

PROCESSING, ENGINEERING, AND TECHNOLOGY FOR FOOD AND BIOPRODUCTS
(formerly)
FOOD PROCESSING AND BIO-BASED PRODUCTS PORTFOLIO

I. Background

This document was prepared in October 2007 as the internal review of Food Processing and Bio-based Products Portfolio for Fiscal Year 07. It contains updates to the portfolio, responses to the comments of the external panel review and changes to criteria scores with accompanying justifications. This document is a result of the efforts of the National Program Leaders from the Plant and Animal Systems (PAS) Unit and the Competitive Programs Unit in collaboration with CSREES Planning and Accountability. KAs 401, 402, and 404 have been added to the portfolio to align the portfolio more closely with the CSREES Processing, Engineering, and Technology Section organizational structure and goals, as recommended by previous external panels.

- **The following knowledge areas (KAs) are included in the Processing Engineering and Technology for Food and Bioproducts portfolio:**

- 401: Structure, Facilities, and General Purpose Farm Supplies
- 402: Engineering Systems and Equipment
- 404: Instrumentation and Control Systems
- 501: New and Improved Food Processes
- 502: New and Improved Food Products
- 503: Quality Maintenance in Storage
- 504: Home and Commercial Food Service
- 511: New and Improved Non-Food Products
- 512: Non-Food Quality Maintenance in Storage

- **Portfolio reviews:**

External Review: May 2004
Internal review: October 2007

- **Portfolio score from the PREP in 2004: 80**

The previous portfolio (sans 40X KAs) received an overall score of 80 from the panel in the 2004 PREP, an overall score of 83 in 2006. Table I-2 below shows the breakdown of scores for different dimensions and criteria.

Table I-2. Scoring of Food Processing and Bio-based Products			
Criteria	Panel Score	2006 Score	2007 Score
Relevance			
1. Scope	3	3	3
2. Focus	2	2	3
3. Emerging Issues	2	2	2.5
4. Integration	1	2	2.5
5. Multi-disciplinary	3	3	3
Quality			
1. Significance	3	3	3
2. Stakeholder	2	3	3
3. Alignment	3	3	3
4. Methodology	3	2	2.5
Performance			

1. Productivity	2	2	2.5
2. Comprehensiveness	2	2	2
3. Timeliness	1	2	2
4. Agency guidance	3	3	3
5. Accountability	2	2	2
Overall score	80	83	91

II. CSREES response to PREP recommendations that cross all portfolios

In response to directives from the Office of Management and Budget (OMB) of the President, CSREES implemented the Portfolio Review Expert Panel (PREP) process to systematically review its progress in achieving its mission. Since this process began in 2003, fourteen expert review panels have been convened and each has published a report offering recommendations and guidance. These external reviews occur on a rolling five-year basis. In the four off years an internal panel is assembled to examine how well CSREES is addressing the expert panel's recommendations. These internal reports are crafted to specifically address the issues raised for a particular portfolio; however, despite the fact that the expert reports were all written independent of one another on portfolios comprised of very different subject matter, several themes common to the set of review reports have emerged. This set of issues has repeatedly been identified by expert panels and requires an agency-wide response. The agency has taken a series of steps to effectively respond to those overarching issues.

Issue 1: Getting Credit When Credit is Due

For the most part panelists were complimentary when examples showing partnerships and leveraging of funds were used. However, panelists saw a strong need for CSREES to better assert itself and its name into the reporting process. Panelists believed that principal investigators who conduct the research, education and extension activities funded by CSREES often do not highlight the contributions made by CSREES. Multiple panel reports suggested CSREES better monitor reports of its funding and ensure that the agency is properly credited. Many panelists were unaware of the breadth of CSREES activities and believe their lack of knowledge is partly a result of CSREES not receiving credit in publications and other material made possible by CSREES funding.

Issue 1: Agency Response:

To address the issue of lack of credit being given to CSREES for funded projects, the Agency implemented several efforts likely to improve this situation in 2005.

First it developed a standard paragraph about CSREES's work and funding that project managers can easily insert into documents, papers and other material funded in part or entirely by CSREES.

Second, the Agency is in the process of implementing the "One Solution" concept. One Solution will allow for the better integration, reporting and publication of CSREES material on the web. In addition, the new Plan of Work (POW), centered on a logic model framework, became operational in June 2006. The logic model framework is discussed in more detail below. Because of the new POW requirements and the POW training conducted by the Office of Planning and Accountability (also described in more detail below), it will be simpler for state and local partners to line up the work they are doing with agency expenditures. This in turn will make it easier for project managers to cite CSREES contributions when appropriate.

Issue 2: Partnership with Universities

Panelists felt that the concept of partnership was not being adequately presented. Panelists saw a need for more detail to be made available. Questions revolving around long-term planning between the entities were common as were ones that asked how the CSREES mission and goals were being supported through its partnership with universities and vice versa.

Issue 2: Agency Response:

CSREES has taken several steps to strengthen its relationship with university partners. First, to the extent possible, implementing partners will be attending the CSREES strategic development exercise which is intended to help partners and CSREES fully align what is done at the local level. Second, CSREES has realigned the state assignments for its National Program Leaders (NPLs). Each state is now assigned to one specific NPL. By reducing the number of states

on which any individual NPL is asked to concentrate and assigning and training NPLs for this duty, better communication between state and NPLs should occur. Finally, several trainings that focused on the POW were conducted by CSREES in geographic regions throughout the country. A major goal of this training was to better communicate CSREES goals to state leaders which will facilitate better planning between the universities and CSREES.

Issue 3: National Program Leaders

Without exception the portfolio review panels were complimentary of the work being done by NPLs. They believe NPLs have significant responsibility, are experts in the field and do a difficult job admirably. Understanding the specific job functions of NPLs was something that helped panelists in the review process. Panelists did however mention that often times there are gaps in the assignments given to NPLs. Those gaps leave holes in programmatic coverage.

Issue 3: Agency Response:

CSREES values the substantive expertise that NPLs bring to the Agency and therefore requires all NPLs to be experts in their respective fields. Given the budget constraints often times faced by the agency, the agency has not always been able to fund needed positions and had to prioritize its hiring for open positions. In addition, because of the level of expertise CSREES requires of its NPLs, quick hires are not always possible. Often, CSREES is unable to meet the salary demands of those it wishes to hire. It is essential that position gaps not only be filled but that they be filled with the most qualified candidate.

Operating under these constraints and given inevitable staff turnover, gaps will always remain. However, establishing and drawing together multidisciplinary teams required to complete the portfolio reviews has allowed the Agency to identify gaps in program knowledge and ensure that these needs are addressed in a timely fashion. To the extent that specific gaps are mentioned by the expert panels, the urgency to fill them is heightened.

Issue 4: Integration

Lack of integration has been highlighted throughout the panel reviews. While review panelists certainly noted in their reports where they observed instances of integration, almost without fail panel reports sought more documentation in this regard.

