving food quality and safety for human consumption and increasing product value that makes substantial contribution to the national economy. Work in this knowledge area focuses on development or improvement of methods, techniques, processes, and materials for improving food nutritional and sensory qualities. At the same time, some of the processes can also benefit food safety against biological hazards exited or developed during food distribution chains. Short term goals are to seek new and improved food processing technologies to maintain or improve quality and functionality, stabilize or preserve foods, or prepare foods for further processing.The key priorities for this KA are 1) Advanced and innovative technologies that enhance the safety, shelf-life, sensory and health attributes, and nutritional quality of foods (where appropriate, such technologies should address energy and water conservation); and 2) development and application of analytical characterization techniques of physical, chemical, biological, and sensory natures.

This KA is an important and integral part of the portfolio. It encompasses all the disciplines in science, engineering and technology relevant to research, development and outreach of novel and improved food processing technologies. It supports the portfolio mission and vision in ensuring a sustainable safe and wholesome food supply for the nation and beyond. It is an essential KA in furthering the agency's food safety, nutrition, international food security and sustainable development of food and agriculture.
This KA does not included subjects such as: utilization of food processing wastes (use KA 403), economics of food processing (use KA 603), nutrient composition of foods (use KA 701), and nutrient requirements and bioavailability (use KA 702).

Agriculture and food system is the second largest national economy after energy sector. Postharvest activities contribute up to 80% of it. This KA is the critical foundation of value added processes throughout every step after farm gate. This KA has been an essential contributor to effectively address important challenges with a good balance among research, extension and education. It can make even great contributions if more resources can be allocated to it.

KA 501: New and Improved Food Processing Technologies' Logic Model:

Situation	Inputs	Activities	Outputs	Outcomes		
				Knowledge	Actions	Conditions
Description of challenge or opportunity - Farmers face increasing challenges from globalization - Resource challenges such as energy and water -Demand of better foods to address developmental and degenerative diseases -Improved food safety through processing technologies - Insufficient # of trained & diverse professionals entering agricultural fields and food industry - Youth at risk - - Bioterrorism - Obesity crisis - Impaired water quality	**Financial Resources:** - Federal - State - Private sectors provide funding that contributes to research, extension and education. **Human Capital:** - CSREES NPLs - Researchers - Faculty - Extension Practitioners - Teachers - Para-professionals - Stakeholders - Volunteers	**Research:** - Develop and verify the model to stimulate air impingement -Develop & improve measurement techniques during thermal processing of foods -Develop new thermal and alternative processing methods to improve quality & safety of hamburger patties **Education:** - Curriculum development - Sabbaticals - Equipment Grants - Capacity and Facility Building - Distance Education - Undergraduate and Graduate Student Training **Extension:** - Develop outreach programs and partnerships	- New fundamental or applied knowledge - Scientific publications - Patents - New methods & Technology Novel processing equipment prototypes - Practical knowledge for policy and decision-makers - Information, skills & technology for individuals, communities and programs - Participants reached - Students graduated in agricultural sciences	Better Understanding of… - Flow & heat transfer in foods - Models to simulate various food processing & increased understanding of the effect of external thermal boundaries & its time dependence - Time temperature indicators for use in food distribution and retail	- Improved process efficiency and heat transfer in foods - Model widely used by frozen food operators - Developed a desktop version - Developed Outreach Centers for Entrepreneurs - Developed partnerships with the food producers and application of the results for end use -Develop innovative computer based teaching materials	- Process to enhance food safety and quality -Energy efficiency in processing - More nutritious processed foods -Food processing professionals trained through formal college education and continued educations

ASSUMPTIONS - Changes in food preparation are feasible and cost efficient and will be accepted by consumers, restaurateurs, and food processing personnel.

EXTERNAL FACTORS - Variable funding; scientific advancements; changing priorities; producers' and consumers' attitudes; natural disasters; economic conditions; coordination and cooperation with other government entities; public policy

KA 501: New and Improved Food Processing Technologies' Key Activities:

Key Activities in 2009:

The NRI program continues supporting research in new and improved food processing technologies. This competitive research program funds projects in advanced and innovative processing, engineering, and technologies that enhance food quality attributes and development and application of analytical characterization techniques of physical, chemical, biological, and sensory natures. Applications addressing combined and inseparable quality and safety objectives are supported in this program.

For example:

SMART COMBINATION OF HEATING MODES FOR IMPROVED QUALITY, SPEED, AND SAFETY OF FOOD PROCESSING: Combining microwave, grilling, and hot air can provide improved quality prepared foods rapidly. This research intends to determine the best combinations of microwave and grilling energy and hot air temperature to achieve the highest quality food quickly, with the click of a button. Advanced mathematical modeling and numerical simulation techniques used in this research represented a new high in this field of science, and demonstrated its value as improved prediction of complicated food processes for a variety of foods.

DEVELOPMENT OF AN ALTERNATIVE FINISH FRYING PROCESS USING DYNAMIC RADIANT HEATING; : Immersion frying is a popular method of food production but also produces foods of a high fat content, waste oil, and a dangerous work environment. Researchers at North Carolina State University seek to develop an alternative process, using infrared heating, for the finish frying process. The new process will produce finished fried foods having reduced oil content, produce no waste oil, and eliminate bulk hot oil and oil handling, at the same time to retain desirable texture, color and flavor of the finished products.

Nanoscale engineering and technology represents the new frontiers of research discoveries and process developments. The agency supports this area through a variety of funding mechanisms including NRI and Formula funds.

DEVELOPMENT OF CROSS-LINKED BIO-NANOCOMPOSITE PACKAGING FILMS WITH ENHANCED BARRIER AND MECHANICAL PROPERTIES: Kansas State University grain scientist and engineer develop biopolymer based nanocomposite materials, that can be used to replace conventional plastics based films and other packaging materials. These nanocomposite materials will be biodegradable, and will have high processability and improve barrier and mechanical properties of biopolymer based packaging materials. This approach will also lead to more environmentally friendly packages and significantly reduced land-fill burden because they can more readily composted.

CSREES continues to provide leadership and administers Congressional earmarked grants to conduct research in new and improved food processing technologies. Two examples are provided below:

> *ENHANCING COMPETITIVENESS OF AGRICULTURAL PRODUCTS*: Washington State University has undertaken a portfolio of research that addresses the profitability of Pacific Northwest agriculture for successful exporting. Given that competition for export markets is intensifying, the purpose of this project is to provide Pacific Northwest exporters with crucial information, technical problem-solving and new products and processes that enhance competitiveness of agricultural producers and food processers.
>
> *ENZYME-ASSISTED AQUEOUS PROCESSING OF SOYBEANS (YEAR 3)*: Hexane extraction is currently the most cost-effective oil recovery method for soybeans; but, is extremely flammable, is a volatile organic compound that interacts with pollutants to form ozone, and contains high levels of the neurotoxic and hazardous air pollutant n-hexane. Food scientists at Iowa State University conducted research to assess the feasibility of using water as the separation medium in processing soybeans and develop enzyme-based solutions to hurdles that still limit use of this approach. An industry partner, Genencor, is allowing the scientists access to their library of enzymes and another industry partner, West Central Cooperative, will commercialize the enzyme process to manufacture soy protein hydrolysate for use in wood adhesives to replace or reduce the use of expensive and toxic petroleum-derived resins.

<u>KA 501: New and Improved Food Processing Technologies' Key Outcomes:</u>

Key Outcomes Reported in 2009:

Faster cooking with improved quality needed at home and in industry, can only be achieved through combination of heating modes such as microwave, infrared and hot air that by themselves have limitations. Rational guidelines for combining heating modes, based on fundamentals, were developed in this study. The quality of the final product such as texture (e.g., sogginess) or flavor (e.g., browning) is much improved comparing other single processes. The knowledge gathered enables delivery of custom quality by implementing temperature and moisture profiles needed for specific processes. Combining microwaves with hot air or infrared provides more uniformity, as has now been verified comprehensively, using experiment and modeling. Quantitative data obtained can be readily used by the food product, process and equipment designer. With microwaves on a higher fraction of time (effectively providing higher power), heating rates increase but so does non-uniformity. We quantified such trends that can be used as guidelines in the industry. This knowledge can be readily utilized by the process designers in food industry and oven designers who are programming recipes that completely automate the cooking process, and provide the best quality in minimum time. Through improved understanding of combination heating, as developed here, overheating, underheating, overdrying and sogginess of food can be minimized while improving speed. Quality is made more predictable, which in turn allows increased automation and reduce the drudgery and frustration

of food product and process development, in industry and at home. Finally, we also developed novel simulation and experimental tools for optimization that can be used not only by researchers and students in the academia, but also by the food product and oven designers in the industry. [NRI]

Infrared heating, for the finish frying process, changes in conditions vis-a-vis improved nutrition and health through development of a method to produced fried foods with a 30-70% reduction in oil content. The process uses continuous dynamic radiant heating of par-fried foods to produce a finish fried product. It is well known that as a food is fried is picks up increasing amounts of oil. Foods fried for a short period of time have low amounts of oil thus a partial fry, or par-fry, is used to establish a crust matrix and add the low but necessary coating of oil. These low oil containing foods are then finished fried using the infrared oven without further addition of oil. The result is a reduced fat fried product. [NRI]

The Nanocomposite biopolymer packaging material research was focused on studying multi-component biodegradable systems, comprising of poly (vinyl alcohol) or PVOH, starch, nanoclay and glycerol, as a substitute for plastic-based packaging films. The above components were mixed using solution method or melt extrusion, and the resultant blends were cast into films, which were in turn tested for mechanical and barrier properties. Increasing molecular weight of PVOH significantly affected the mechanical properties of the nanocomposite films. With increased molecular weight, the degree of polymerization and viscosity of PVOH increased, which led to a higher elongation and tensile strength. Composites produced using melt extrusion method led to films having lower WVP, higher tensile strength and higher elongation at break as compared to composites prepared by solution method. Results from this project are used to develop new and enhanced products from agricultural materials, which will reduce dependence on non-renewable raw materials such as petroleum for making plastic-based packaging for food and non-food applications.

ENHANCING COMPETITIVENESS OF AGRICULTURAL PRODUCTS: Washington State University program contains multiple projects at any given time under this program. Each project has a unique impact on producers, industry and policymakers. For instance, the omega-3 project will influence potato and dairy industry sales and exports by producing a more marketable product and attaining a greater sales price for undervalued culls and developing a production process for fine nutraceuticals, providing jobs and economic sustainability to rural communities. The PEF/thermal processing is a sound alternative to prolong shelf-life of milk while maintaining sensory characteristics. The development of an integrated computational model for prediction of electromagnetic field and thermal phenomena associated with microwave and radio frequency heating processes will add value to the commodities and competitiveness of the agricultural and fish products harvested in Washington and the Pacific Northwest. The Safety and Quality of High Value Exports project has developed a spectroscopic method to measure microbial growth in foods, milk, juice, and water to determine the selectivity for closely related microbes. A new method of differentiating guaiacol producing and non-guaiacol producing Alicyclobacillus spp. will benefit apple juice producers by identifying spoilage. Results from Identifying Ideal Combinations of Physiochemical Traits for Dual-Purpose Hard White Wheat

will allow breeders to identify specific starch attributes during breeding, which may enhance the market demand for dual-purpose quality hard white wheat. Working computable general equilibrium models were made for assessing the economic impact to Washington in several areas. [Special Research Grant]

ENZYME-ASSISTED AQUEOUS PROCESSING OF SOYBEANS (YEAR 3): The water reduction represents an important energy savings in recovering protein and carbohydrates of the dilute skim fraction and makes developing products for this fraction easier. Scaling-up two-stage countercurrent EAEP demonstrated with high probability that EAEP can be successfully applied at industrial scale. The specific oleosome fractionation process fits into the soy protein isolate technology used by the food industry. Undenatured soy protein can be recovered from the aqueous supernatant in addition to isolating the oleosome fraction. Scale-up results indicate the unique process developed here is feasible to do at industrial scale. Oleosomes are intriguing food and drug delivery systems. The enhanced cream stability due to HPP is potentially a major advantage to using the cream as food ingredients and understanding the cream characteristics should lead to new applications. Since methanol is reacted with soy oil to produce biodiesel, using methanol for demulsification integrates with biorefining operations and could eliminate refining steps. The absence of anti-nutritional factors in the new protein products offers potential for added value for the economically important protein fraction. Hydrolyzed protein is an important EAEP co-product that will significantly impact process economics. Soy protein hydrolysates have considerable potential to replace or eliminate hazardous and polluting adhesive resin components. Hydrolysate production is possible on large industrial scale and industrial equipment leads to more desirable product characteristics. The use of enzymes also enables tailoring hydrolysate products for use in non-phenol formaldehyde adhesive systems, which broadens the potential applications of protein hydrolysates for adhesive use. Hydrolyzing soy protein improved the quality of the soy protein for broiler chicks. The EAEP soy proteins with minimal heat treatment may be fed to broilers after a practical reducing agent treatment to reduce or rearrange the disulfide bonds thereby reducing activities of the ant nutritional factors. Such feasible treatment and improvement in nutritional quality of soy protein renders the AEP concept practical and attractive. EAEP is an attractive process to incorporate as the front-end to soybean biorefinery to produce biodiesel, bio-based products, edible oils, enhanced protein ingredients for food and feed, and a lignocellulose-rich fraction that could be converted to fuel ethanol. [Special Grant]

Knowledge Area 502: New and Improved Food Products

KA 502: New and Improved Food Products' Introduction

This KA includes research, education and extension activities to improve existing food products and developing novel food products. Emphasis is placed on the generation of knowledge needed to enhance the healthful, safety, and quality attributes of the food ingredients and final food products. Specifically, this KA addresses basic chemical and biological mechanisms involved in the interaction of molecules in the food matrix in controlling structure, texture, stability, and flavor delivery in foods. In addition, this KA explores the stability and delivery of bioactive components in foods that exert a positive influence on health. This KA also addresses the instrumental and subjective evaluation of the sensory properties of foods.

This KA also addresses biochemical and microbiological (including fermentation science) aspects of foods. Determination of relationship of the structure of the components of food and the function (both in terms of functionality of food and nutrition) of the food and other quality parameters is a center piece of this KA. Designing novel functional foods (foods fortified with nutraceuticals and natural bioactive components, medical foods, individualized foods) is integral to this KA. Simultaneous addressing of safety of the food products being developed is also an essential component of this KA. Other areas include the use of process stream co-products for developing/designing new food products and new food uses for agricultural products,

The Short term goal of this KA is to support basic and applied research to further expand the knowledge data base of the effect of chemical and physical mechanisms of interaction of food components on food quality, use appropriate technologies for producing foods of better quality and safety.