Issue 4: Agency Response:

Complex problems require creative and integrated approaches that cut across disciplines and knowledge areas. CSREES has recognized the need for these approaches and has undertaken steps to remedy this situation. CSREES has recently mandated that up to twenty-two percent of all NRI funds be put aside specifically for integrated projects. These projects cut across functions as well as disciplines and ensure that future Agency work will be better integrated. Finally, integration is advanced through the portfolio process which requires cooperation across units and programmatic areas.

Issue 5: Extension

While most panels seemed satisfied at the level of discussion that focused on research, the same does not hold true for extension. There was a call for more detail and more outcome examples based upon extension activities. There was a consistent request for more detail regarding not just the activities undertaken by extension but documentation of specific results these activities achieved.

Issue 5: Agency Response:

Outcomes that come about as a result of extension are, by the very nature of the work, more difficult to document than the outcomes of a research project. CSREES has recently shuffled its strategy of assigning NPLs to serve as liaisons for states. In the past, one NPL might serve as a liaison to several states or a region comprised of states. Now, each state will be assigned two NPLs and no NPL will serve as liaison to more than two states. Those same liaisons will review states Plans of Work for formula-based support, and work with those state to ensure that meaningful outcomes are reported. This will ensure more attention is paid to extension activities.

In addition CSREES also has been in discussion with partners and they have pledged to do their best to address this issue. The new POW will make extension-based results and reporting a priority. Placing heavy emphasis on logic models by CSREES will have the effect of necessitating the inclusion of extension activities into the state's POWs. This, in turn, will require more reporting on extension activities and allow for improved documentation of extension impact.

Issue 6: Program Evaluation

Panelists were complimentary in that they saw the creation of the Office of Planning and Accountability and portfolio reviews as being the first steps towards more encompassing program evaluation work; however, they emphasized the need to see outcomes and often stated that the scores they gave were partially the result of their own personal experiences rather than specific program outcomes documented in the portfolios. In other words, they know first hand that CSREES is having an impact but would like to see more systematic and comprehensive documentation of this impact in the reports.

Issue 6: Agency 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 Planning and Accountability unit has implemented a systematic process for pulling together the material required for these reports.

Simply managing the process more effectively is not sufficient for raising the level of program evaluations being done on CSREES funded projects to the highest standard. 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.

Issue 7: Logic Models

Panelists were consistently impressed with the logic models and the range of their potential applications. They expressed the desire to see the logic model process used by all projects funded by CSREES and hoped not only would NPLs continue to use them in their work but, also, that those conducting the research and implementing extension activities would begin to incorporate them into their work plans.

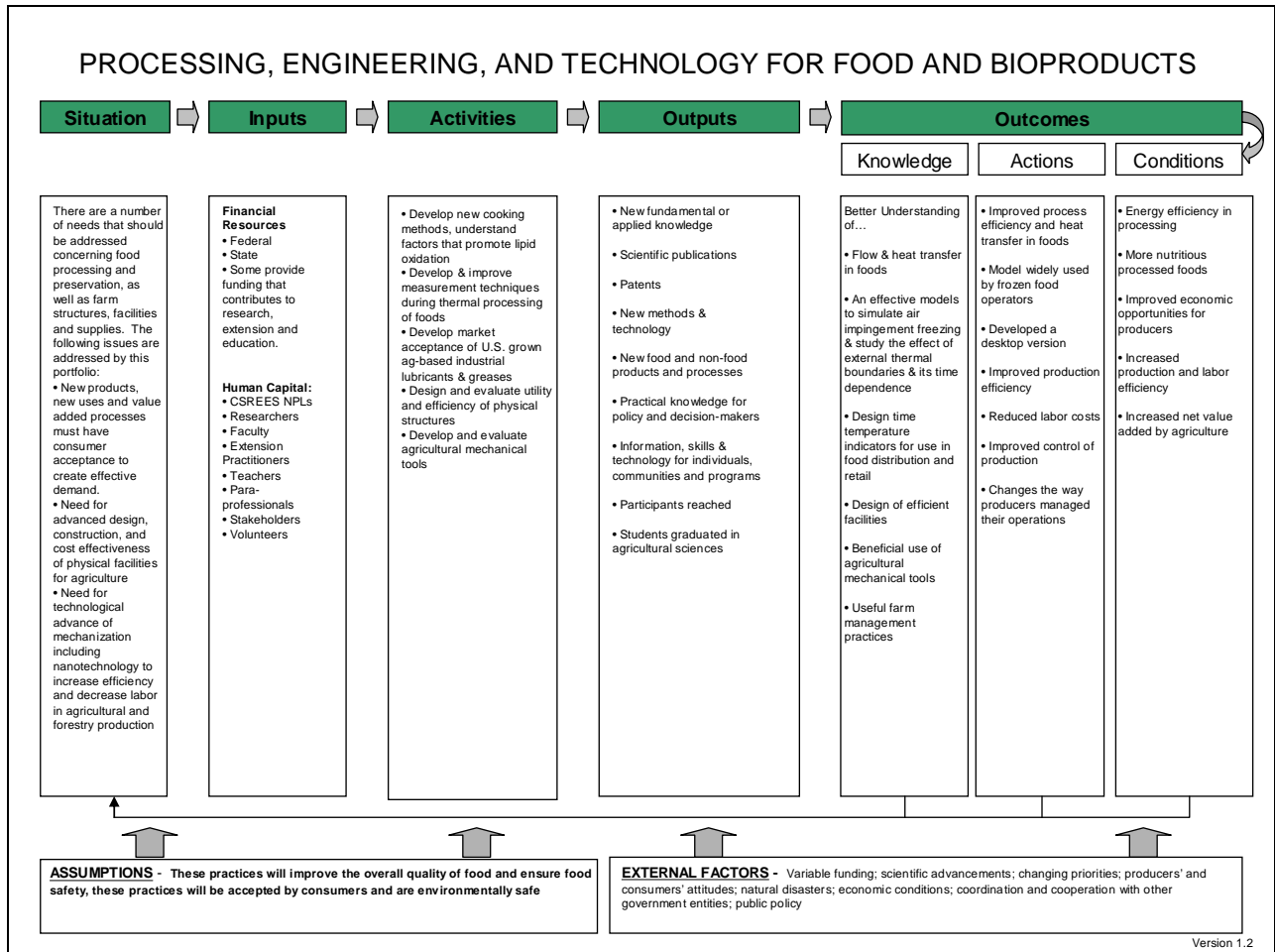
Issue 7: Agency Response:

Logic models have become a staple of the work being done at CSREES and the Agency has been proactive in promoting the use of logic models to its state partners. Two recent initiatives highlight this. First, in 2005, the POW reporting system into which states submit descriptions of their accomplishments was completely revamped. The new reporting system now closely matches the logic models being used in portfolio reports. Beginning in fiscal year 2007, states will be required to enter all of the following components of a standard logic model. These components include describing the following:

- Program Situation
- Program Assumption
- Program Long Term Goals
- Program Inputs which include both monetary and staffing
- Program Output which include such things as patents
- Short Term Outcome Goals
- Medium Term Outcome Goals
- Long Term Outcome Goals
- External Factors
- Target Audience

The system is now operational and states were required to begin using it by June of 2006. By requiring the inclusion of the data components listed above states are in essence, creating a logic model that CSREES believes will help improve both program management and outcome reporting.