The long term goal of this KA is two-fold: **1**. Generate and apply knowledge needed for the design of **foods** that are part of a comprehensive approach to **preventing chronic degenerative and debilitating diseases** such as coronary heart and other vascular diseases, cancer, Alzheimer's, diabetes, arthritis and obesity, **and 2**. Support basic and applied research for developing **foods that are safe to consume, nutritionally superior**, convenient, and pleasant to the palate.

Current priorities addressing this KA address 1. Molecular interactions affecting food quality and 2. Designing foods with health benefits

This KA addresses the CSREES strategic goal number 2.1.5 developing new and Improved Food Products.

The science is moving in the right direction. Additional resources will accelerate the movement toward the production of desirable foods.

KA 502: New and Improved Food Products' Logic Model:

Situation	Inputs	Activities	Outputs	Outcomes		
				Knowledge	Actions	Conditions
New products, new uses, and value added processes must have consumer acceptance to create effective demand. Bio-based technologies promise opportunities for energy, industrial, pharmacological, and other non-food markets for U.S. producers. New markets are emerging for environmental concerns. The foundation for economic and technological advancement is timely, valid and reliable research that leads to inventions and practices that help establish new products in the market place.	**Financial Resources:** - Federal - State - Some provide funding that contributes to research, extension and education. **Human Capital:** - CSREES NPLs - Researchers - Faculty - Extension Practitioners - Teachers - Para-professionals - Stakeholders - Volunteers	**Research:** - Increase knowledge concerning the physical properties of the systems sensitive to chemical reactions that impact food quality - Develop an understanding of the factors which promote lipid oxidation in food emulsifiers - Study the critical factors impacting the chemistry of lipid oxidation in food emulsions **Education:** - Curriculum development - Sabbaticals - Equipment Grants - Capacity and Facility Building - Distance Education - Undergraduate and Graduate Student Training **Extension:** - Develop outreach programs and partnerships	- New fundamental or applied knowledge - Scientific publications - Patents - New methods & technology - Practical knowledge for policy and decision-makers - Information, skills & technology for individuals, communities and programs - Participants reached - Students graduated in agricultural sciences	- Improved understanding on the mechanism of lipid oxidation in food emulsions - Improved understanding of factors affecting the chemistry of lipid oxidation in food emulsions - Improved understanding on the physical properties of the systems sensitive to chemical reactions that impact food quality	- Efficient anti-oxidant technology developed - New technologies to incorporate healthy lipids in foods - Patent application for the new anti-oxidant technology - Anti-oxidant technologies to prevent fish oils from developing off-flavors	- New antioxidant technology - High quality nutritious foods - New anti oxidant technology - Improved health

ASSUMPTIONS - Bio-based technologies are feasible and cost efficient and that the added cost will not significantly impact consumer income.

EXTERNAL FACTORS - Variable funding; scientific advancements; changing priorities; producers' and consumers' attitudes; natural disasters; economic conditions; coordination and cooperation with other government entities; public policy

KA 502: New and Improved Food Products' Key Activities:

Key Activities in 2009:

A Hatch grant to Cornell University to determine the microwave energy absorption, temperature rise in the food, and its sterilization led to subsequent two grants from NRI for exploring the use of computer aided prediction of food products quality and safety in a complex food processing system. In 2004, Cornell scientists teamed up with three other US universities, a National laboratory, a USDA lab, and three other university and research organizations in the UK to win a NIFSI grant. In this multidisciplinary effort, the scientists are using computer aided simulation to predict the quality of final food product and likelihood of an unsafe condition for food during processing or distribution. Such prediction, however, is difficult due to tremendous variation in the types of foods, ingredients used, the process of cooking/packing, and the mode of transportation/storage, etc.

With the help of a series of CSREES-supported projects the investigators exploited the highly underutilized advances in computer simulation to develop a tool for food science extension workers, educators and researchers that would allow easy and accurate prediction of quality and safety of the final food products.

The researchers have integrated the process simulations with various databases such as USDA composition database to get the composition of food, a food property database and a chemical and microbiological database both form U.S. and U.K. A user friendly GUI (Graphical User Interface) has been built on top of the commercial software to make the software interactive and easy to use. The integration with various databases and the user-friendly interface makes the software unique and a useful tool to a much broader user base covering research, education and Extension.

KA 502: New and Improved Food Products Key Outputs and Outcomes:

Key Outputs and Outcomes Reported in 2009:

Outputs:

- The software for food safety was demonstrated two years in a row in IFT Annual Meeting with standing room only audience (70+). Information has been disseminated through numerous meeting presentations and publications in both food and engineering community.
- Several peer-reviewed publications and presentations at major professional society meetings

Outcome:

- Several food companies are working with the investigators and food appliance companies have donated equipment.
- Feedback from industry, academia and regulatory agencies, is being integrated in further refining the capabilities of the software and provide access to the food community in an appropriate manner.

Expected outcome:

- Ultimately, this quantitative predictive approach will result in economical development of foods of high quality and safety.

Knowledge Area 503: Quality Maintenance in Storing and Marketing Food Products

KA 503: Quality maintenance in Storing and Marketing Food Products' Introduction:

The long term goal is increase our ability to maintain quality of food products during storage, distribution and marketing for safe consumption and minimal economic losses. The priorities of this KA include understanding of and minimizing food chemical, biochemical, physical, and physiological, deterioration mechanisms during preservation, storage, distribution, and marketing. The public benefit is to retain the quantity and quality of foods delivered to consumers, minimize food loss and costs, ensure food security, and enhance profitability for food producers and marketers. This KA is another important and integral subject area of the portfolio to ensure food security and to improve human health and nutrition, and to reduce economical loss due to food spoilage. This is a critically important area of investment for new science and technology. More impact can be produced if additional resources are made available for this area. Currently, the food industry R&D carries a heavy load in this area.

KA 503: Quality Maintenance in Storing and Marketing Food Products' Logic Model:

Situation	Inputs	Activities	Outputs	Outcomes		
				Knowledge	Actions	Conditions
New products, new uses, and value added processes must have consumer acceptance to create effective demand. Bio-based technologies promise opportunities for industrial, pharmacological, and food markets for U.S. producers and processors. New markets are emerging for environmental concerns. The foundation for economic and technological advancement is timely, valid and reliable research that leads to inventions and practices that help establish new and improved products in the market place.	**Financial Resources:** - Federal - State - Some provide funding that contributes to research, extension and education. **Human Capital:** - CSREES NPLs - Researchers - Faculty - Extension Practitioners - Teachers - Para-professionals - Stakeholders - Volunteers	**Research:** - Develop non-chemical approaches to postharvest disinfestations of fruits and nuts - Study postharvest quality of fresh cut vegetables and fruit - Develop reusable containers for fresh produce and meat packing **Education:** - Curriculum development - Sabbaticals - Equipment Grants - Capacity and Facility Building - Distance Education - Undergraduate and Graduate Student Training **Extension:** - Develop outreach programs and partnerships	- New fundamental or applied knowledge - Scientific publications - Patents - New methods & technology - Practical knowledge for policy and decision-makers - Information, skills & technology for individuals, communities and programs - Participants reached - Students graduated in agricultural sciences	- Increased understanding of eliminating harmful chemical treatments for disinfestations of stored food products - Increased understanding of spoilage and effective methods of disinfestations for food using short duration fumigants - Increased understanding of reusable containers for fresh produce and meat packaging -Increase understanding of food deterioration mechanisms and kinetics	- Rapid on-line processes may be developed to use rapid frequency heating to destroy insects in harvesting produce while maintaining quality - Treated fresh cut salads with ozone-chlorine dioxide improved and extended the shelf life - New bulk containers are market tested with excellent results	- Improved health - Improved food quality - Improved economic gains

ASSUMPTIONS - These bio-based technologies will enhance consumer confidence in the preservation and security of foods

EXTERNAL FACTORS - Variable funding; scientific advancements; changing priorities; producers' and consumers' attitudes; natural disasters; economic conditions; coordination and cooperation with other government entities; public policy

KA 503: Quality maintenance in Storing and Marketing Food Products' Key Activities:

Key Activities in 2009:

- ROLE OF PHYSICAL STRUCTURES IN FOOD OILS ON LIPID OXIDATION (NRI): Nutrition recommendations are causing manufacturers to change lipid profiles in their products to contain more polyunsaturated fatty acids and less hydrogenated fats. These trends result in food products that are more susceptible to rancidity. To overcome the challenge of developing low trans fatty acids products with nutritionally significant amounts of unsaturated fatty acids, new antioxidant technologies must be developed for the food industry. The goal of this project was to gain a better understanding of how the chemical and physical properties of edible oil impact the deterioration of polyunsaturated lipids. Understanding how the physical nature of edible oils impacts rancidity could lead to the development of new antioxidant technologies and to the more efficient use of existing antioxidant ingredients.

- HYPERSPECTRAL FLUORESCENCE IMAGING TO DETECT BLACK WALNUT SHELL FRAGMENTS (NRI): The Eastern black walnut is found throughout the central and eastern parts of the United States. The black walnut has a rich and tasty flavor and is a high-valued food additive. There are over 15.4 million acres of black walnut yielding approximate 4 billion pounds of raw nuts annually. However, only about 20 million pounds of the raw nuts are commercially processed every year. The growers can gain great economic potential if these nuts can be processed. The USDA has enacted standards that allow no more than 0.05% shell or foreign material in any grade of shelled walnuts. The shell fragments of black walnuts are hard and especially hazardous to consumers. There presently are no automated methods to separate them. Therefore, Engineers at University of Maryland worked on an effective hyperspectral fluorescence imaging method needs to differentiate the shell from the meat, particularly for the black walnut. This proposal intends to develop a valuable technology so that growers will be able to recoup economic benefits from these nut trees.

- Improved Quarantine Treatments for Tropical Fruit Using Thermal Energy [NRI]: Methyl bromide is the most effective fumigant for pest control, but it is a highly toxic gas and listed as an ozone depleting chemical under the Montreal Protocol of 1992. To find an alternative, scientists at Washington State University with colleagues at the University of California, Davis and USDA-ARS, Parlier, CA developed a way to harness electromagnetic energy at radio frequency (RF) to eliminate the targeted insect pests. This technology delivers more thermal energy to insects than in dry nuts such as walnuts, which is an appropriate form of pest control in low-moisture commodities. The results of this research are published in two papers in the latest issue of Postharvest Biology and Technology, a leading scientific journal in post-harvest research and presented in the new book entitled, *Heat Treatments for Postharvest Pest Control: Theory and Practice*.

- INFLUENCE OF PROTEIN OXIDATION ON MECHANISMS GOVERNING THE CALPAIN SYSTEM AND MEAT TENDERNESS (NRI): Inconsistent tenderness and its impact on consumer satisfaction with beef products are an impediment to enhancing demand for beef. Protein oxidation is induced by processes like aging and irradiation and can

influence meat tenderness. Scientists at Iowa State University conducted this research to elucidate the mechanisms by which protein oxidation impedes tenderization will lead to the development of novel procedures to improve the tenderness of meat.

- POSTHARVEST PHYSIOLOGY OF FRESH HAWAIIAN COMMODITIES [Hatch]: This research is intended to address a lack of information on the physiology and optimum handling procedure for many tropical fruits and ornamentals. The presence in the islands of quarantinable insects requires commodities to be disinfested prior to shipping to certain markets. Low acid pineapple hybrids show less variation in titratable acidity that published for canning varieties. The variety 4-16 is firmer and slowly softened to the eating stage. Irradiated Rainbow and Kapoho fruit had a slower ripening and better quality than non-irradiated fruit after 2 weeks storage at 8-10C. Vapor heated Rainbow and Kapoho fruit had slower ripening and were firmer than non-vapor heated fruit after 2 weeks storage at 8-10C. Twenty-eight putative transformed papaya plants with xylanase inserted in the antisense orientation have been generated. The mRNA expression patterns are correlated with the pattern of fruit softening during ripening. The xylanase expressed began to appear in 50% yellow Line 8 fruit and at 75% yellow stage in Sunset. The xylanase was not detected in slow ripening Line 4-16 until the papaya was 4 days after the 100% yellow stage. The results indicated that the faster a fruit softened the sooner the xylanase gene was expressed. lsozymes proved to be unsuccessful in differentiating rambutan varieties, molecular probes look promising. Six selected molecular probes appear to easily separate the six varieties being used for testing.

<u>KA 503: Quality maintenance in Storing and Marketing Food Products' Key Outputs and Outcomes:</u>

Key Outputs and Outcomes Reported in 2009:

- ROLE OF PHYSICAL STRUCTURES IN FOOD OILS ON LIPID OXIDATION (NRI): The number of antioxidants allowed in foods has not changed significantly in decades and those currently available are not sufficient to control lipid oxidation in all foods. It is critical that new technologies using existing food additives are developed to control oxidation. This first study has revealed how physical structures in bulk oils impact the reactions that cause rancidity. By better understanding how physical structures in bulk oils impact the reactions that cause rancidity, it is hoped that new antioxidant technologies can be developed.

- HYPERSPECTRAL FLUORESCENCE IMAGING TO DETECT BLACK WALNUT SHELL FRAGMENTS (NRI): In this research, University of Maryland agricultural engineers developed a hyperspectral fluorescence imaging technology which is proved very effective in imaging differentiating shell fragments from nut meat by their chemical compositions' precise spectral information, which is otherwise impossible to be done manually. Through the lab research, novel statistical based pattern classification methods were used analyze walnuts hyperspectral fluorescence imagery, the results showed about 100% recognition rate on object-based recognition, which later is used for the removal decision. Fully automated vision detection and sorting system requires further engineering work to capitalize the technology for nut growers by providing them a useful technological tool to recoup the economic values from otherwise undervalued black walnuts.

- Improved Quarantine Treatments for Tropical Fruit Using Thermal Energy [NRI]: RF treatments effectively control insect pests at life stages present in in-shell walnuts without negatively affecting walnut quality or storability. RF treatments can potentially serve as a non-chemical alternative to chemical fumigants for post-harvest pest control in similar commodities, such as almonds, pecans, pistachios, lentils, peas, and soybeans, thereby reducing the long-term impact on the environment, human health, and competitiveness of agricultural industries in an increasingly competitive global economy. This technological discovery could affect the world agricultural exports with value between US$220 billion to US$300 billion annually.

- INFLUENCE OF PROTEIN OXIDATION ON MECHANISMS GOVERNING THE CALPAIN SYSTEM AND MEAT TENDERNESS (NRI): This project resulted in a significant change in knowledge for both the fresh meat industry and the greater scientific community interested in protein oxidation and the regulation of enzymes. In this study we examined the role that protein oxidation plays in the activity of a protease (calpain) involved in muscle growth and meat tenderness. This study discovered that the active site cysteine in mu-calpain is able to form a disulfide bond. This discovery is revolutionary and will have a long-term influence on how the industry handles and packages fresh meat products. This is new knowledge that has not been reported before. These results provide new information that will aid in improving the quality of meat and improving the efficiency of muscle growth. Results from this project are novel and will change how the calpain research community views the regulation of calpain and its role in muscle.