The second recent initiative by CSREES regarding logic models concerns a set of training sessions conducted by Planning and Accountability staff. In October and November of 2005 four separate training sessions were held in Monterrey, California, Lincoln, Nebraska, Washington D.C. and Charleston, South Carolina. More than 200 people representing land-grant universities attended these sessions where they were given training in logic model creation, program planning, and evaluation. In addition, two training sessions were provided to NPLs in December 2005 and January 2006 to further familiarize them with the logic model process. Ultimately it is hoped these representatives will pass on to others in the Land-Grant system what they learned about logic models thus creating a network of individuals utilizing the same general approach to strategic planning. These materials also have been made available to the public on the CSREES website.



III. National Program Leaders Responses

• **A Brief Summary of the PREP Report with the Panel's Specific Portfolio Recommendations:**

KA's 401, 402, and 404 were previously reviewed under the Structure and Farm Management Portfolio. The External preview was conducted in July 2004 and an internal review was conducted in 2006. The panel recommended the engineering KA's be separated from the farm management KA's. The agency agrees and the engineering KA's 401, 402, and 404 are now included in the Processing, Engineering, and Technology for Food and Bioproducts portfolio. The panel's findings relevant to the Engineering component of the Structure and Farm Management Portfolio indicate the identification of emerging and contemporary issues is good. The future should include more emphasis on bioenergy, bioproducts, and nanotechnology. The panel commended the CSREES group for its leadership in organizing and conducting the strategic planning workshop on nanotechnology to develop a roadmap for new research, teaching, and extension actions. *NOTE: The new alignment with the Processing, Engineering, and Technology for Food and Bioproducts portfolio is supportive of this recommendation and will enhance the synergy necessary to support these recommendations.*

The Food Processing and Bio-based Products panel found that the people of CSREES make a significant difference and add considerable value to the work of both the agency and the partnership. The evidence presented in this portfolio reflects hard work and indicates high levels of productivity. There is evidence of increasing emphasis on integration and that CSREES staffs are becoming more creative and determined about planning and reporting as forms of accountability.

The panel recommends continued effort in partnerships with 1890 and 1994 institutions. Many opportunities exist for programming on critical issues, expanding urban track issues and the issue of wildlife-urban interface. National needs can often be met by working in international collaborations and contexts. The panel suggests that the partnership continue to expand interactions with stakeholders to include "emerging stakeholders." It is as important for planning processes to identify new stakeholders and partners as it is for the process to identify emerging issues and priorities.

Further, players throughout the partnership should examine all federal reports across states within program areas in order to document the synergistic effect of integrated funding on levels of research, education and extension productivity. There is a need to standardize and expand the documentation and evaluation metrics across program areas and increase the archiving and accessibility of research project data (in the CRIS and other systems). This is necessary in order to permit meta-analysis of the data. The panel recommends training on the logic model for agency employees and external and internal partners. Instead of just evaluating past performance, the panel also suggests developing strategic plans for each problem area and increasing stakeholder contributions by including panel members and other stakeholders in the development and review of CSREES strategic plans at the portfolio level. Finally, the panel suggests increasing the documentation of outcomes. Formative evaluations to document program implementation successes and challenges should be performed.

RELEVANCE

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

2007 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 that 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 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.

2007 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 Specialist (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 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.

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

2007 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 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.

2007 response:

The Office of Planning and Accountability has completed revision of the scoresheet and the instrument will be used in all 2008 reviews.

2006 response:

The Office of Planning and Accountability will revise the scoresheet to provide a more detailed definition for “focus.”

Emerging Issues: 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.

2007 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
- NPL continues 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, 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 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, 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

2007 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 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 disconnect 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 –

2007 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 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.

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.*

2007 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 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.*

2007 response:

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

2006 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: 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.

2007 response: The portfolio continues to demonstrate an emphasis on emerging issues and sharing of significant findings.

2006 response: The portfolio demonstrates an emphasis on emerging issues.

Stakeholder 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.

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

2006 response: The portfolio continues to have many stakeholders/constituents inputs.

Alignment: 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.

2007 response: The portfolio staff work closely with and collaborate with many different agencies.

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

Appropriate Methodology: The methodology shown for peer-reviewed research projects is good, but the Review Panel would like to see examples of cutting-edge methodologies highlighted.

2007 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 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.

2007 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 response: The portfolio continues to improve its services through funding, directing, managing, and partnering with its various stakeholders.

Portfolio Completeness: 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.

2007 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 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.*

2007 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 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.

2007 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 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.

2007 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 response: The portfolio will improve post-award management and its requirements that funded projects complete with thoroughness, clarity, timeliness, adequacy, and usefulness.

IV. Updates of the self-assessment paper

1. Budget

Portfolio: Food Processing and Bio-based Products CSREES Funding									
(as reported in the Current Research Information System)									
\$ in the thousands									
Year	HATCH	MC-STN	Evans Allen	Animal Health	Special Grants	NRI Grants	SBIR Grants	Other CSREES	Total CSREES
2000	10,881	1,779	1,547	0	9,613	3,830	1707	14,318	43,675
2001	10,815	1,510	1,538	0	11,290	10,987	3853	16,554	56,547
2002	10,838	1,465	1,464	0	11,783	5,992	5290	4,725	41,557
2003	11,631	1,275	1,514	2	14,634	12,032	6016	7,210	54,314
2004	11,074	1,018	1,516	1	15,012	8,801	7091	7,386	51,899
2005	10,356	997	1,561	6	15,470	17,574	4113	7,065	57,143
Portfolio Total	65,595	8,044	9,140	9	77,802	59,216	28,070	57,258	305,135

Portfolio: Food Processing and Bio-based Products Overall Funding								
(as reported in the Current Research Information System)								
\$ in the thousands								
Year	CSREES Admin	Other USDA	Other Federal	State Appr.	Self-Gen	Ind/Gr Agrmt	Other Non-Fed	Total
2000	41,954	4,264	10,218	67,930	5,478	15,383	7,706	152,930
2001	57,816	5,221	10,911	75,755	6,338	15,656	9,120	180,818
2002	40,332	5,849	9,572	75,074	6,999	15,046	9,468	162,341
2003	54,377	6,327	9,565	71,713	6,904	16,395	9,934	175,216
2004	51,065	5,492	14,057	70,957	7,995	15,132	9,849	174,548
2005	60,883	5,801	20,319	83,436	11,417	20,576	14,221	216,655
Portfolio Total	306,427	32,954	74,642	444,865	45,131	98,188	60,298	1,062,508