- POSTHARVEST PHYSIOLOGY OF FRESH HAWAIIAN COMMODITIES [Hatch]: Papaya softening is a complex event that involves many cell wall hydrolases, such as endoxylanase, b-xylosidase, b-galactosidase, and endoglucanase. These hydrolases may play their roles in concert, to provide the unique texture of a particular fruit. Endoxylanase appears to play a major role in papaya softening. A regulated decline in mesocarp pH during ripening may regulate these hydrolases and impact papaya mesocarp softening. In addition the potential slow-ripening QTL, if we can isolate it to specific genes, could have wider application in modifying fruit ripening. A sequence tagged high density genetic map of papaya has been developed with 11,976 SSR markers. This high density genetic map was used for integration of genetic and physical maps and for the papaya genome sequence assembly. About 92% of the markers in the genetic map were in the assembled genome. This genetic map was published in Genetics and the information is available to the public.

Knowledge Area 504: Home and Commercial Food Service

KA 504: Home and Commercial Food Service's Introduction:

This KA addresses the research, education and extension activities on developing and or improving methods for preparation, storage and service at the home and retail service level. Emphasis is placed on quality along with safety, consumer acceptability, effective management at retail food service, and product labeling. Thus, this KA directly addresses the final sector of the food system, i.e. consumer. This area also includes the quality and safety of foods prepared commercially in institutional settings such as hospitals, schools etc. Among others, this KA addresses improving methods of preparing, storing handling, holding and serving food including any automation and computerization involved. This KA encompasses development of methods to provide effective and efficient management in institutional and commercial food services. Included in the KA are product labeling of foods to improve consumer information/understanding about the product quantity and quality, preparation/handling, and nutritional value for home and commercial food use.

Currently, there are no priorities in the program addressing this KA . Most of the funding for this KA is from Hatch funding. The priorities are set by the partners in case of Hatch funding depending on local, regional and national needs.

KA 504: Home and Commercial Food Service's Logic Model:

Situation	Inputs	Activities	Outputs	Outcomes		
				Knowledge	Actions	Conditions
New products, new uses, and value added processes must have consumer acceptance to create effective demand. Bio-based technologies promise opportunities for energy, industrial, pharmacological, and other non-food markets for U.S. producers. New markets are emerging for environmental concerns. The foundation for economic and technological advancement is timely, valid and reliable research that leads to inventions and practices that help establish new products in the market place.	**Financial Resources:** - Federal - State - Some provide funding that contributes to research, extension and education. **Human Capital:** - CSREES NPLs - Researchers - Faculty - Extension Practitioners - Teachers - Para-professionals - Stakeholders - Volunteers	**Research:** - Understanding factors affecting quality of food prepared at home or commercially - Improve the quality of meals delivered to older citizens **Education:** - Increase the number of trained school food service directors - Teach food service providers about the mechanics of improving customer service **Extension:** - Increase awareness of food allergies	- New fundamental or applied knowledge - Scientific publications - Patents - New methods & technology - Practical knowledge for policy and decision-makers - Information, skills & technology for individuals, communities and programs - Participants reached - Students graduated in agricultural sciences	- Improved consumers and food delivery personnel understanding on food preparation and handling practices - Improved understanding of customer service practices - Improved understanding of food allergies	- Better informed consumers and food delivery personnel - Trained 68 school food service directors - National Restaurant Association incorporated food allergy information in their training - Taught dinning service employees in NE, KS and MO how to improve their customer service skills - Improved quality, better management, and effective methods of delivery	- Improved health - Increased economic opportunities - Cost reducing methods of food delivery systems

ASSUMPTIONS - Bio-based technologies are feasible and cost efficient and that the added cost will not significantly impact consumer income.

EXTERNAL FACTORS - Variable funding; scientific advancements; changing priorities; producers' and consumers' attitudes; natural disasters; economic conditions; coordination and cooperation with other government entities; public policy

KA 504: Home and Commercial Food Service's Key Activities:

Key Activities in 2009:

Most of the KA 504 activities are funded by Hatch formula and Evans-Allen funds. KA 504 specifically excludes food safety activities. In spite of this exclusion, state reports are including food safety related extension activities under 504. The activity reported here is cross cutting in nature.

Extension specialists at North Carolina A&T State University have tracked the issue of food safety in agriculture. Safe and sustainable food systems are essential to our state and national economy and quality of life for North Carolina citizens. The need is to protect the food supply from contamination and to develop new and improved products and processing technologies. The issue is to reduce the incidence of food borne illness and to ensure continued safety and healthy foods for consumers.

The extension personnel have conducted food safety education and training workshops for red meat, poultry, seafood, dairy and juice processors to reduce or eliminate food safety hazards in the food supply. In addition food safety plans based on the Hazard Analysis and Critical Control Points (HACCP) approach have been implemented. Those individuals responsible for food safety must complete non-degree credit certification training in order to comply with state and federal regulations.

KA 504: Home and Commercial Food Service's Key Outputs and Outcomes:

Key Outputs and Outcomes Reported in 2009:

Outputs:
Over 400 industry and regulatory personnel were certified under either the International HACCP Alliance or Seafood HACCP Alliance in 20 workshops. This allowed industry members to comply with mandatory regulatory requirements to verify food prevention plan and weekly Critical Control Point (CCP) records.

Outcome:
These trained individuals have demonstrated proficiency in knowledge and skills to ensure fewer opportunities whereby unsafe food may cause food poisoning or related illnesses.

Knowledge Area 511: New and Improved Non-Food Products and Processes and Knowledge Area 512: Quality Maintenance in Storing and Marketing Non-Food Products

KA 511: New and Improved Non-Food Products and Processes and Knowledge Area 512: Quality Maintenance in Storing and Marketing Non-Food Products' Introduction:

Nonfood uses of agricultural and forestry materials offer the best opportunities to realize the full economic potential which agriculture and forestry can play, beyond the traditional food and fiber markets. Research and development in nonfood products can have a positive impact in many ways: 1) value-added products from new uses of conventional crops, forestry materials and wastes, 2) diversified agriculture through new crop development and expanded growing areas with modified crops, 3) new business opportunities, 4) economic development in rural areas through new farming and processing opportunities, and 5) development of sustainable, renewable resources for the U.S. industrial base. Even though increased profitability and rural economic development are the major incentives for new products research, current research is also driven by society's need for products that are more environmentally acceptable than traditional counterparts. Two problem areas in the CSREES portfolio address new nonfood products development. Knowledge Area 511 (KA 511) "New and Improved Non-Food Products and Processes" is broad and encompasses products and energy, product characterization and functionality, product performance and environmental impacts, and improved processing. Knowledge Area 512 (KA 512) "Quality Maintenance in Storing and Marketing Non-Food Products" focuses on quality maintenance of feeds, seeds, and other nonfood agricultural and forest products during handling, storage and marketing.

For the purposes of this review, KA 511 and 512 will be considered as a single KA, rather than separately.

KA 511: New and Improved Non-Food Products and Processes and Knowledge Area 512: Quality Maintenance in Storing and Marketing Non-Food Products' Logic Model:

Situation	Inputs	Activities	Outputs	Outcomes		
				Knowledge	Actions	Conditions
New products, new uses, and value added processes must have consumer acceptance to create effective demand. Bio-based technologies promise opportunities for energy, industrial, pharmacological, and other non-food markets for U.S. producers. New markets are emerging for environmental concerns. The foundation for economic and technological advancement is timely, valid and reliable research that leads to inventions and practices that help establish new products in the market place.	**Financial Resources:** - Federal - State - Some provide funding that contributes to research, extension and education. **Human Capital:** - CSREES NPLs - Researchers - Faculty - Extension Practitioners - Teachers - Para-professionals - Stakeholders - Volunteers	**Research** - Genetically engineered maize as new crop to produce cellulases for ethanol production - Novel conversion technology linking biochemical and thermochemical technologies to produce biofuel frrom lignocellulose Develop microorganism to metabolize syngas to ethanol and chemicals -Develop microorganism to produce new product succinic acid from glycerol and CO2 -new product line of biobased lubricants -new emphasis on sustainability, i.e. environmental, economic and social impacts **Education** - Curriculum development - Sabbaticals - Equipment Grants - Capacity and Facility Building - Distance Education - Undergraduate and Graduate Student Training **Extension** - Develop outreach opportunities for researchers, farmers and commercial retailers - Develop partnerships among all stakeholders	- New fundamental or applied knowledge - Scientific publications - Patents - New methods & technology - Practical knowledge for policy and decision-makers - Information, skills & technology for individuals, communities and programs - Participants reached - Students graduated in agricultural sciences	- Improved understanding of alternative methods for developing biofuels and chemicals - Improved understanding about the use of cloned genes to create biofuel -improved understanding about developing biobased lubricants -improved understanding about environmental attributes of technologies to develop biofuels and biobased products	- Biotech crop will produce enzymes for converting lignocellulosic materials into sugars - Efficient production into cellulases - Optimized gasification and fermentation systems - Elucidate pathways for anaerobic fermentation of glycerol and CO2 - Engineered microbes for the production of fuels and chemicals from glycerol and CO2 -develoment and commercial production of biobased lubricants	- Reduced dependency on petroleum - Improved environmental impact - Revenue generated from waste product - Efficient waste management - Rural processing

ASSUMPTIONS - These programs will produce economic gains in a number of industries and globally

EXTERNAL FACTORS - Variable funding; scientific advancements; changing priorities; producers' and consumers' attitudes; natural disasters; economic conditions; coordination and cooperation with other government entities; public policy

KA 511: New and Improved Non-Food Products and Processes and Knowledge Area 512: Quality Maintenance in Storing and Marketing Non-Food Products' Key Activities

Key Activities in 2009:

- The agency continues to expand the scope of research, education and Extension program to include bioenergy and biobased products as priority topic areas. An extensive CRIS search on these topics continues to show a significant increase in formula, competitive and congressionally directed projects since 2000.

- A new program was added to the NIFA portfolio, which expanded the scope of projects typically supported through NIFA funding authorities. The Biomass Research and Development Initiative (BRDI) supports developmental research and demonstration projects. Nine awards were made, averaging about $2M each with cost share from industry and academia. Topics include feedstock development, conversion technologies for advanced biofuels, and economic analyses.

- The theme of sustainability has become an overarching theme for programs within KA 511. SBIR, the Critical Agricultural Materials Program and BRDI gave priority to projects that address environmental, economic and social implications of the technologies being proposed. The Critical Agricultural Materials Program required applicants to use a specific model that takes into consideration the environmental and human health impacts at every stage in the life cycle of the product.

KA 511: New and Improved Non-Food Products and Processes and Knowledge Area 512: Quality Maintenance in Storing and Marketing Non-Food Products' Outputs and Outcomes:

Key Outputs and Outcomes Reported in 2009:

(IFAFS, Special Research Grant) The Oklahoma State University project to convert low cost biomass to ethanol continues to be a success story for NIFA. In 2008, biology based renewable energy company Coskata Inc. and automotive giant General Motors announced their cooperative plans to reduce fossil fuel consumption thanks in part to Coskata's next generation ethanol process based on research and technology developed by the OSU Biofuels Team and licensed exclusively to Coskata. The process offers solutions to many issues associated with bioenergy, including environmental, transportation and land-use concerns and is net energy positive. The company recently announced the successful start-up of their semi-commercial flex ethanol facility located in Madison, PA. The facility is an integrated biorefinery that integrates Westinghouse Plasma Gasification and the syngas-to-biofuels conversion process. In the facility is an excellent example of two leading companies working together to deliver a viable process to the biofuel market, using technology developed through CSREES/NIFA funding authorities.

(Special Research Grant) University of Northern Iowa's National Ag-Based Industrial Lubricants Center has successfully commercialized many soybean oil-based products over the past decade. The most recent success comes from two companies that have begun to market the lubricant technology created by the Center. Plews/Edelmann and Environmental Lubricants

Manufacturing, Inc., (ELM), both market biobased consumer lubricants. Plews/Edelmann features the line of biobased lubricants and grease under the LubriMatic Green™ brand. The company is an industry leader in hand-held lubrication equipment, lubricants, air hose and accessories, tire repair, power steering hose and repair kits, transmission oil cooler lines, and automotive fittings. The company considers UNI's products as better-performing lubricants that also have the advantage of being environmentally friendly, and has stocked the shelves of major retail stores including Ace Hardware and Lowe's. ELM commercially manufactures as well as markets products developed through the UNI program, and announced that it has created a line of biobased lubricants and greases for use around the house. ELM's product promotion can be seen in a full-page ad in the Delta Airline Magazine. University of Northern Iowa's NABL was established in 1991 through the collaborative efforts of UNI, the state of Iowa, CSREES/NIFA, the U.S. Department of Energy, and the Iowa Soybean Association/Iowa Soybean Promotion Board.

Section IV: External Panel Recommendations to the Portfolio and Portfolio Responses
In 2005 an external panel convened to assess the progress of this portfolio. From that meeting, several recommendations were made to foster the advancement of this portfolio's work within the Institute. Since the initial external panel, this portfolio has responded to recommendations made. Past portfolio responses for this portfolio may be found in Appendix I.

Relevance

Overall Comment: *The chief weakness relates to the integration of education and extension with research.*

- 2009 Portfolio Response
  Integration of education, extension and research continues to take place within the agency and the programs that it administers. The AFRI competitive grant program requires that 30% of the projects be integrated. The new NIFA organization structure facilitates additional integration.

Scope
The scope of the portfolio is very good, especially given the available resources. This is an emerging portfolio, though, so there is room for improvement. Even so, the Portfolio is not falling behind in coverage and some areas are exceptional. For example, the Portfolio is moving into nanotechnology, and some older programs have been dropped. In the Panel's opinion, while *spread thin*, the Portfolio is very deep and has exceptional breadth.

- 2009 Portfolio Response
  The activities for 2007 and 2008 are continued with expansion of the energy and biobased products program thru the Biomass Resource and Development Initiative. Food processing and food products related grant programs have continued along with the nanotechnology program.