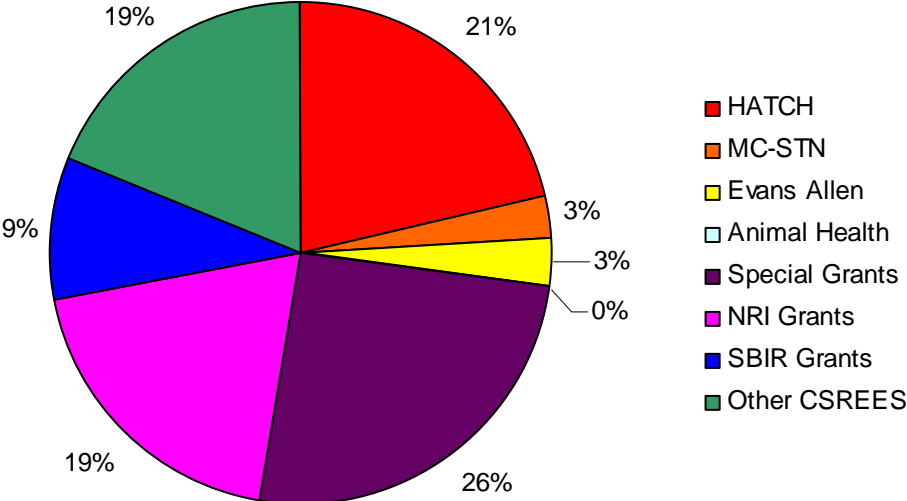
Since 2000, the portfolio as a whole has seen increases in several key funding sources. Funding from Special Grants has nearly doubled in amount since 2000 and funding from NRI grants has more than tripled. The total funding amount from CSREES sources has steadily increased overall. The small decrease in overall CSREES funding from 2005 to 2006 may be reflective of the change in Knowledge Areas associated with this portfolio.

Knowledge Area 402 experienced a large increase in McIntire-Stennis and Special Grant funding sources. These two sources account for the vast majority of the nearly doubled CSREES funding amount from 2005 to 2006.

Knowledge Area 501 has had steady, gradual increases in total CSREES funding over the past 6 years. From 2005 to 2006, the most significant increases originated from SBIR funding and other CSREES sources of funding.

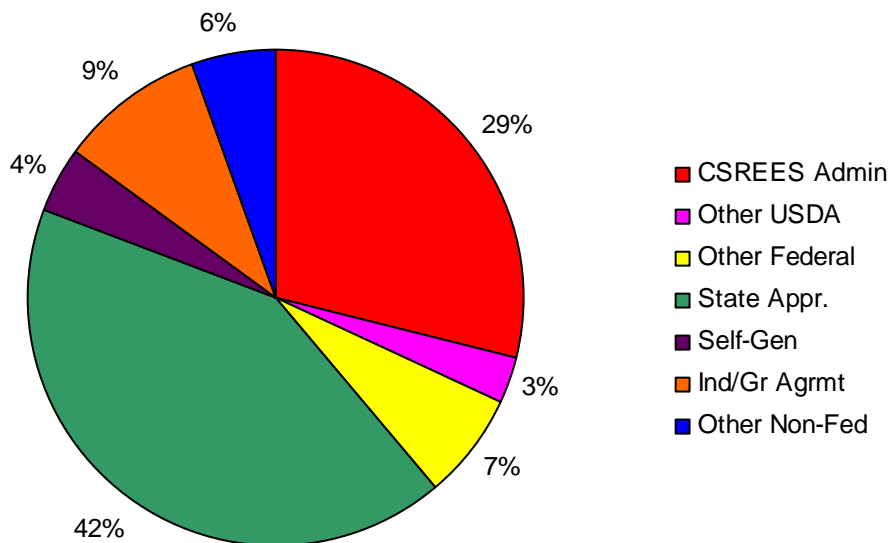
2. Pie Charts

CSREES Funding



Source: 2006 CRIS data

Overall Funding



Source: 2006 CRIS data

3. Performance Measures

1. A. *Measure Description*: Expand commercially adaptable processes that convert biomass to fuels through the development of cost effective biochemical or thermochemical technologies.

B. *Measure Explanation*: These processes in conversion of cellulose to fermentable sugars, 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 U.S. consumers.

Time Frame	Target	Actual	Development: Baseline/Target
2005	Baseline	3	Conversion technologies that will be adaptable for commercialization by 2009 = 4; 1) new biocatalysts for conversion of cellulose to ETOH or chemicals; 2) new chemical catalysts for production of biodiesel; 3) new biocatalysts for production of biodiesel; 4) pyrolysis for production of bio-oils; 5) gasification to produce syngas; 6) syngas conversion to liquid fuel
2006	1	1	
2007	1		
2008	1		

2. A. *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.

B. *Measure Explanation*: Products are biodegradable, as appropriate and utilize oils, proteins, starches, or lignocellulosic materials. Biobased products will open new markets for these materials and will increase availability of environmentally preferable products for US consumers.

Time Frame	Target	Actual	Development:Baseline/Target
2005	Baseline	45	30 of 45 products are based on soybean oil formulations developed at University of Northern Iowa for specific applications
2006	1	1	
2007	1		
2008	1		

3. A. *Measure Description*: Expand the number of unique biomass feedstocks that have been developed to the precommercialization stage or have been commercialized for production of agricultural raw materials.

B. *Measure Explanation*: New crops or biotech crops provide agricultural materials with properties that are chemically and physically unique. New crops provide diversity, new sources of revenue, and can be grown sustainably with reduced inputs.

Time Frame	Target	Actual	Development:Baseline/Target
2005	Baseline	3	3 new oilseed crops have been developed as source of industrial oil, one fiber crop for specialty paper products, and one crop for hypoallergenic latex
2006	1	1	
2007	1		
2008	1		

V. Evidence of Progress --

1. **Development of Xylose-Specific Transporters for Further Improvement of Glucose/Xylose Co-Fermenting Saccharomyces Yeast**, Purdue University. This project will continue to optimize a genetically engineered yeast currently used commercially to convert sugars derived from cellulose and hemi-cellulose to ethanol. Optimization will include developing genes encoding a xylose-specific transport protein and continued efforts to make the yeast co-ferment galactose with glucose and xylose, and to complete efforts to make the yeast co-ferment L-arabinose. This yeast biocatalyst has been supported with National Research Initiative funding and is currently being used by Iogen Biorefinery Partners LLC. The company was recently awarded a DOE Biorefinery grant to scale up cellulosic ethanol production from barley and wheat straw and other farm wastes, in Shelley Idaho. The facility is expected to be operational in 2-3 years.

2. **Biomass-Based Energy Research**, Oklahoma State University/Mississippi State University/University of Oklahoma. This research links biomass gasification and fermentation technologies to produce ethanol and chemicals. The project is comprehensive in scope and includes optimizing energy crops, tailoring gasification to the feedstock, and it includes an economic analysis to determine the potential economies of scale from a coordinated biorefinery operation that includes harvesting and handling. Through the establishment of the Oklahoma State University, University of Oklahoma, and Mississippi State University Consortium, the three universities are developing an ethanol gasification-bioconversion process that utilizes all of the plant biomass, including the lignin. While making the process more cost efficient than other methods of ethanol production, this process utilizes all portions of a variety of biomass and feedstock material that includes grasses, crop residues, and processing plant byproducts. The primary goal is to develop a holistic, cost-effective biomass conversion-to-ethanol production system utilizing a unique gasification-fermentation process. Breeding efforts for bermudagrass and switchgrass as energy crops have resulted in genetic improvement and new cultivar development. Additional biomass feedstocks such as cotton gin waste and sawdust have been processed to evaluate handling and storage, material composition, and synthesis gas yield and quality. Two gasifiers, a fluidized-bed reactor and a downdraft unit, have been optimized using switchgrass, bermudagrass, and corn fermentation waste as inputs. Synthesis gas produced from the gasification process has been evaluated for quantity and quality from a variety of biomass sources. The microbial catalyst used in the fermentation process continues to be optimized for more efficient production of ethanol. Researchers are in discussion with a private partner. This project is funded through the Special Research Grant authority.

3. Value-Added Products from Agricultural Commodities, Purdue University. This research is addressing the use of mixtures of soybean methyl esters, i.e. biodiesel, with jet fuel, quantifying the physical properties and measuring turbine jet engine combustion performance and emissions. Aviation jet fuels are a unique energy fuel market due to the critical nature of fuel weight/energy density required for jet flight. A key performance limitation of soy methyl esters is the very low freezing point required for jet fuel. This project has developed a fractionation technology that removes the saturated components to produce workable fuel blends with existing jet fuels. The byproduct of biodiesel production is glycerin. This project is also evaluating the use of glycerin for aviation deicers to replace ethylene/propylene glycol deicers. The fractionation process and glycerin deicer product are being patented and Purdue is working with industrial partners to commercialize the technologies. Product testing is ongoing. This project is supported with Hatch formula funds.

4. New conversion technology 2006. Biodiesel Production, Resodyn Corporation. Waste restaurant grease and residues from animal processing represent a large underutilized waste stream with potential for conversion to high-value products. Resodyn Corporation, Butte, MT developed an innovative process for the conversion of low-value feedstocks to biodiesel which can be produced at costs competitive to traditional diesel fuel. Resodyn's process uses proprietary catalysts and unique ultrasonic mixing technology to convert waste restaurant grease and tallow from large commercial animal carcass rendering plants to produce a high quality biodiesel. The impacts of this project include: the consistent production of both high quality biodiesel and a glycerin by-product; the lowest production costs in the industry; competitively priced capital investments (low cost for setting up a plant); elimination of waste water discharge; and complete solvent recovery. Resodyn sold their technology for \$29 MM to developers. There are now three biodiesel plants either in operation or under construction in the upper Midwest based on the technology that Resodyn developed supported by USDA SBIR funding.

5. New biobased product in 2006. Biobased Glue, Oregon. Radio Frequency Energy for Control of Walnut Pests: an Alternative to Methyl Bromide, Washington State University. Researchers at Oregon State; USDA-ARS-SJVASC, Parlier, CA; University of California, Davis developed a new, environmentally friendly adhesive made with renewable natural resources. The glue, which replaces current adhesives that release cancer-causing chemicals into the air, will improve the environment and human health, as well as provide new markets for U.S. soybean farmers. Since the 1940s, adhesive products used to make wood products, such as plywood, particleboard and fiberboard, contained cancer causing-chemicals, such as phenol-formaldehyde and urea-formaldehyde resins. This product, developed by Kaichang Li and colleagues at Oregon State University, provides a high-performance, formaldehyde-free adhesive alternative. The soy-based adhesive is stronger than, and cost-competitive with, conventional adhesives. Application of this adhesive in U.S. wood products may improve the global competitiveness of U.S wood composite companies, including furniture and kitchen cabinetry industries. In addition, the use of a soy-based adhesive product will enhance the economic benefits to U.S. soybean farmers. In 2006, the new adhesive was adopted by industry and replaced more than 47 million pounds of conventional formaldehyde-based adhesives. A study found the new adhesive reduced the emission of hazardous air pollutants, such as formaldehyde, from each plant by 50 to 90 percent. Li's inspiration for the adhesive came from the strong, water-resistant proteins used by ocean mussels to cling to rocks to avoid being washed away by the surf. He wanted to develop a wood adhesive from renewable natural resources, like soy protein, carbohydrates and lignin that would be strong and water-resistant. For this achievement, Li, along with partners Columbia Forest Products and Hercules Incorporated, received the Greener Synthetic Pathways Award, one of five 2007 Presidential Green Chemistry Challenge awards, which promote innovative development in, and use of, green chemistry for pollution prevention. This research was supported through the National Research Initiative (NRI) Biobased Products and Bioenergy Production Research program.

6. New crop development 2006. Camelina is an oilseed crop that produces a high quality oil and meal that can be refined into industrial oils, biodiesel, and food and feed products high in omega 3 fatty acids. Development of this new crop and potential products is supported through various funding authorities. 1) The SBIR is supporting the Great Northern Growers Cooperative to develop camelina as a rotation crop in Montana and to process and manufacture value-added products. Camelina oil is highly stable, resistant to oxidation, and the biodiesel industry has indicated it will consume all the oil produced. The challenge is to develop valuable markets and demand for the meal. 2) The Institute for Biobased Products at Montana State University is funded through a special research grant to provide an infrastructure that encourages collaborative research to develop biobased products, and value-added alternative crops. Camelina has been identified by the Institute as a rapidly emerging profitable crop. Three bioproducts, chain oil, penetrating oil, and dust suppressant are being produced and marketed by a rural oilseed refinery, and scale-up is in progress. 3) Montana State University is also supported with Hatch funds to develop weed management strategies for camelina. 4) Fort Peck Tribal College is supported through a SERD grant to grow camelina as an alternative crop for biofuel, food and feed products. State funds support camelina production in other states including Mississippi.

7. Radio Frequency Energy for Control of Walnut Pests: an Alternative to Methyl Bromide, Washington State University; USDA-ARS-SJVASC, Parlier, CA; University of California, Davis. This project utilized the strength of multiple disciplines from different research institutes of two states and integrated research and extension efforts. Radio frequency (RF) treatments provided an environment-friendly alternative to methyl bromide fumigation for post-harvest control of insects in walnuts and other low-moisture agricultural commodities. International trade of agricultural commodities has become an essential part of US agriculture production in the increasingly competitive global market. Agricultural commodities are natural carriers of exotic insect pests. These pests can cause major local economic losses when accidentally introduced to new areas without co-evolved natural enemies. To reduce the risk of introducing pests, importing countries or regions impose quarantine, or phytosanitary requirements, for a whole host of targeted pests. Methyl bromide has been 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. Restriction of its uses has created an urgent need to find environmentally friendly and effective alternatives.