Focus
The Portfolio was focused—every Program Area (PA) [*Note: currently KA*] presentation included contemporary issues and cutting edge technology, and is consistent with the Science Roadmap—but *could be better integrated as a portfolio instead of as individual KAs. The Panel believes NPLs may be operating individually, instead of as a team.* Obesity is misplaced as an issue in this portfolio. The Panel believes that the portfolios need to be reviewed and integrated to make sure all appropriate areas are in the correct portfolios (e.g., food safety, economics, policy, international trade, and market development). The Panel believes that the Portfolio showed evidence of curiosity in seeking out what new knowledge needs to be found. The Portfolio process is new, and the progress is positive. *Based on the descriptor language, though, the Portfolio was not fully focused.*

a. [The portfolio] could be better integrated as a portfolio instead as individual KAs; NPLs may be operating individually, instead of as a team

- 2009 Portfolio Response

This is a diverse portfolio but there are several cross-cutting programs that include most of the portfolio. The bioenergy program includes engineering and technology. The Specialty Crops Research Initiative includes engineering, technology, economics, and food safety. Nanothechnology is also a cross-cutting through sensors and detection, food quality, and bioenergy and bioproducts. The food products and processing related NPLs work together as a team along with those from AFRI.

b. Based on the descriptor language, though, the Portfolio was not fully focused.

- 2009 Portfolio Response

<u>Contemporary and/or Emerging Issues</u>*:*
The Panel encourages *further coordination with other agencies working with bio-based technologies, bioproducts and energy*. The NRI Request for Applications shows appropriate changes over time; nanotechnology, for example, has been identified as an emerging issue. The ability to identify emerging issues depends on NPLs having the time to meet with people doing work on the "cutting edge" of the fields encompassed by this Portfolio. *A process needs to be devised to keep the Portfolio current.*

a. *Panel encourages further coordination with agencies working with bio-based technologies, bio-products and energy*.

- 2009 Portfolio Response
  The NPLs involved in bio-based technologies, bio-products and energy have expanded their efforts in coordinating with other federal and non-federal agencies. These agencies include: NSF, DOE, DOT, EPA and several USDA agencies (ARS, ERS, NASS and FS). There have been new efforts from the Under Secretary's Office to lead the REE agencies to develop an action plan on bioenergy.

b. *A process needs to be devised to keep the Portfolio current*

- 2009 Portfolio Response
  As described in Section I of this report there are recommendations on how the portfolio could be modified to make it more appropriate to meet the future needs of the agency and complementary with other efforts within USDA and other federal agencies.

<u>Integration</u>
The Review Panel was presented with separate projects for education and extension but was shown little evidence of integration (the best job was done by the SBIR program). Although there were a few anecdotal examples of funding, there was an apparent disconnecting between education and extension in the Portfolio. This was due in part to the nature of the Portfolio. It has greater challenges than most in matching education and extension to research because of a *general lack of curricula dealing with biobased resources*. On the other hand, emerging food-processing centers in states are an example of a success story in this arena and represent integrated, multidisciplinary activities. Figuring out how to capture appropriate, integrated data represents an opportunity for this relatively new portfolio.

a. Lack of curricula dealing with biobased resources

- 2009 Portfolio Response
  The REE Strategic Energy Science Plan has Workforce Development as one of the four major goals. Several of the Land Grant universities have now implemented courses and curricula to educate students on the production, logistics, and conversion of biomass to energy sources either as solid fuel or liquid fuel. They have included sustainability and environmental assessments in these curricula.

Multidisciplinary Balance
The topical areas covered in this portfolio make it an opportunistic one for multidisciplinary activities. Other areas for inclusion in this Portfolio include business and managerial activities, economics, and competitive impacts.

- 2009 Portfolio Response
  The 2008 Farm Bill established AFRI which has encouraged multidisciplinary projects.

Quality
This is the weakest portion of the Portfolio and due, for the most part, to the fact that definitions on the scoring sheet were difficult to understand. In the future, with better clarity around these definitions, panels should see what is needed to achieve scores in the highest category. The data presented showed high quality, but metrics were limited and CSREES needs to have very clear examples of performance indicators for future reviews. *The evaluation process needs work*.

- 2009 Portfolio Response
  The Plan of Work (POW) reporting system that is in place tracks the measures set by each Land Grant university for their teaching, extension and research efforts. This provides the metrics for each university. The AFRI program has post award management practices in place to track accomplishments and outcomes. The CRIS system can be used to search for accomplishments and impacts by key word searches.

Significance of Findings
The Panel saw evidence of research findings that influence industry definitions, including commercially viable products, curricula, and patents. There is an opportunity to engage in outreach to capture and integrate teaching and extension, with research.

- 2009 Portfolio Response
  The portfolio continues to demonstrate an emphasis on emerging issues and sharing of significant findings. The eXtension communities of practice is connecting with stakeholders thru the web site for approximately 26 topic areas. This is an example of how research is being made available thru an extension program on a national and international basis.

Stakeholder/Constituent Input:
The Portfolio was presented with well-developed evidence for stakeholder input, but little evidence was presented regarding stakeholder feedback. Though the KAs have existed for some

time, there was no stakeholder assessment of the Portfolio. The Panel feels that the rubrics of this aspect of evaluation need to be broken apart; input, feedback, and assessment are different.

- 2009 Portfolio Response
  There is no stakeholder input for the portfolio as a separate entity. Individual initiatives and programs elicit stakeholder input on multiple occasions, thru national professional society meetings and special topic workshops/meetings which are attended by NPLs. Some programs in NIFA meet jointly with ARS when they conduct their five year program reviews. These reviews include extensive input from stakeholders.

Alignment with Current State of Science
Peer-reviewed publications are an indication of the quality and currency of the Portfolio alignment with current science. The Portfolio appears to be well aligned.

- 2009 Portfolio Response
  The portfolio continues to demonstrate alignment with the current state of science-based knowledge and previous work.

Appropriate and/or Cutting Edge Methodology
The methodology shown in peer-reviewed research projects is good, but the Review Panel would like to see examples of cutting-edge methodologies highlighted.

- 2009 Portfolio Response
  NPLs working in the bioenergy and biobased products area are actively engaged with universities, bioenergy organizations and federal agencies regarding renewable fuels. The eXtension effort has started a community of practice focusing on renewable energy. This web based program provides briefings to the stakeholders, energy providers and academics on all aspects of renewable energy production. This program also includes an "Ask the Expert" component where persons from any state can seek information targeted to them if the Frequently Asked Questions link does not provide the necessary information.

Performance

Overall Comment: Performance indicators such as Timeliness, Agency Guidance, and Accountability are management issues and should not be questions for a Panel to consider. The Review Panel has rated the general Portfolio performance as adequate, though this was done mostly on the basis of personal experience, instead of presented evidence. The Portfolio needs to address the issue of documentation and evidence and implement a better reporting system before the next review. In the future, evidence should be stronger as mapping and assessment efforts identify outputs and linkages.

Portfolio Productivity
Anecdotal examples of Portfolio productivity were presented to the Panel, but there was no evidence of productivity on a significant enough scale to permit analysis. The Panel has made an intuitive evaluation of this Portfolio aspect to be adequate at this time, given current resources

and portfolio mix. This represents an opportunity for CSREES to provide portfolio analysis for future portfolio reviews.

- 2009 Portfolio Response
  The portfolio continues to improve its services through funding, directing, managing, and partnering with its various stakeholders.

Portfolio Comprehensiveness
The Review Panel's comments for this area are similar to those expressed in Portfolio Productivity. The Review Panel did not see the sufficient evidence of completeness necessary to permit analysis. As stated in the Multidisciplinary Balance section, the Panel recommends that a cross-walk of portfolios be done to ensure that all relevant subjects, such as economics, are included in this Portfolio. In addition the wording of the evaluation definitions for this aspect were confusing. The Panel believes the definitions should be reworded so that a score of three would indicate, "All Portfolio projects accomplished stated objectives," and a score of two would indicate, "Most Portfolio projects accomplished stated objectives." If outputs are redefined in this manner then the Panel believes that the Portfolio is fairly complete, but ignores some critical areas. *Better post-award management is necessary to garner requisite data*. This represents an opportunity for improvement.

- 2009 Portfolio Response
  The new NIFA organizational structure, with the four institutes, is designed to provide an integrated effort for each of the programs. Many of the programs in this portfolio will be linked with more than one of the institutes. Post-award management will have an additional effort. This is presently being done by several activities, one of which is the requirement that Program Directors attend post-award workshops on an annual basis.

Portfolio Timeliness
There was a lack of evidence presented for this aspect. The Panel was not even provided with anecdotal evidence of timeliness and believes that no-cost extensions are common to competitive grants programs, due to funding availability, in a fiscal year. *CSREES needs to present evidence of system timeliness and completeness*.

- 2009 Portfolio Response
  NPLs and program staff strive to process grants in a timely fashion. Congressional Q&As for the earmarked projects require annual reports. These reports were prepared and submitted on time by NPLs and program specialists. POW reports are reviewed by the NPL liaisons according to the deadlines of the agency.

Agency Guidance
Based on the Panel's experience, the Portfolio is judged to be excellent as it relates to the solicitation process. CSREES has provided a number of grants workshops and many have been targeted towards specific audiences, such as 1890 institutions. CSREES also has encouraged diverse partnerships among grant applicants.

- 2009 Portfolio Response

The portfolio staff involved in the NRI annual grantsmanship workshops provided guidance through breakout session presentation and answering questions, one-on-one consultation, mock panel review, and other means to help grant seekers. NPLs attend, as regularly as travel budget and schedule availability permit, to multistate research committees, state liaison visits, and professional meetings to provide information about the portfolio and the agency to scientific, producer, and processor communities.

Portfolio Accountability

The Panel was not provided with any evidence of accountability. Accountability metrics also appear to be lacking and there is room for improvement in the quality of the self-study document, and supporting materials.

- 2009 Portfolio Response
  The portfolio continues to improve its requirements that funded projects are completed with thoroughness, clarity, timeliness, adequacy, and usefulness. NPLs use a variety of tools, including grantees' workshops, NPL dashboard, reviewing project progress reports to ensure program accountability.

Section V: Self-Assessment

Portfolio Scoring

Criteria	Panel Score	2006 Score	2007 Score	2008 Score	2009 Score
Relevance					
Scope	3	3	3	3	n/a
Focus	2	2	3	3	n/a
Contemporary and/or Emerging Issues	2	2	2.5	3	n/a
Integration	1	2	2.5	3	n/a
Multi-disciplinary Balance	3	3	3	3	n/a
Quality					
Significance of Findings	3	3	3	3	n/a
Stakeholder/ Constituent Inputs	2	3	3	3	n/a
Alignment with Current State of Science	3	3	3	3	n/a
Appropriate and/or Cutting Edge Methodology	3	2	2.5	2.5	n/a
Performance					
Portfolio Productivity	2	2	2.5	2.5	n/a
Portfolio Comprehensiveness	2	2	2	2	n/a
Portfolio Timeliness	1	2	2	2	n/a
Agency guidance	3	3	3	3	n/a
Portfolio Accountability	2	2	2	2.5	n/a
Overall score	80	83	91	93	n/a

2009 Portfolio Score Change Discussion

Portfolio NPLs decided not to conduct the 2009 annual assessment. The decision was based on the fact that the team had to develop a plan to reorganize the portfolio.

Appendix A - Detailed Funding Tables for Primary KAs – CSREES Funding

CSREES Only Funding tables provide details of agency specific funding for a five fiscal year span for primary KA activities. The funding sources are agency ONLY funding sources. The grand total of these funding sources equals CSREES ADMIN funding that is included in the Overall Funding tables. Below are definitions for CSREES funding sources identified in the following funding tables.

- Hatch (HATCH) formula funds are allocated to the States, for the purpose of conducting agricultural research by the State Agricultural Experiment Stations. Hatch dollars are reported as expenditures in the following funding tables.

- McIntire-Stennis (MC-STN) are funds allocated to the States, for the purpose of conducting forestry research by schools of forestry, land-grant colleges, and State Agricultural Experiment Stations. McIntire-Stennis dollars are reported as expenditures in the following funding tables.

- Evans-Allen funds are allocated to the eligible institutions for support of agricultural research by the 1890 Colleges and Tuskegee University. These dollars are reported as expenditures to the Current Research Information System.

- Animal Health and Disease Program formula funds are allocated to eligible institutions for support of livestock and poultry disease research. These dollars are reported as expenditures to the Current Research Information System.

- Special Research Grants funds are awarded to eligible institutions for the purpose of conducting research to facilitate or expand food and agricultural research programs. These dollars are obligated funds reported in the Current Research Information System.

- National Research Initiative (NRI) Competitive Grants awarded to the eligible institutions for the purpose of conducting research emphasizing natural resources and the environment; nutrition, food quality, and health; plant systems; animal system; rural development, markets, and trade; and processing for value-added products. These dollars are obligated funds reported in the Current Research Information System. These dollars are obligated funds reported in the Current Research Information System.

- Small Business Innovation Research (SBIR) Program grants awarded to eligible institutions for the purpose of supporting high quality research proposals containing advanced concepts related to research on forests and related resources; plant production and protection; animal production and protection; air, water and soils; food science and nutrition; rural and community development; aquaculture; and industrial applications. These dollars are obligated funds reported in the Current Research Information System.

- OTHER CSREES funds are CSREES Administered funding programs not included in Hatch, McIntire-Stennis, Evans-Allen, Animal Health and Disease, Special Research Grants,

National Research Initiative, or Small Business Innovation Research funding programs. These include cooperative agreements, and all other agency administered research grants awarded either competitively or non-competitively. These dollars are obligated funds reported in the Current Research Information System.

- Smith Lever 3(d) provides the opportunity for 1862 and 1890 Land-Grant Institutions, including Tuskegee University and West Virginia State University, and the University of the District of Columbia to compete for and receive extension funds. Smith Lever 3(d) funds became competitive in 2008, prior to that it was a non-competitive extension funding source for the previously mentioned institutions. These dollars are obligated funds reported in the Current Research Information System.

- Smith Lever 3(b) and (c) funds provide funding for agricultural extension programs at 1862 Land-grant universities. These dollars are reported as expenditures in the Plan of Work Annual Report.

- 1890 funds provide funding for agricultural extension programs at 1890 Land-grant universities. These dollars are reported as expenditures in the Plan of Work Annual Report.

KA 401: Structures, Facilities, and General Purpose Farm Supplies NIFA Funding						
Combined Research and Extension Dollars						
Formula -Expenditures/Grant-Obligations in Thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
Hatch	339	354	316	337	1,189	2,535
McIntire-Stennis	147	169	99	151	78	644
Evans Allen	0	0	0	116	130	246
Animal Health	0	0	0	0	0	0
Special Grants	281	359	240	0	91	971
NRI Grants	21	246	0	340	532	1,139
SBIR Grants	80	0	198	80	64	422
Other NIFA	225	49	95	336	1,789	2,494
Smith-Lever 3(d)	*NA*	*NA*	*NA*	14	14	28
Total Reported in CRIS	1,093	1,177	948	1,374	3,887	8,479
Smith-Lever 3(b) and (c)	*NA*	*NA*	*NA*	607	585	1,193
1890 Extension	*NA*	*NA*	*NA*	57	42	99
Total Extension Reported in POW	*NA*	*NA*	*NA*	664	627	1,291
Total (NIFA Admin)	1,093	1,177	948	2,038	4,514	9,770

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report
NA = data aren't available

KA 402: Engineering Systems and Equipment NIFA Funding						
Combined Research and Extension Dollars						
Formula -Expenditures/Grant-Obligations in Thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
Hatch	990	905	974	1,103	1,689	5,661
McIntire-Stennis	28	44	155	329	232	788
Evans Allen	0	53	60	60	47	220
Animal Health	0	0	0	0	0	0
Special Grants	605	674	1,531	0	1,306	4,116
NRI Grants	53	493	524	232	198	1,500
SBIR Grants	987	1,090	1,001	836	1,192	5,106
Other NIFA	632	523	1,948	478	4,998	8,580
Smith-Lever 3(d)	*NA*	*NA*	*NA*	519	314	832
Total Reported in CRIS	3,295	3,782	6,193	3,557	9,976	26,803
Smith-Lever 3(b) and (c)	*NA*	*NA*	*NA*	823	907	1,730
1890 Extension	*NA*	*NA*	*NA*	40	137	177
Total Extension Reported in POW	*NA*	*NA*	*NA*	864	1,043	1,907
Total (NIFA Admin)	3,295	3,782	6,193	4,421	11,019	28,710

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report
NA = data aren't available

KA 404: Instrumentation and Control Systems NIFA Funding						
Combined Research and Extension Funding						
Formula -Expenditures/Grant-Obligations in Thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
Hatch	1,034	990	952	949	1,249	5,174
McIntire-Stennis	55	20	34	54	38	201
Evans Allen	25	124	0	0	42	191
Animal Health	0	0	0	0	0	0
Special Grants	748	579	582	0	953	2,862
NRI Grants	596	782	440	33	95	1,946
SBIR Grants	130	830	710	908	847	3,425
Other NIFA	317	415	71	63	2,807	3,673
Smith-Lever 3(d)	*NA*	*NA*	*NA*	0	0	0
Total Reported in CRIS	2,905	3,740	2,789	2,007	6,031	17,472
Smith-Lever 3(b) and (c)	*NA*	*NA*	*NA*	270	383	653
1890 Extension	*NA*	*NA*	*NA*	10	51	61
Total Extension Reported in POW	*NA*	*NA*	*NA*	281	434	714
Total (NIFA Admin)	2,905	3,740	2,789	2,288	6,465	18,186

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report
NA = data aren't available

KA 501: New and Improved Food Processing Technologies NIFA Funding						
Combined Research and Extension Dollars						
Formula -Expenditures/Grant-Obligations in Thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
Hatch	3,088	3,512	3,184	3,600	5,137	18,521
McIntire-Stennis	0	0	0	0	0	0
Evans Allen	515	704	166	166	167	1,718
Animal Health	0	1	4	13	5	23
Special Grants	3,458	3,391	3,185	0	1,445	11,479
NRI Grants	1,322	3,533	3,093	1,137	2,757	11,842
SBIR Grants	1,376	511	948	1,806	482	5,123
Other NIFA	1,143	1,167	3,448	357	1,881	7,996
Smith-Lever 3(d)	*NA*	*NA*	*NA*	0	0	0
Total Reported in CRIS	10,902	12,819	14,029	7,079	11,874	56,703
Smith-Lever 3(b) and (c)	*NA*	*NA*	*NA*	1,584	1,458	3,042
1890 Extension	*NA*	*NA*	*NA*	319	275	594
Total Extension Reported in POW	*NA*	*NA*	*NA*	1,903	1,733	3,636
Total (NIFA Admin)	10,902	12,819	14,029	8,982	13,607	60,339

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report
NA = data aren't available

KA 502: New and Improved Food Products NIFA Funding						
Combined Research and Extension Dollars						
Formula -Expenditures/Grant-Obligations in Thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
Hatch	2,929	2,435	2,538	3,023	4,133	15,058
McIntire-Stennis	0	0	0	0	0	0
Evans Allen	570	341	352	549	997	2,809
Animal Health	0	0	0	0	0	0
Special Grants	2,470	3,228	3,047	0	2,049	10,794
NRI Grants	2,732	3,638	2,323	2,183	1,594	12,470
SBIR Grants	776	374	296	0	113	1,559
Other NIFA	493	1,178	1,605	25	686	3,987
Smith-Lever 3(d)	*NA*	*NA*	*NA*	0	0	0
Total Reported in CRIS	9,970	11,194	10,161	5,780	9,572	46,677
Smith-Lever 3(b) and (c)	*NA*	*NA*	*NA*	1,159	1,152	2,311
1890 Extension	*NA*	*NA*	*NA*	147	171	318
Total Extension Reported in POW	*NA*	*NA*	*NA*	1,307	1,322	2,629
Total (NIFA Admin)	9,970	11,194	10,161	7,087	10,894	49,306

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report
NA = data aren't available

KA 503: Quality Maintenance in Storing and Marketing Food Products NIFA Funding						
Combined Research and Extension Dollars						
Formula -Expenditures/Grant-Obligations in Thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
Hatch	1,148	1,508	1,280	1,417	2,094	7,447
McIntire-Stennis	0	0	0	0	0	0
Evans Allen	307	318	143	129	147	1,044
Animal Health	0	0	0	0	0	0
Special Grants	1,116	1,139	982	0	540	3,777
NRI Grants	608	1,544	963	363	729	4,207
SBIR Grants	936	587	158	402	80	2,163
Other NIFA	1,142	170	1,682	366	732	4,092
Smith-Lever 3(d)	*NA*	*NA*	*NA*	0	0	0
Total Reported in CRIS	5,257	5,266	5,208	2,677	4,322	22,730
Smith-Lever 3(b) and (c)	*NA*	*NA*	*NA*	974	768	1,741
1890 Extension	*NA*	*NA*	*NA*	50	117	167
Total Extension Reported in POW	*NA*	*NA*	*NA*	1,024	884	1,908
Total (NIFA Admin)	5,257	5,266	5,209	3,701	5,206	24,639

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report
NA = data aren't available

KA 504: Home and Commercial Food Service NIFA Funding						
Combined Research and Extension Dollars						
Formula -Expenditures/Grant-Obligations in Thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
Hatch	16	7	7	15	38	83
McIntire-Stennis	0	0	0	0	0	0
Evans Allen	0	0	0	0	0	0
Animal Health	0	0	0	0	0	0
Special Grants	0	0	0	0	0	0
NRI Grants	65	219	157	0	42	483
SBIR Grants	0	0	0	0	0	0
Other NIFA	435	1,607	507	188	259	2,996
Smith-Lever 3(d)	*NA*	*NA*	*NA*	0	0	0
Total Reported in CRIS	516	1,833	671	203	339	3,562
Smith-Lever 3(b) and (c)	*NA*	*NA*	*NA*	806	448	1,254
1890 Extension	*NA*	*NA*	*NA*	111	155	266
Total Extension Reported in POW	*NA*	*NA*	*NA*	917	603	1,520
Total (NIFA Admin)	516	1,833	671	1,120	942	5,082

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report
NA = data aren't available

KA 511: New and Improved Non-Food Products and Processes NIFA Funding						
Combined Research and Extension Dollars						
Formula -Expenditures/Grant-Obligations in Thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
Hatch	1,255	1,377	1,420	2,398	4,473	10,923
McIntire-Stennis	823	784	1,170	1,739	1,460	5,976
Evans Allen	0	145	347	423	521	1,436
Animal Health	1	5	0	0	0	6
Special Grants	6,351	6,570	6,791	0	4,417	24,129
NRI Grants	3,218	7,899	5,405	3,838	4,470	24,830
SBIR Grants	2,106	1,471	2,022	2,514	3,051	11,164
Other NIFA	2,769	2,200	2,387	1,251	3,110	11,717
Smith-Lever 3(d)	*NA*	*NA*	*NA*	9	9	18
Total Reported in CRIS	16,523	20,451	19,544	12,172	21,511	90,201
Smith-Lever 3(b) and (c)	*NA*	*NA*	*NA*	682	762	1,444
1890 Extension	*NA*	*NA*	*NA*	19	11	30
Total Extension Reported in POW	*NA*	*NA*	*NA*	700	774	1,474
Total (NIFA Admin)	16,523	20,451	19,544	12,872	22,285	91,675

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report
NA = data aren't available

KA 512: Quality Maintenance in Storing and Marketing Non-Food Products NIFA Funding						
Combined Research and Extension Dollars						
Formula -Expenditures/Grant-Obligations in Thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
Hatch	319	258	334	331	298	1,540
McIntire-Stennis	0	0	0	0	6	6
Evans Allen	0	0	0	0	0	0
Animal Health	0	0	0	0	0	0
Special Grants	152	109	0	0	66	327
NRI Grants	0	2	0	0	0	2
SBIR Grants	0	80	0	40	175	295
Other NIFA	132	171	178	1	200	682
Smith-Lever 3(d)	*NA*	*NA*	*NA*	0	0	0
Total Reported in CRIS	603	620	512	372	745	2,852
Smith-Lever 3(b) and (c)	*NA*	*NA*	*NA*	59	101	160
1890 Extension	*NA*	*NA*	*NA*	1	2	3
Total Extension Reported in POW	*NA*	*NA*	*NA*	60	103	163
Total (NIFA Admin)	603	620	512	432	848	3,015

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report
NA = data aren't available

Appendix B - Detailed Funding Tables for Primary KAs – All Known Funding

Overall Funding tables provide financial information regarding outside funding sources and their contribution to agency activities, for a five fiscal year span. The grand total of these funding sources amounts to the total funding for agency activities, including internal and external funding.

- CSREES ADMIN funds are expenditures of formula grant and other grant funding administered by CSREES and distributed to the State Agricultural Experiment Stations (SAES) and Other Cooperating Institutions (OCI). The programs included are Hatch, McIntire Stennis, Evans Allen, Animal Health, Special Grants, Competitive Grants, Small Business Innovation Research Grants, Other CSREES grant, Smith-Lever 3(d), Smith-Lever 3(b) and (c), and 1890 Extension programs.

- Other USDA funds are expenditures of funds received by the SAES and other cooperating institutions from contracts, grants, or cooperative agreements, with one of the USDA research agencies other than CSREES.

- Other Federal (FED) funds are expenditures of funds by USDA agencies, the SAES and other cooperating institutions received from federal sources, outside of USDA, through contracts, grants, and cooperative agreements directly with other federal agencies.

- State Appropriations (APPR) funds are expenditures of funds by the SAES and other cooperating institutions received from sources outside of the federal government. Direct appropriations from individual state governments.

- OTHER NON-Federal (FED) funds are expenditures of funds by USDA agencies, the SAES and other cooperating institutions received from sources outside of the federal government. Sources include the sale of products (self generated), industry grants, and miscellaneous non federal sources

KA 401: Structures, Facilities, and General Purpose Farm Supplies Overall Funding						
Combined Research and Extension Dollars						
$ in the thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
NIFA Admin	1,093	1,177	948	2,038	4,514	9,770
Other USDA	192	88	85	60	101	526
Other Federal	220	130	81	743	56	1,230
State Appr.	2,401	2,303	2,236	874	2,124	9,938
Other Non-Fed	1,029	1,312	1,190	5,222	1,171	9,924
Total	4,934	5,010	4,540	8,937	7,966	31,387

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report

KA 402: Engineering Systems and Equipment NIFA Funding						
Combined Research and Extension Dollars						
$ in the thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
NIFA Admin	3,296	3,782	6,193	4,421	11,019	28,711
Other USDA	168	55	590	1,255	759	2,827
Other Federal	941	732	1,337	2,121	1,101	6,232
State Appr.	5,480	5,265	5,967	1,077	7,280	25,069
Other Non-Fed	1,701	2,043	2,233	10,074	3,136	19,187
Total	11,587	11,876	16,320	18,948	23,295	82,026

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report

KA 404: Instrumentation and Control Systems Overall Funding						
Combined Research and Extension Funding						
$ in the thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
NIFA Admin	2,905	3,740	2,789	2,288	6,465	18,186
Other USDA	266	225	262	341	292	1,386
Other Federal	1,100	443	947	3,026	1,327	6,843
State Appr.	5,155	4,647	6,061	640	6,316	22,819
Other Non-Fed	1,684	1,942	2,036	9,101	2,235	16,998
Total	11,110	10,997	12,095	15,396	16,635	66,232

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report

KA 501: New and Improved Food Processing Technologies Overall Funding						
Combined Research and Extension Dollars						
$ in the thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
NIFA Admin	10,902	12,819	14,029	8,982	13,607	60,339
Other USDA	1,892	673	514	671	1,205	4,955
Other Federal	2,999	3,851	3,920	5,188	1,874	17,832
State Appr.	17,331	16,897	17,993	4,322	20,885	77,428
Other Non-Fed	8,356	8,657	8,708	32,439	12,019	70,179
Total	41,478	42,896	45,164	51,602	49,590	230,730

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report

KA 502: New and Improved Food Products Overall Funding						
Combined Research and Extension Dollars						
$ in the thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
NIFA Admin	9,971	11,194	10,161	7,087	10,894	49,307
Other USDA	394	448	636	1,046	1,367	3,891
Other Federal	2,535	1,630	1,739	2,503	1,690	10,097
State Appr.	16,820	15,519	15,571	1,960	16,357	66,227
Other Non-Fed	8,316	7,853	7,788	23,711	7,952	55,620
Total	38,036	36,642	35,894	36,307	38,260	185,139

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report

KA 503: Quality Maintenance in Storing and Marketing Food Products Overall Funding						
Combined Research and Extension Dollars						
$ in the thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
NIFA Admin	5,257	5,266	5,209	3,701	5,206	24,639
Other USDA	996	844	679	390	558	3,467
Other Federal	603	734	1,299	1,152	459	4,247
State Appr.	8,397	9,380	8,378	923	8,081	35,159
Other Non-Fed	3,803	4,110	4,304	12,487	5,320	30,024
Total	19,056	20,335	19,869	18,653	19,624	97,537

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report

KA 504: Home and Commercial Food Service Overall Funding						
Combined Research and Extension Dollars						
$ in the thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
NIFA Admin	516	1,833	671	1,120	942	5,082
Other USDA	3	1	0	23	16	43
Other Federal	147	68	19	18	2	254
State Appr.	140	216	119	15	194	684
Other Non-Fed	119	97	78	821	126	1,241
Total	925	2,213	887	1,997	1,280	7,302

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report

KA 511: New and Improved Non-Food Products and Processes Overall Funding						
Combined Research and Extension Dollars						
$ in the thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
NIFA Admin	16,524	20,451	19,544	12,872	22,285	69,391
Other USDA	1,423	1,526	1,690	2,203	2,087	6,842
Other Federal	4,619	3,662	4,756	10,146	5,674	23,183
State Appr.	14,058	15,186	14,799	3,577	23,782	47,620
Other Non-Fed	7,367	7,999	8,633	41,147	12,517	65,146
Total	43,992	48,824	49,422	69,945	66,345	212,183