About 30 percent of in-shell walnuts produced in the United States are exported to Asian and European markets where quarantine or phytosanitary restrictions are imposed. Radio frequency (RF) heating technology was developed as a selective high temperature-short time process and applied to walnuts, a heat sensitive low moisture commodity. The fifth-instar navel orange worm, the most heat-resistant life stage and species among the four common pests found in walnuts, was studied as the bench mark organism. Effective treatments were identified and should be effective to control all other pests in walnuts.

RF treatments effectively control insect pests at life stages present in in-shell walnuts without negatively affecting walnut quality or storability. This process is technically feasible for large-scale commercial application. The 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, reducing the long-term impact on the environment, human health, and competitiveness of agricultural industries in an increasingly competitive global economy.

8. Biohazard Detection Made Simple with a Newly Developed Cloth, Cornell University. Nanotechnology is leading the way in new techniques and products that will advance the protection in food safety, health services, and homeland security to a new higher level. The researchers of this project have developed a cloth that has the potential to detect multiple bacteria, viruses, and other biohazards simultaneous. The newly developed non-woven fabric could revolutionize how biohazards are detected and add a new layer of protection from the home to the homeland.

The cloth is a product of a new and emerging field of science, nanotechnology. The smallest conventional textile fibers have diameters of approximately 10 microns (μ) or 10,000 nanometers (nm), but the fibers created using nanotechnology have diameters ranging from 2 – 100 nm, several orders of magnitude finer. The fibers in the new cloth are produced from polylactic acid (PLA), polyester made from corn starch rather than petroleum, by Natureworks, LLC. The new cloth has fine nanoscale fibers that greatly enhance the cloth's surface area and absorbency. During the cloth forming process, biotin, a reactive component of the B vitamin complex, is incorporated into the PLA fibers. Biotin acts as an attachment site for the streptavidin protein, which can react with multiple agents, activating the fabric to capture the targeted biohazards. To aid in visualizing detection, the fibers contain liposomes that release a dye when contact with a biohazard is made. The use of liposomes allows the confirmation of biohazard detection with the naked eye. The resulting fabric can be used as an easy-to-handle swab or wiper capable of picking up and identifying biohazards on surfaces or in liquids.

Development of the biodetection cloth was made possible through funding provided by the National Research Initiative Nanoscale Science and Engineering for Agriculture and Food Systems program. Potential uses for this new product are numerous. The Department of Homeland Security could apply the new technology to screen for biohazards, such as the anthrax virus. The cloth could also be used by the health care community to confirm the removal of pathogens in operating rooms. The Centers for Disease Control and Prevention could apply the new technology to identify the presence of viruses, such as avian influenza. Finally, food preparation facilities could rapidly screen for common contaminants, such as *E. coli* or Listeria. Although this test would not provide as much information as a full biochemical analysis, it could provide a rapid response test that could be performed by personnel without highly specialized training or equipment. The future applications of this product are limitless and provide exciting new opportunities to keep people safe and healthy.

9. Effects of food processing on health components in Berries, University of Arkansas.

In 2005, a National Research Initiative grant was awarded to the University of Arkansas to study the effects of processing on the content and absorption of grape and berry polyphenolics (bioactive health components) in the amount of \$ 220,000, for a period of 3 years. The PI is collaborating with ARS-USDA scientists in Little Rock to

complete the study. Fruits are an excellent source of polyphenolics, which are powerful antioxidants, and may play an important role in preventing oxidative stress associated with numerous chronic diseases. However, fruits are commonly consumed after some sort of processing, and the efficacy of polyphenolics in food products can be affected by processing steps as well as by the bioavailability of these compounds from the final products. The purpose of the study is to determine the fates of bioactive compounds in small fruits during processing and storage, and to determine how these changes influence the bioavailability of polyphenolics in fruit fractions obtained during processing operations.

An assessment of the progress of the project was made with the PI, Dr. Luke Howard on October 13, 2007 at the Second International Symposium on Fruits and Vegetables Effects on Human Health in Houston, Texas. The PI presented a Plenary Lecture on the topic. The Co-PI, Dr. Ron Prior from ARS was also present. Significant outputs thus far include: Freezing and subsequent frozen storage of berries have minimum effect on the stability of polyphenolics; significant losses in all thermally treated products during processing and storage; major losses occur in juice processing (lost into pulp); in purees and canned products polyphenolics leached into liquid medium; flavonols and ellagitannins and chlorogenic acid showed more stability; polyphenolics polymerized extensively, retained antioxidant activity but may not be bioavailable. Enough knowledge has been generated to construct several hypotheses for processing to mitigate the losses. High pressure processing might mitigate the losses of health components in fruits and vegetables. Sub-critical water processing may minimize the inactivation (A 2006 NRI project was awarded to the same PI based on the outputs of the 2005 grant). Health components can be recovered from the by products of processed juice and added back to the juice. The investigators indicated that they have other patentable technologies in mind at this time. The investigators will similarly study grapes for the effects of processing. Bioavailability studies are in progress.

VI. 2007 Self Score of Portfolio

Relevance

1.1 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.

1.2 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.

1.3 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.

1.4 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.

1.5 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

2.1 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.

2.2 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.

2.3 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.

2.4 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

3.1 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.

3.2 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.

3.3 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.

3.4 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.

3.5 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, clarity, 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 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.