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report

KA 512: Quality Maintenance in Storing and Marketing Non-Food Products Overall Funding						
Combined Research and Extension Dollars						
$ in the thousands						
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**Total**
NIFA Admin	603	621	512	432	848	3,016
Other USDA	158	322	32	316	256	1,084
Other Federal	893	1,011	421	300	134	2,759
State Appr.	1,175	1,353	1,657	79	1,300	5,564
Other Non-Fed	601	978	1,058	2,779	533	5,949
Total	3,430	4,284	3,680	3,906	3,071	18,371

Source of Funding: Current Research Information System (CRIS) and Plan of Work (POW) Annual Report

Appendix C - List of Supporting Programs:

Programs Related to Processing Engineering and Technology for Food and Bioproducts Portfolio	
Name of Related Program	**Description of Relationship**
Hatch	Formula research grant program to the 1862 land grant universities that provides broad funding, including support for this portfolio
Evans-Allen	Formula research grant program to the 1890 land grant universities that provides broad funding, including support for this portfolio
National Research Initiative	Broad competitive research grants program that provides broad funding, including support for this portfolio
Small Business Innovation Research	Broad competitive research grants programs to small businesses that provides broad funding, including support for this portfolio
McIntire-Stennis	Formula grant program that broadly supports forestry and related research
Smith-Lever 3(b) and (c)	Formula extension grant program to the 1862 land grant universities that provides broad funding, including support for this portfolio
1890 Extension	Formula extension grant program to the 1890 land grant universities that provides broad funding, including support for this portfolio
Special Grants	Congressional Earmarks
406 Water Quality	The program identified the impact of bioenergy development on water use and water quality as an area of special emphasis in FY 2007 and 2008
Economic and Community Systems Unit	Two NPLs are addressing economics and social aspects of the bioeconomy
SARE	Regions are soliciting for projects that address sustainable biofuels production
Biotechnology Risk Assessment Research Grant Program	Influence of genetically-engineered bioenergy crops on ecosystem function
Critical Agricultural Materials	R & D of biobased paints, coatings, adhesives with low volatile organic compound emissions to replace petroleum-based products
Federally Recognized Tribes Extension	Increasing knowledge of bioenergy and

Program	biomass conversion as an example topic
Higher Education Challenge Grants	Encourages new academic curricula covering sustainable biobased technologies and economies at the baccalaureate degree level. It also supports curriculum development in food science and technology, and agricultural engineering areas.
Multicultural Scholars Program	Student training support towards baccalaureate degree in a Program Area of Emphasis: Agricultural Sciences and Engineering for Bioenergy
National Needs Fellowship Program - Graduate and Post Graduate	Student training support towards Master's and Doctoral degrees in the Target Expertise Shortage Area: Agricultural Systems Engineering – Biobased Products, Bioenergy, Food Science, and Engineering.
Plant Feedstock Genomics for Bioenergy (Jointly administered by USDA & DOE)	Fundamental research advancing knowledge for the production of biofuels from lignocellulosic feedstocks
Secondary Education, Two-Year Postsecondary Education, and Agriculture in the K-12	Encourages new academic curricula covering sustainable biobased technologies and economies at the secondary and associate degree level.
Tribal Colleges Extension Program	Purpose and priorities description includes increasing knowledge of bioenergy and biomass conversion as an example topic
Tribal Colleges Research Grant Program	Program area description includes alternative energy sources as an example

Appendix D - Partnering Agencies and Other Organizations:

Processing Engineering and Technology for Food and Bioproducts Portfolio Partnering Agencies and Organizations	
Name of Program	**Agency Type**
Office of Energy Policy and New Uses (Biodiesel Education Program)	USDA Agency
Department of Energy (Energy Feedstocks Genomics Program)	Non-USDA Federal Agency
Department of Transportation (Sun Grant Initiative)	Non-USDA Federal Agency
U.S. Army (biobased product testing)	Non-USDA Federal Agency
25X25 (supported Bioenergy Awareness Days in 2008)	Non Federal Organization

Appendix E - Documentation of Previous Score Changes:

Past Score Change Discussions

2008 Portfolio Score Change Discussion

Relevance

Scope:
External Panel commended the portfolio for having an exceptional breadth and depth in its scope, especially given the limited resources allocation. The portfolio review team maintained the scope excellence, and further expands in bioenergy and nanotechnology, and established a new major program in specialty crops. The team gave a rating of 3 again for 2008.

Focus:
The portfolio focus was significantly improved in 2007 by given extensive attention on key program areas in nanotechnology, bioenergy, food safety, and food security through NRI and SBIR RFA development and execution. This effort continued in 2008 in these key areas. The new specialty crop program also reflected a good integration of engineering and technology. The portfolio team rated in 3 again with good confidence.

Contemporary and/or Emerging Issues:
CSREES national program leaders have made significant efforts in identify contemporary and emerging issues, and effectively converted the visions into actions. The specialty crop research initiative (SCRI) competitive grant program was designed and implemented for the first time in 2008. Societal issues were identified and addressed for the first time through NRI nanoscale science, engineering and technology program in 2008. CSREES is leading an REE effort to implement a strategic energy science plan for the next five years. Based on the significant improvement, the portfolio review team felt strongly to edge up the rating from 2.5 to 3 for 2008.

Integration:
Integration across research, education and extension has been more evident in this year's report. Workforce training for the biobased economy vision has been amply reflected in strategic planning, financial investment and program implementations. NRI Improving Food Quality and Value program continued its supported in integrated projects in both emerging food processing technologies and use of bioactives in foods to combat obesity and energy imbalance. Nanotechnology programs supported efforts in Extension for improving public understanding of the new cutting-edge science and its broad impacts. The specialty crops research initiative program has research, education and extension well integrated from get-go. The evidences are well documented; hence increasing the rating from 2.5 to 3 is warranted.

Multi-disciplinary Balance:
Multi-disciplinary balance of the portfolio has been well maintained from beginning. There are ample examples of multi-disciplinary approaches in this portfolio.

Quality

Significance of Findings:
The External Panel rated the significance of findings of the portfolio as 3. The portfolio has continued producing highly significant results. More significant findings in the portfolio have been documents. Two out of four issues of CSREES Partner Video magazines produced and disseminated in 2008 related to the work in this portfolio. They are biofuels and nanotechnology, to highlight the most significant works supported by the agency. The current review panel kept the rating of 3 for 2008.

Stakeholder/Constituent Inputs:
The current review panel retained the score of 3 for its traditional approach of soliciting many stakeholder/constituent inputs. Significant stakeholder meetings held on topics including specialty crops, bioenergy, and nanotechnology are exemplary in many ways.

Alignment with Current State of Science:
The portfolio continues its demonstration of alignment with the current state of science-based knowledge—a score of 3. CSREES program staff work closely with and collaborate with many different agencies on important national initiatives such as bioenergy, nanotechnology, sustainability, and food for health.

Appropriate and/or Cutting Edge Methodologies:
The appropriate and/or cutting edge methods and techniques are interpreted as those employed in the agency funded projects that are carried out at our partner institutes.
It is recognized although variation in technology and methodology use across the broad partner institutions does exist; constant improvement over previous years is generally agreed. Moreover, the works performed in some areas of research works of this portfolio such as nanotechnology are at true world leading edge. Evidences are recorded in this report. The score remains as 2.5, the same as the last year.

Performance

Portfolio Productivity:
The NPLs demonstrated a tremendous potential of achieving highest productivity through the remarkable 100-day completion from the SCRI RFA development to awards. The use of electronic grant submission and processing, a reduction in the turn around time for awarding a grant, and the work completed in the NPL liaison program were all improved in 2008. However, the review team believes that CSREES can continue to build capacity and increase productivity, hence gave a conservative score of 2.5, the same as the last year.

Portfolio Comprehensiveness:
The External Panel and all the previous review teams gave the portfolio a score of 2 for demonstrating moderate comprehensiveness of the portfolio in terms of areas of work, outputs, and outcomes. Though some improvements are evident in certain KAs, the current review team did not see a cross board improvement, partly because of no significant new dollars, hence kept a score of 2.

Timeliness:
Internal timeliness is a measure how the portfolio program staff to process grant applications, awards, and House Q&As. It is evident that the program staff were able to carry out these tasks in timely fashion. External timeliness refers to the degree that the grant awardees complete the projects timely as proposed. While most of the projects are completed on time, there are a small percentage of them needing non-cost extensions. It is frequently due to unexpected externalities. This will remain as an issue to be addressed in the future. The score remains 2.

Agency Guidance:
The strength of CSREES portfolio leadership and management relating to the portfolio has remained a strong trait of this portfolio. The score remains the same as all previous years as well as the one given by the External Panel.

Portfolio Accountability:
The post-award management has continued to improve by utilization of various tools and that program staff are developing capability to trace project impact years past the funded project expiration. Grantees' workshops are common practice now to observe the progress of funded projects. NPLs provide timely feedbacks to the project directors to assure the accountability in conducting research, education and extension projects. The score hence reflected the improvement – from 2 to 2.5 – for 2008.

<u>Overall Portfolio 2008 Score Comments</u>
The overall portfolio score increased from 91 to 93. This increase is indicative of the National Program staff's leadership, will and energy to maintain and improve the quality and impact of this portfolio. NPLs have devoted significant efforts in creatively design and implement new ideas to address the weakness identified in previous reviews. Significant improvements, especially in capturing opportunities in emerging issues, function integration, and project execution accountability are made in 2008. The increase in score is well-justified, as demonstrated by this updated report.

<u>2007 Portfolio Score Change Discussion</u>

Relevance

Scope:
The portfolio review team rated the portfolio's description of what it can provide in terms of coverage of work with the funds available as a 3, which is the same ranking as last year. External reviewers noted weaknesses in sensors and other new technologies, but great progress has been made within the SBIR program and the NRI Nanoscale Science and Engineering programs which fully address the external review panel's concern.

Focus:
The previous score for the portfolio's demonstrated ability to remain focused on issues, topics, and critical needs of the nation was a 2. The current internal portfolio review team rated the area as a 3, based on extensive attention paid to topics in nanotechnology, bioenergy, food safety, and

food security. Requests for Applications from SBIR and the NRI were focused more closely in the past year to draw attention to critical issues and topics.

Contemporary and/or Emerging Issues:
The previous internal review process netted a score of 2 in terms of the portfolio's ability to identify contemporary and/or emerging issues that are consistent and relevant to the portfolio and its mission. After review of progress made in the past year, the current review team gave the portfolio a score of 2.5. It is demonstrated in the portfolio that CSREES program leaders have the ability to identify contemporary and emerging issues and attempts have been made to focus on those issues. However, as of yet, there is still a significant weakness in the ability to capture and address all of the contemporary and emerging issues. It may not be possible to act on each and every issue that is identified.

Integration:
Last year's internal review team gave the portfolio a score of 2 in terms of demonstration of functional integration of CSREES research, extension, and education efforts in the portfolio. The review team struggled with the definition of "integration." After close review of the portfolio, the team gave the current document a score of 2.5, citing some improvement over last year, but pointing out that the portfolio is still not as well-integrated as it has potential to be. However, there are several examples provided that demonstrate forward thinking and projects in early stages with components of integration.

Multi-disciplinary Balance:
The review teams from last year and the current year gave the portfolio a score of 3 for strong demonstration of a multi-disciplinary balance of the portfolio in solving scientific problems. The current portfolio reaches across several diverse disciplines.

Quality

Significance of Findings:
The review teams from last year and the current year gave the portfolio a score of 3 for demonstrating many significant findings in the portfolio. The current review panel found an emphasis on emerging issues, as well as identification and sharing of significant findings.

Stakeholder/Constituent Inputs:
The current review panel gave the panel a score of 3 for its many stakeholder/constituent inputs. This score is the same as last year. Several new significant stakeholder meetings were held in the past year on topics including specialty crops, REE, and bioenergy.

Alignment with Current State of Science:
The review panel from last year and the current year rated the portfolios demonstration of alignment with the current state of science-based knowledge and previous work as highly aligned—a score of 3. CSREES program staff work closely with and collaborate with many different agencies.

Appropriate and/or Cutting Edge Methodologies:
The review panel from the previous year gave the portfolio a score of 2 in terms of demonstrated use of appropriate and/or cutting edge methods and techniques for funded projects. There was some confusion during the current review regarding whether the evaluation was to be applied to the physical management of funds or to the funded projects actually doing the research. The current review panel gave the portfolio a score of 2.5, citing several examples of CSREES use of appropriate methodologies including revising how RFAs are written to solicit the most innovative and cutting edge proposals. Further, the portfolio demonstrates that funded projects are using the best methods available to carry out their work. Program staff at CSREES are working to do everything within their control to ensure that projects are utilizing the most innovative and cutting edge techniques.

Performance

Portfolio Productivity:
The previous review panel gave the portfolio a score of 2 for its demonstration of the ability of CSREES to create and provide service through funding, directing, managing, and partnering with its various stakeholders. The current review panel gave the portfolio a score of 2.5 based on its demonstration of improvement in electronic grant submission, the development and use of the Leadership Management Dashboard, a reduction in the turn around time for awarding a grant, and the work completed in the NPL liaison program. The review team believes that CSREES can continue to build capacity and increase productivity.

Portfolio Comprehensiveness:
The previous review team and the current review team gave the portfolio a score of 2 for demonstrating moderate comprehensiveness of the portfolio in terms of areas of work, outputs, and outcomes. The portfolio is varied and there are impacts across the breadth of the portfolio although not necessarily in each and every KA. As a whole, the portfolio is moderately comprehensive, but did not demonstrate significant enough improvement to warrant an increase in score.

Timeliness:
The previous review team and the current review team gave the portfolio a score of 2 for demonstrating to a moderate extent that funded activities are completed within the funding time frame. The review panel agreed that there is still room for improvement in encouraging projects to complete on time and make judicious use of no cost extensions.

Agency Guidance:
The current review team concurred with the previous review team and gave the portfolio a score of 3. The portfolio demonstrates strength of CSREES portfolio leadership and management relating to the portfolio. The portfolio is well-managed.

Portfolio Accountability:
The current review team concurred with the previous reviewers' score of 2 regarding the demonstrated extent to which funded projects of the portfolio have been completed with thoroughness, clarify, timeliness, adequacy, and usefulness. The review panel noted that post-

award management has improved since the last review and that program staff are developing closer relationships with project directors that extend past the funded project expiration date. This action is helpful for identifying impacts that occur after the project is terminated, when the project director can no longer access CRIS to update project impacts.

Overall Portfolio 2007 Score Comments

The overall portfolio score increased from 83 to 91. This increase is indicative of several things, including program staff efforts to improve the portfolio, as well as the inclusion of KA 401, 402, and 404. The portfolio restructuring has served to strengthen the foundation of the portfolio. National program leaders have taken portfolio reviewers' comments and made efforts to improve weaker areas of the portfolio and reinforce the strong aspects of the portfolio. The increase in score is well-justified, as demonstrated by the updated review document.

Appendix F – Past Portfolio Responses to the External Panel's Recommendations

Relevance

Overall Comment: *The chief weakness relates to the integration of education and extension with research.*

- 2008 Portfolio Response
  - Higher Education competitive grant programs continue to give bioenergy and biobased products a priority in annual solicitations
  - The REE Strategic Energy Plan includes research, education, and extension activities.
  - The 2008 Farm Bill establishes the AFRI competitive grant program that requires a minimum of 30% of projects be integrated.
  - An eXtension Community of Practice was developed to focus on renewable energy production and conservation.
  - In FY 2008, CSREES requested $19.1 M to support a new competitive program to fund research, education, and extension projects on bioenergy. Efforts supported by the new program would utilize a systems approach to bioenergy, including the environmental and social implications of bioenergy production.
  - The 2008 Farm Bill established the Specialty Crop Research Initiative (SCRI) as a research and extension grants program. The RFA for FY 2008 tightly links those two functions. Education was not included in the Farm Bill language.
  - NRI 71.1 program continued supporting integrated projects for improving food quality and value, improving nutrition and addressing energy imbalance with the NRI bioactives program and obesity program.
  - NRI 75.0 program initiated a new priority to conduct three social science research projects to study public perception and acceptance of nanotechnology applications in agriculture and food systems. The funded project integrated extension and public education into the research activities.

- 2007 Portfolio Response

  In early 2007, the Secretary submitted several proposals to the Congress for the 2007 Farm Bill authorization. One of those proposals involved new spending authorizations and mandatory funding for specialty crops. Shortly after this announcement, CSREES NPLs authored a white paper that laid out an implementation plan for the Secretary's Specialty Crop Research Initiative. A basic principle of that plan involves a tight integration of competitive research, education, and extension activities that would enhance problem-solving capabilities. A second proposal for the 2007 Farm Bill included a Bioenergy Biobased Products Initiative with a new spending authorization and mandatory funding.

  The USDA Research, Education, and Economics (REE) Mission Area, which includes CSREES, along with ARS, NASS, and ERS, held a strategic planning workshop September 5-6, 2007 to develop a coordinated mission-area plan in the area of Energy Science, Education, and Extension. The strategic plan developed from the workshop promotes an integrated, transdisciplinary planning and implementation process based on the unique capacities of the REE agencies and their partners and stakeholders. The plan targets

renewable energy and energy conservation and integrates research, education, and extension to reach specified goals.

Specialty crop industry stakeholders, university and federal researchers, educators, and federal program managers met in early 2007 for a workshop entitled, "Engineering Solutions for Specialty Crop Challenges." The workshop provided a forum for special crop industries to engage the science and technology community. Industry representatives voiced their concerns with regard to productivity, production efficiency, post-harvest processing, and environmental quality. In response, the research community offered some engineering science and technology capabilities that could form key components of eventual solutions. A workshop report details the dialog, and will be used as guidance for future federal science and engineering investments to assist this important segment of U.S. agriculture.

In FY 2008, CSREES requested $19.1 M to support a new competitive program to fund research, education, and extension projects on bioenergy. Efforts supported by the new program would utilize a systems approach to bioenergy, including the environmental and social implications of bioenergy production.

- 2006 Portfolio Response
  The National Research Initiative has the authority to fund up to 22% of its annual budget for integrated projects. Many NRI programs have included integrated priorities in the annual request for applications. A Multistate committee, S-1007 Science and Engineering for a Biobased Industry and Economy, consisting of scientists representing research, education and extension from all over the country, has been holding annual meetings since 2001. This is an 11 excellent forum to develop integrated approaches to address critical issues in this important area.

Scope

The scope of the portfolio is very good, especially given the available resources. This is an emerging portfolio, though, so there is room for improvement. Even so, the Portfolio is not falling behind in coverage and some areas are exceptional. For example, the Portfolio is moving into nanotechnology, and some older programs have been dropped. In the Panel's opinion, while *spread thin*, the Portfolio is very deep and has exceptional breadth.

- 2008 Portfolio Response
  Activities in 2007/2008 are continued, and an increasing number of projects focus on energy and biobased products. New engineering emphases are emerging in research and extension activities for specialty crops. Nanotechnology programs maintained its broad scope in nanotechnology applications in crop production, animal production, food safety and biosecurity, novel delivery mechanisms for nutraceuticals and functional foods, soil conditioning and improvement, forest products, and many others through a combination of competitive grants, formula funds, and special research grants. Societal issues are now included in the nanotechnology portfolio.

- 2007 Portfolio Response

The shared faculty has identified and analyzed over 500 projects that have some activity in biobased or bioenergy, and to help the agency determine research needs.

Other sections and units in CSREES are now including bioenergy and biobased products as topic areas in their programs. NRE Water Quality Program included bioenergy crop production and conversion as a priority in 2007; SERD Challenge Grants and National Needs Fellowships programs addressed curriculum development and student support, Agriculture in the Classroom; ECS SARE program, new NPL for the Bioeconomy has training in rural sociology, NPL Agricultural Economist is addressing bioenergy from an environmental perspective. In PAS, the NPL for Animal Nutrition is addressing issues related to distillers' grains and solubles as an animal feed.

An internal bioenergy working group has been formed, and meets periodically. This effort is coordinated by a Program Specialists (hired in 2006) with a background in bioenergy and forest products.

The REE Under Secretary established a task force (the ABBREE Council) in 2006 to help coordinate mission area activities in bioenergy and biobased products that can replace petroleum-based products.

The USDA Small Business Innovation research (SBIR) Program Biofuels and Biobased Products topic area RFA exclusively focused on the development and production of biofuels and related value-added coproducts and the development of new industrial crops to supply raw materials for new biobased products.

- 2006 Portfolio Response
  A shared faculty has been hired for expertise in the economics of bioenergy technologies.

  The National Research Initiative has focused the priorities of the Biobased Products Bioenergy Research Program. The current priorities of the program include the biological conversion of agricultural biomass and the identification of sustainable agricultural biomass for the production of value-added products including bioenergy.

  Basic plant science activities are now supported by NRI programs focusing on biochemistry and genomics.

<u>Focus</u>
The Portfolio was focused—every Program Area (PA) [*Note: currently KA*] presentation included contemporary issues and cutting edge technology, and is consistent with the Science Roadmap—but *could be better integrated as a portfolio instead of as individual KAs. The Panel believes NPLs may be operating individually, instead of as a team.* Obesity is misplaced as an issue in this portfolio. The Panel believes that the portfolios need to be reviewed and integrated to make sure all appropriate areas are in the correct portfolios (e.g., food safety, economics, policy, international trade, and market development). The Panel believes that the Portfolio showed evidence of curiosity in seeking out what new knowledge needs to be found. The

Portfolio process is new, and the progress is positive. *Based on the descriptor language, though, the Portfolio was not fully focused.*

a. [The portfolio] could be better integrated as a portfolio instead as individual KAs; NPLs may be operating individually, instead of as a team

- 2008 Portfolio Response
  This portfolio is diverse. Bioenergy is a cross-cutting theme across KAs, as is engineering. The inclusion of engineering, technology, economics, and food safety in the SCRI will enhance focus for this portfolio. Furthermore, nanotechnology is also crosscutting through sensors and detection, food quality, bioenergy and bioproducts, and many others. If more resources can be provided, many more examples can be shown that nanotechnology is a true enabler across many KAs.

- 2007 Portfolio Response
  The knowledge areas brought in to realign and strengthen the Food and Non-Food Product portfolio in 2007 has created the Processing, Engineering, and Technology for Food and Bioproducts portfolio. Obesity is no longer included in this portfolio. Also, the internal bioenergy working group mentioned under *Scope* provides a collaborative team environment for individualized NPL activities in this portion of the portfolio.

- 2006 Portfolio Response
  The following knowledge areas will be brought in to realign and strengthen the Food and Non Food Product Portfolio. They will be included in the next internal annual review. The funding, activities, and outcomes for these KAs are not reflected in the current tables and logic models:
    - 401: Structure, Facilities, and General Purpose Form Supplies
    - 402: Engineering Systems and Equipment
    - 404: Instrumentation and Control Systems

b. Based on the descriptor language, though, the Portfolio was not fully focused.

- 2008 Portfolio Response
  This is a very diverse portfolio by the nature of the KA grouping.

- 2007 Portfolio Response
  The Office of Planning and Accountability has completed revision of the score sheet and the instrument will be used in all 2008 reviews.

- 2006 Portfolio Response
  The Office of Planning and Accountability will revise the score sheet to provide a more detailed definition for "focus."

<u>Contemporary and/or Emerging Issues</u>*:*
The Panel encourages *further coordination with other agencies working with bio-based technologies, bioproducts and energy*. The NRI Request for Applications shows appropriate

changes over time; nanotechnology, for example, has been identified as an emerging issue. The ability to identify emerging issues depends on NPLs having the time to meet with people doing work on the "cutting edge" of the fields encompassed by this Portfolio. *A process needs to be devised to keep the Portfolio current.*

a. *Panel encourages further coordination with agencies working with bio-based technologies, bio-products and energy*.

- 2008 Portfolio Response
  NPLs participation on Biomass R&D Board interagency working groups including: feedstock development, biomass handling and logistics, conversion technologies, environment/health/safety, sustainable biofuels production.

  The nanotechnology program supports activities that address critical societal challenges of sustainability, crop and livestock productivity, food safety and biosecurity, nutraceutical and functional foods for human health, novel uses of natural resources, and environmental improvement.

  Over the past five years, agency staff have been working closely with specialty crop stakeholders to define and articulate broad industry needs. In the engineering area, a workshop was held in 2007 that brought together industry, academia, and government representatives. Following passage of the 2008 Farm Bill in June 2008 and the Specialty Crop Research Initiative, the agency published a Request for Applications that solicited proposals dealing many aspects of processing, engineering, and technology.

- 2007 Portfolio Response
  NPLs continue to serve on USDA's Biobased Products Bioenergy Coordination Council; NPLs serve on subcommittees of the newly formed USDA Energy Council. The subcommittees address 1) research and development, 2) commercialization, 3) education/outreach, 4) international programs, 5) linking the Department's programs.

  NPLs continue to collaborate with U.S. Army on a full scale demonstration of biobased hydraulic fluids at Fort Leonard Wood in Missouri; successful testing has been completed and efforts are underway to require the use biobased hydraulic fluids in construction equipment on all army bases.

  NPLs continue to interact on a regular basis with DOE Office of Biomass to assist in evaluation of progress in key topic areas; NPL continues to serve on 2 advisory boards for projects that are funded by DOE.

  CSREES continues to be an active participant in the Interagency Metabolic Engineering Working Group which is formed of eight federal agencies (NSF, NIH, NASA, EPA, DOE, NIST, USDA, and DOD).

  CSREES participates with the DOE Office of Science to implement the Plant Feedstock Genomics program.

Under the National Nanotechnology Initiative, NPL coordinates the agency's nanotechnology program, which encourages and supports research and education relevant to this portfolio, with 22 other participating Federal agencies.

CSREES collaborates with the EPA Office of Science on sustainable biofuels production.

As noted above, in 2006, the Under Secretary established an REE task force (the ABBREE Council) on bioenergy to aid inter-agency coordination.

In July 2006 The CSREES-administered USDA SBIR Program partnered with DOE and Oak Ridge national laboratories to sponsor and implement a joint USDA/DOE SBIR Energy Summit. The summit introduced over 75 small businesses to the renewable energy-related programs within USDA and DOE.

- 2006 Portfolio Response
  NPLs continue to serve on USDA's Biobased Products Bioenergy Coordination Council; NPL is collaborating with U.S. Army on a full scale demonstration of biobased hydraulic fluids at Fort Leonard Wood in Missouri; NPLs interact on a regular basis with DOE Office of Biomass to assist in evaluation of progress in key topic areas; NPL serves on 2 advisory boards for projects that are funded by DOE.

  CSREES is an active participant in the Interagency Metabolic Engineering Working Group which is formed of eight federal agencies (NSF, NIH, NASA, EPA, DOE, NIST, USDA, and DOD). The agency leverages a $400,000 investment to the total Working Group investment of $6M to support metabolic engineering for bioproducts and biofuel production.

  Under the National Nanotechnology Initiative, NPL coordinates the agency's nanotechnology program, which encourages and supports research and education relevant to this portfolio, with 22 other participating Federal agencies.

b. *A process needs to be devised to keep the Portfolio current*

- 2008 Portfolio Response
  NPLs are actively engaged, to the best extent possible given existing personnel and financial resources, with NSTC, USDA IWG, industrial and other stakeholders, professional societies to seek inputs while planning relevant programs. CSREES is leading an REE effort to implement a strategic energy science plan for the next 5 years. A stakeholder planning session was held in 2007 followed by formation of implementation teams and an annual summit to facilitate partnerships and measure progress toward the goals identified in the plan.

- 2007 Portfolio Response
  NPLs are responsible for ensuring the portfolio is kept current. A major element of their performance includes assuring relevancy, quality and performance through effective planning, implementation, and evaluation of new and existing programs that address high priority issues. They take leadership and overall responsibility for the coordination and

integration of these programs within and outside the agency, and exhibit understanding of the broad portfolio of Federal programs within the program area. NPLs must stay abreast of new developments, technologies, trends, and/or changing legal requirements in their areas of responsibility, and they apply new technologies/knowledge to the priority setting process.

- 2006 Portfolio Response
  The process is described in the performance elements for NPLs.

Integration

The Review Panel was presented with separate projects for education and extension but was shown little evidence of integration (the best job was done by the SBIR program). Although there were a few anecdotal examples of funding, there was an apparent disconnecting between education and extension in the Portfolio. This was due in part to the nature of the Portfolio. It has greater challenges than most in matching education and extension to research because of a *general lack of curricula dealing with biobased resources*. On the other hand, emerging food-processing centers in states are and example of a success story in this arena and represent integrated, multidisciplinary activities. Figuring out how to capture appropriate, integrated data represents an opportunity for this relatively new portfolio.

a. Lack of curricula dealing with biobased resources

- 2008 Portfolio Response
  Workforce Development is a major goal in the REE Strategic Energy Science Plan. Targeted results by 2012 include tripling the number of students in college and university-based bioenergy and bioeconomy education programs. A complementary effort is the Biomass R&D Board interagency working group for sustainable biofuels. This group had identified workforce development as a criterion and will develop indicators for tracking progress.