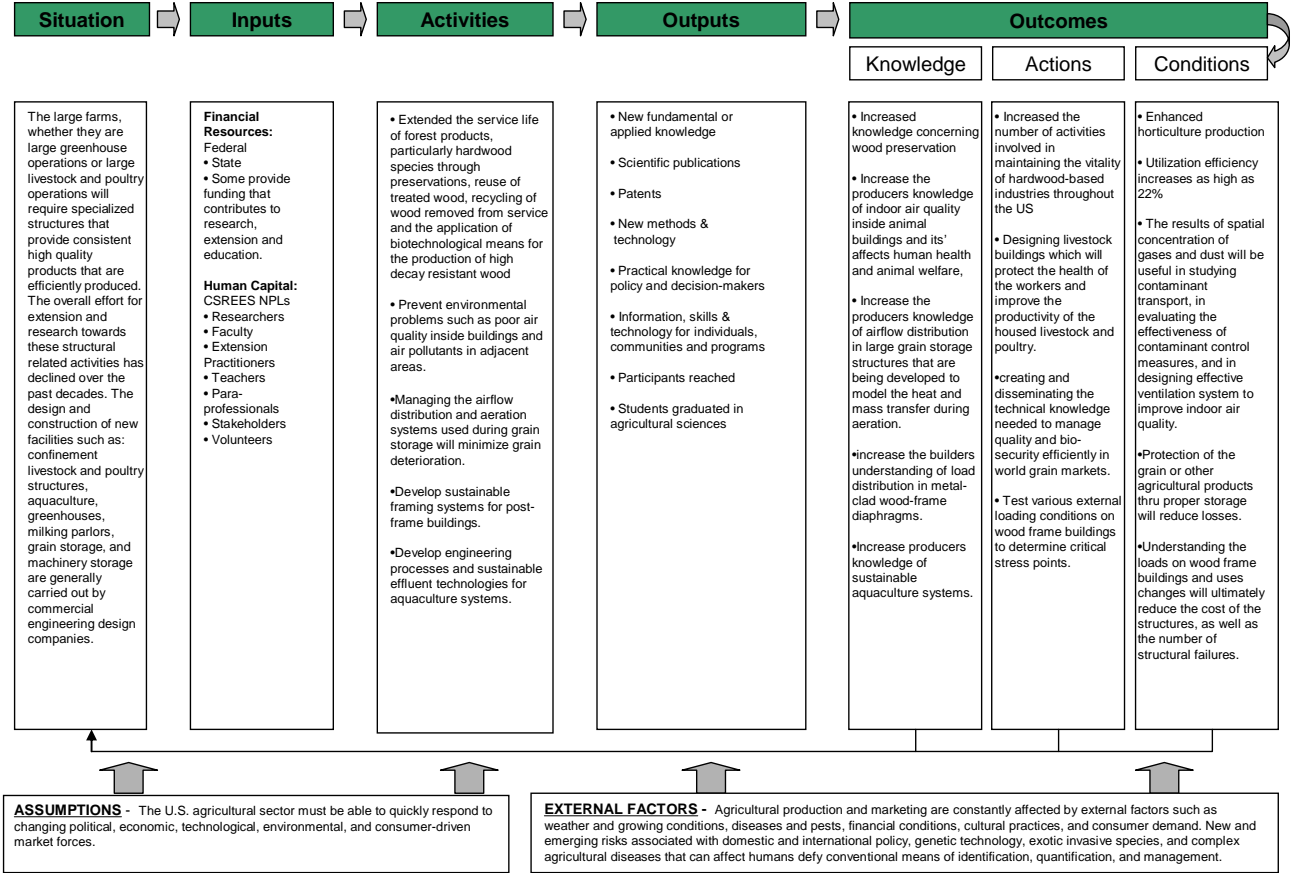
VII. Summary

Support for bioenergy and biobased products has expanded significantly over the past 2 years (FY 2006, FY 2007). The SBIR has included renewable energy as an overarching theme for all topic areas for the past two years, and the number of awards has increased significantly. Other programs in the agency are including bioenergy and biobased products activities in their programs, such as Ag in the Classroom, and higher education competitive grant programs for curriculum development and student support. The Water Quality Program competitive grant program included

bioenergy as a priority topic in 2007. The Sustainable Agricultural Research Education (SARE) program has also added renewable energy as a priority. Project highlights include the commercial use of a genetically modified yeast that has been developed and further optimized through NRI support to metabolize sugars from crop residues. The pilot plant in Shelley, Idaho is expected to be operational in 2-3 years. Researchers with the biomass project that links gasification and fermentation technologies to produce ethanol and chemicals are negotiating with a private partner. Industry testing of aircraft deicers based on glycerol byproduct from biodiesel products are still ongoing.