  NRI 71.1 program supported integration of research with education and/or extension activities. In food products area, under the NRI Improving Food Quality and Value program, a total of 8 proposals that integrated research, outreach and/or education were awarded during the period of 2006-2008. There was significant improvement in the quality of the integrated proposal submitted to this program. For example, one proposal in the high priority category was not funded in fiscal year 2008 due to the limits on the availability of funds. Not only the integrated grants activity was successful in this program, but also three additional proposals were funded in the joint priority integrated program addressing disciplines of both nutrition and food science in the same proposal.

  NRI 75.0 program supported a research and extension integrated project at Michigan State University on public perception and acceptance of nanotechnology applications in agriculture and foods.

- 2007 Portfolio Response
  As of 2006, all U.S. agricultural engineering departments now include “biological” or “bio” in their name, e.g., Agricultural and Biosystems Engineering. Furthermore, the associated professional society changed their name in 2006 to the American Society for Agricultural

and Biological Engineers, and has recommended that all academic programs change their name to “biological engineering.”

North Dakota State University, along with five other institutions (including one 1890 school), will be establishing a graduation certification program in biological sensorics in 2008.

- 2006 Portfolio Response
  The Multidisciplinary Graduate Education Training award to Cornell University in 2001 has resulted in approximately 25 graduate students trained in biobased related technologies;

  Department of Bioproducts and Biosystems Engineering was established at University of Minnesota;

  Higher Education has made awards for curriculum development that focuses on biomass and product development;

  2006 Higher Education Challenge Grants RFA includes biobased product and technologies as a priority area;

  Institute of Biobased Products at Montana State University is in its third year;

  Ohio State University has established a The Ohio Bioproducts Innovation Center.

<u>Multidisciplinary Balance</u>
The topical areas covered in this portfolio make it an opportunistic one for multidisciplinary activities. Other areas for inclusion in this Portfolio include business and managerial activities, economics, and competitive impacts.

- 2008 Portfolio Response
  The 2008 Farm Bill established AFRI which will encourage multidisciplinary projects.

  The emphasis on bioproducts that are sustainable, requires economics and social impacts be taken into consideration during project planning stages.

  The new SCRI requires trans-disciplinary teams, emphasizing biological, physical, and socio-economic sciences.

  Nanotechnology program is multidisciplinary and supports many cross-disciplinary collaborations among engineers, chemists, biologists, and even social scientists.

- 2007 Portfolio Response
  While business, managerial and economic KAs are not included in this portfolio, our new NPL in Bioeconomy and Rural Communities (2006) brings that perspective to intra-agency activities surrounding this portfolio.

- 2006 Portfolio Response

Integration of research, education, and extension and multidisciplinary activities cannot necessarily be required across the KAs because of the nature of various funding authorities.

Most biobased projects are inherently multidisciplinary and many include economic and marketing activities. The best examples of integrated/multidisciplinary activities can be found in IFAFS projects, some of which are still active through 2005;

The Biodiesel Fuel Education Program at the University of Idaho addresses outreach by educating the public about the benefits of using biodiesel through technical reports and workshops tailored for a variety of audiences.

Quality

This is the weakest portion of the Portfolio and due, for the most part, to the fact that definitions on the scoring sheet were difficult to understand. In the future, with better clarity around these definitions, panels should see what is needed to achieve scores in the highest category. The data presented showed high quality, but metrics were limited and CSREES needs to have very clear examples of performance indicators for future reviews. *The evaluation process needs work*.

- 2008 Portfolio Response
  The post award management has been in place for the NRI programs for last few years. For example, the NRI nanotechnology program has had four annual grantees meetings with 100% grantee attendance for every year. These grantees meetings served as highlights of the cutting edge researches in food and agricultural conferences, catalysts for collaboration in multistate research committee meetings, and connectors with other professionals.

- 2007 Portfolio Response
  The new POW report system ensuring data needed for good program evaluation will be available in April 2008.

- 2006 Portfolio Response
  The effective management of programs is at the heart of the work conducted at CSREES and program evaluation is an essential component of effective management. In 2003 the PREP process and subsequent internal reviews were implemented. Over the past three years fourteen portfolios have been reviewed by expert panel members and each year this process improves. NPLs are now familiar with the process and the staff of the Office of Planning and Accountability has implemented a systematic process for pulling together the material required for these reports.

  Good program evaluation is a process that requires constant attention by all stakeholders and the agency has focused on building the skill sets of stakeholders in the area of program evaluation. The Office of Planning and Accountability has conducted training in the area of evaluation for both NPLs and for staff working at Land-Grant universities.

  This training is available electronically and the Office of Planning and Accountability will be working with NPLs to deliver training to those in the field. The Office of Planning and Accountability is working more closely with individual programs to ensure successful

evaluations are developed, implemented and the data analyzed. Senior leadership at CSREES has begun to embrace program evaluation and over the coming years CSREES expects to see state leaders and project directors more effectively report on the outcomes of their programs as they begin to implement more rigorous program evaluation. The new POW system ensures data needed for good program evaluation will be available in the future.

Significance of Findings

The Panel saw evidence of research findings that influence industry definitions, including commercially viable products, curricula, and patents. There is an opportunity to engage in outreach to capture and integrate teaching and extension, with research.

- 2008 Portfolio Response
  The REE Energy Strategic Plan includes a workshop this fall that will focus on partnerships among stakeholders, and developing strategies to integrate research, education and extension.

  Bioenergy Awareness Day has been held for the past two years to publicly showcase REE-supported technologies and Extension activities.

  The Biodiesel Fuel Education Program is credited for effective public outreach about the benefits of biodiesel and about issues associated with fuel quality that were addressed through research. This program is reauthorized in the 2008 Farm Bill.

  The new SCRI requires 100% matching non-federal support, which will provide important opportunities for stakeholder (industry) engagement. The RFA for this grants program also requires substantial programmatic stakeholder involvement.

  Nanotechnology program supports bionanosensor development and applications in numerous applications. CSREES Partner Video Magazine highlighted four exciting research breakthroughs which could significantly impacts value-added products, food safety and biosecurity, monitoring complex biological system, and no-point pollution control.

- 2007 Portfolio Response
  The portfolio continues to demonstrate an emphasis on emerging issues and sharing of significant findings.

- 2006 Portfolio Response
  The portfolio demonstrates an emphasis on emerging issues.

Stakeholder/Constituent Input:

The Portfolio was presented with well-developed evidence for stakeholder input, but little evidence was presented regarding stakeholder feedback. Though the KAs have existed for some time, there was no stakeholder assessment of the Portfolio. The Panel feels that the rubrics of this aspect of evaluation need to be broken apart; input, feedback, and assessment are different.

- 2008 Portfolio Response
  While there is no stakeholder input for the portfolio as a separate entity, individual initiatives and programs elicit stakeholder input on multiple occasions.

- 2007 Portfolio Response
  Several significant stakeholder meetings were held in the past year on various topics including specialty crops, REE, and bioenergy.

- 2006 Portfolio Response
  The portfolio continues to have many stakeholders/constituents inputs.

Alignment with Current State of Science
Peer-reviewed publications are an indication of the quality and currency of the Portfolio alignment with current science. The Portfolio appears to be well aligned.

- 2008 Portfolio Response
  NPLs ensure the alignment of the programs with the current state-of-art of sciences and technologies.

- 2007 Portfolio Response
  The portfolio staff work closely with and collaborate with many different agencies.

- 2006 Portfolio Response
  The portfolio continues to demonstrate alignment with the current state of science-based knowledge and previous work.

Appropriate and/or Cutting Edge Methodology
The methodology shown in peer-reviewed research projects is good, but the Review Panel would like to see examples of cutting-edge methodologies highlighted.

- 2008 Portfolio Response
  CSREES nanotechnology program continues its concerted efforts in advancing the frontiers of science, engineering and technology in the NNI. Opportunities to use the NNI funded national nanotechnology user facilities and world class advanced instrumentations were introduced to the scientists and engineers involved in CSREES supported research projects. The NRI nanotechnology competitive grant program uses a balanced panel consisting of about a half of nanotechnology experts and a half of agricultural and food scientists from universities, industries and National Laboratories.

- 2007 Portfolio Response
  Since 2001, CSREES has actively participated in the coordination, leadership, planning, and management of nanotechnology under the framework of the National Nanotechnology Initiative (NNI), which currently involves 23 Federal departments and agencies. Through the NNI, the agency is taking a concerted effort in charting the course for the research, education and public engagement for nanoscale science, engineering and technology. The importance of the new cutting edge science and technology on improving agriculture and food has gained

an increased recognition among the NNI agencies. A number of projects relevant to agriculture and food systems have been funded by several NNI agencies to support activities led by our LGU partners. The Current Research Information System (CRIS) homepage, under "What's New in CRIS?" has a direct link to CSREES bioenergy/biofuels projects. These projects illustrate examples of cutting edge methodologies.

- 2006 Portfolio Response:
  NPLs did that for the review. SBIR added Animal Waste as a topic area in 2005, and value-added products are included in the RFA.

Performance

Overall Comment: Performance indicators such as Timeliness, Agency Guidance, and Accountability are management issues and should not be questions for a Panel to consider. The Review Panel has rated the general Portfolio performance as adequate, though this was done mostly on the basis of personal experience, instead of presented evidence. The Portfolio needs to address the issue of documentation and evidence and implement a better reporting system before the next review. In the future, evidence should be stronger as mapping and assessment efforts identify outputs and linkages.

Portfolio Productivity
Anecdotal examples of Portfolio productivity were presented to the Panel, but there was no evidence of productivity on a significant enough scale to permit analysis. The Panel has made an intuitive evaluation of this Portfolio aspect to be adequate at this time, given current resources and portfolio mix. This represents an opportunity for CSREES to provide portfolio analysis for future portfolio reviews.

- 2008 Portfolio Response
  During a 100-day period at the end of FY 2008, a SCRI RFA was written and published, proposals were received and peer-reviewed, and awards were made.

- 2007 Portfolio Response
  The portfolio has improved its productivity based on electronic grant submission, the development and use of the Leadership Management Dashboard, a reduction in the turn around time for awarding a grant, and the work in the NPL State Liaison program.

- 2006 Portfolio Response
  The portfolio continues to improve its services through funding, directing, managing, and partnering with its various stakeholders.

Portfolio Comprehensiveness
The Review Panel's comments for this area are similar to those expressed in Portfolio Productivity. The Review Panel did not see the sufficient evidence of completeness necessary to permit analysis. As stated in the Multidisciplinary Balance section, the Panel recommends that a cross-walk of portfolios be done to ensure that all relevant subjects, such as economics, are included in this Portfolio. In addition the wording of the evaluation definitions for this aspect

were confusing. The Panel believes the definitions should be reworded so that a score of three would indicate, "All Portfolio projects accomplished stated objectives," and a score of two would indicate, "Most Portfolio projects accomplished stated objectives." If outputs are redefined in this manner then the Panel believes that the Portfolio is fairly complete, but ignores some critical areas. *Better post-award management is necessary to garner requisite data*. This represents an opportunity for improvement.

- 2008 Portfolio Response
  Many of the grant programs represented in this portfolio now require project director attendance at subsequent post-award workshops. These workshops were performed regularly on annual basis.

  While significant advancements have been achieved in the programs of the portfolio, more comprehensive outcomes can be achieved by increasing investment of funding to the portfolio. Many more opportunities in value addition of food and biobased products, better utilization of enabling power of nanoscale science, engineering and technology crosscutting through broad field of biological science and agricultural technologies can be better captured to substantially impact the national economy, human health, the environment, and agricultural community.

  The recently established Specialty Crop Research Initiative solicits project proposals that include: stakeholder advisory boards, transdisciplinary research and extension teams (biological, physical, and socio-economic sciences), clearly stated outreach plans, and systems approaches to solving problems. Having these components in each funded project helps ensure that supported research and extension activities will achieve demonstrable impacts.

- 2007 Portfolio Response
  The portfolio continues the activities cited in the 2006 response. Additionally, project director meetings were convened in 2005-2006 for awardees of special research grants covering a common theme, e.g., food safety.

- 2006 Portfolio Response
  S-1007 Multistate committee is completing first round of site visits to Biomass Initiative awardees and reports serve as the basis for a report to Congress in 2005 regarding the status of the program;

  Specific instructions are given to principal investigators regarding substantive and timely reporting to CRIS;

  Template for reporting results and impacts is under development.

  The NRI and SBIR have initiated many post award management activities including: presenting highlights in an annual report, conducting annual PI meetings, preparing success story highlights for dissemination to stakeholders, and site visits.

Portfolio Timeliness

There was a lack of evidence presented for this aspect. The Panel was not even provided with anecdotal evidence of timeliness and believes that no-cost extensions are common to competitive grants programs, due to funding availability, in a fiscal year. *CSREES needs to present evidence of system timeliness and completeness*.

- 2008 Portfolio Response
  NPLs and program staff strive to process grants in timely fashion. Congressional Q&As for the ear-marked projects require annual reports. These reports were prepared and submitted on time by NPLs and program specialists.

- 2007 Portfolio Response
  Under the law, no projects can extend over five years. Also, annual progress, final, and termination reports are required. The portfolio continues to improve in encouraging projects to complete on time and make judicious use of no-cost extensions.

- 2006 Portfolio Response
  The portfolio continues to require projects to complete on time.

Agency Guidance

Based on the Panel's experience, the Portfolio is judged to be excellent as it relates to the solicitation process. CSREES has provided a number of grants workshops and many have been targeted towards specific audiences, such as 1890 institutions. CSREES also has encouraged diverse partnerships among grant applicants.

- 2008 Portfolio Response
  The portfolio staff involved in the NRI annual grantsmanshiop workshops provided guidance through breakout session presentation and answering questions, one-on-one consultation, mock panel review, and other means to help grant seekers. NPLs attend, as regularly as travel budget and schedule availability permit, to multistate research committees, state liaison visits, and professional meetings to provide information about the portfolio and the agency to scientific, producer, and processor communities.

- 2007 Portfolio Response
  The strength of CSREES portfolio leadership and management relating to the portfolio continues to be excellent, and the portfolio continues to be well managed.

- 2006 Portfolio Response
  The portfolio continues to provide excellent leadership and management to its partners.

Portfolio Accountability

The Panel was not provided with any evidence of accountability. Accountability metrics also appear to be lacking and there is room for improvement in the quality of the self-study document, and supporting materials.

- 2008 Portfolio Response

NPLs uses a variety of tools, including grantees' workshop, NPL Dashboard, reviewing project progresses, etc. to ensure the program accountability.

- 2007 Portfolio Response
  The portfolio continues to improve its requirements that funded projects complete with thoroughness, clarity, timeliness, adequacy, and usefulness. The portfolio has improved its post-award management.

- 2006 Portfolio Response
  The portfolio will improve post-award management and its requirements that funded projects complete with thoroughness, clarity, timeliness, adequacy, and usefulness.