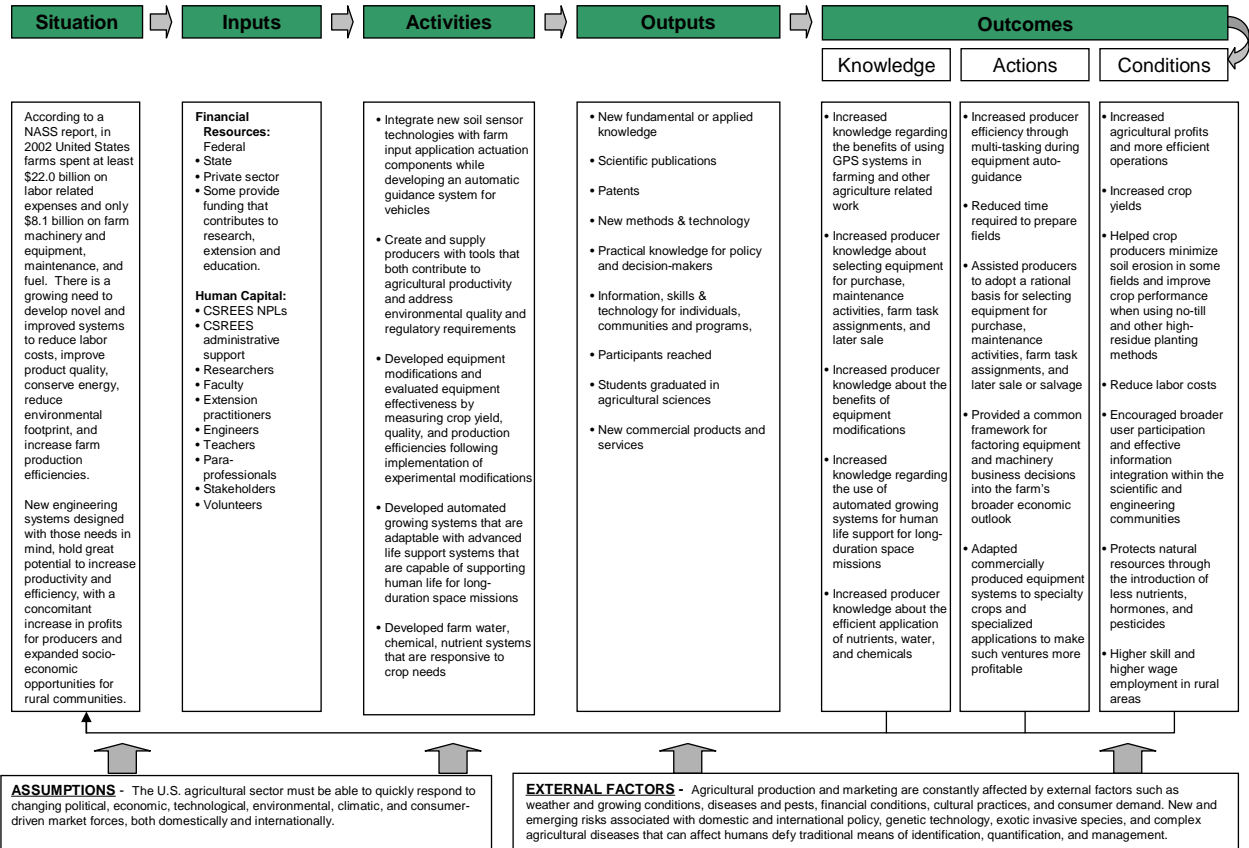
APPENDIX A KA Logic Models

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



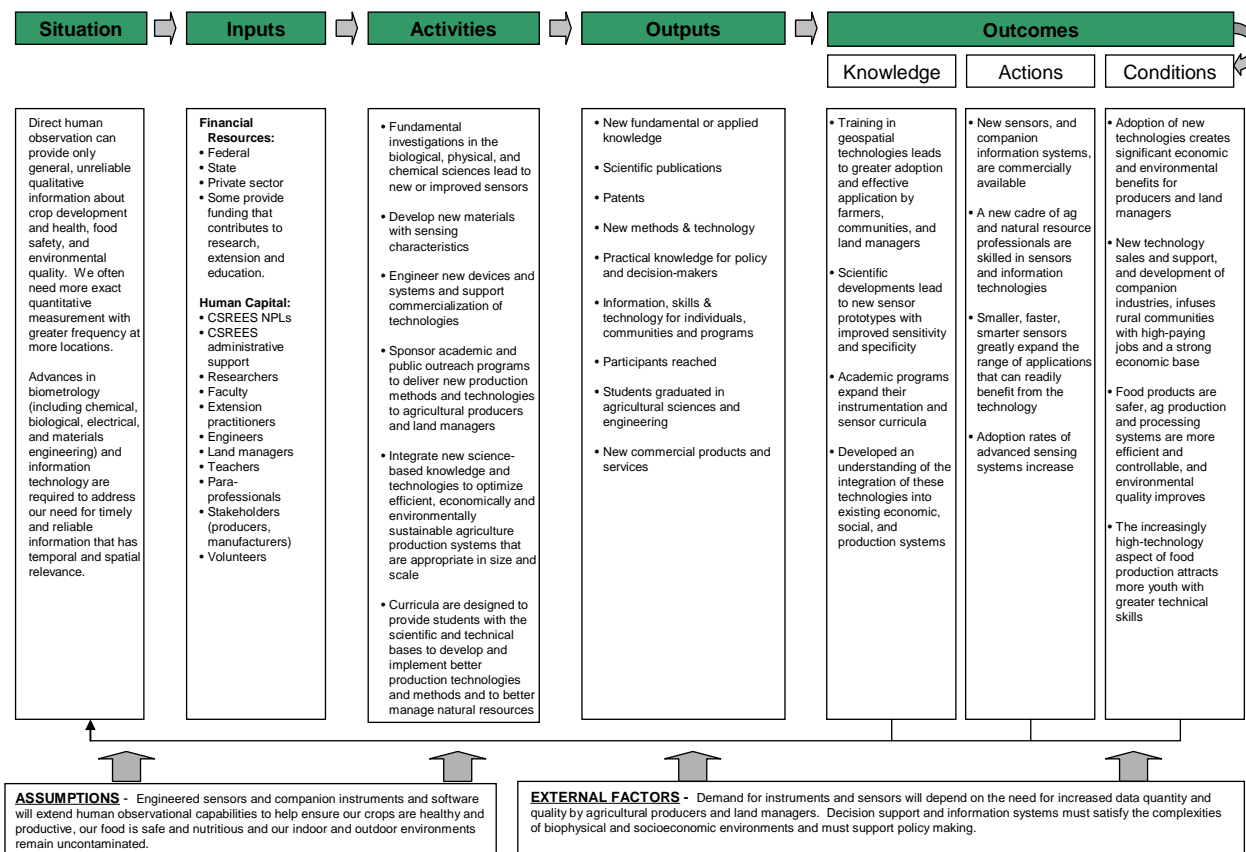
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Knowledge Area 402: Engineering Systems and Equipment



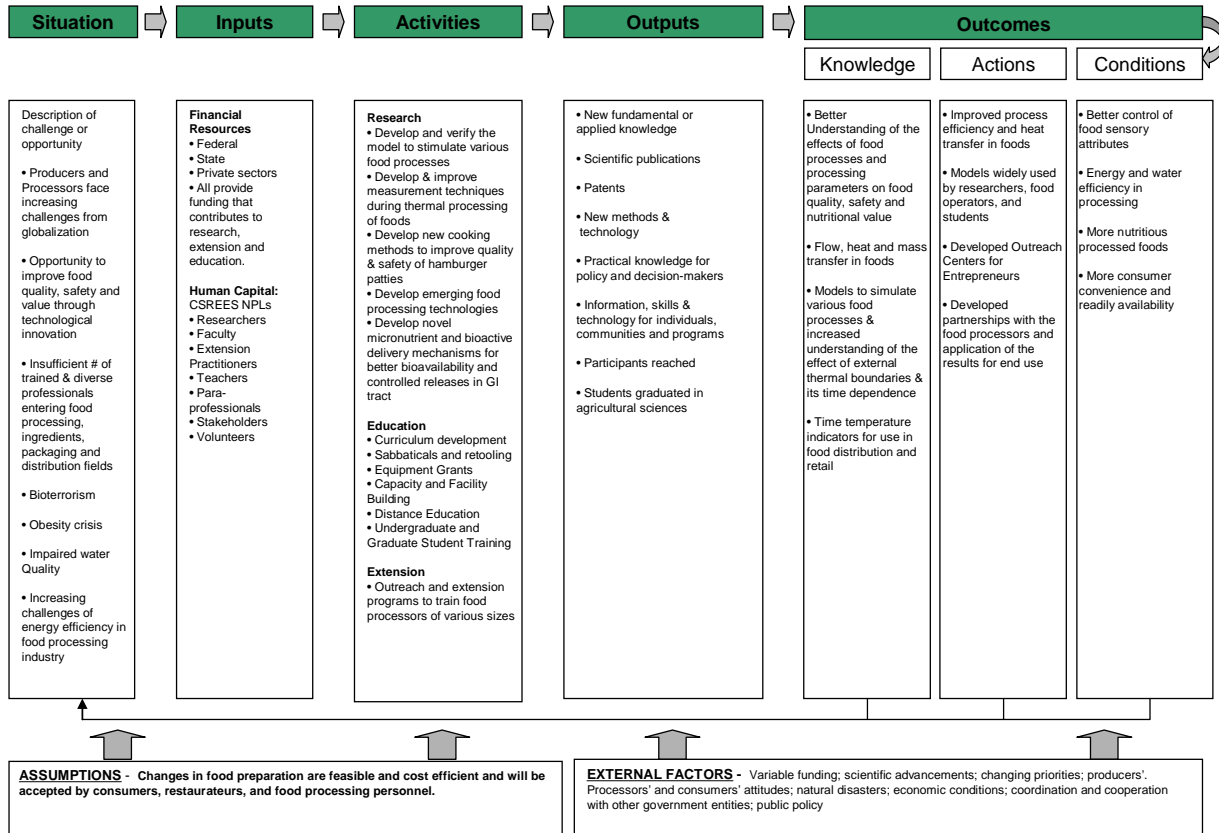
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Knowledge Area 404: Instrumentation and Control Systems



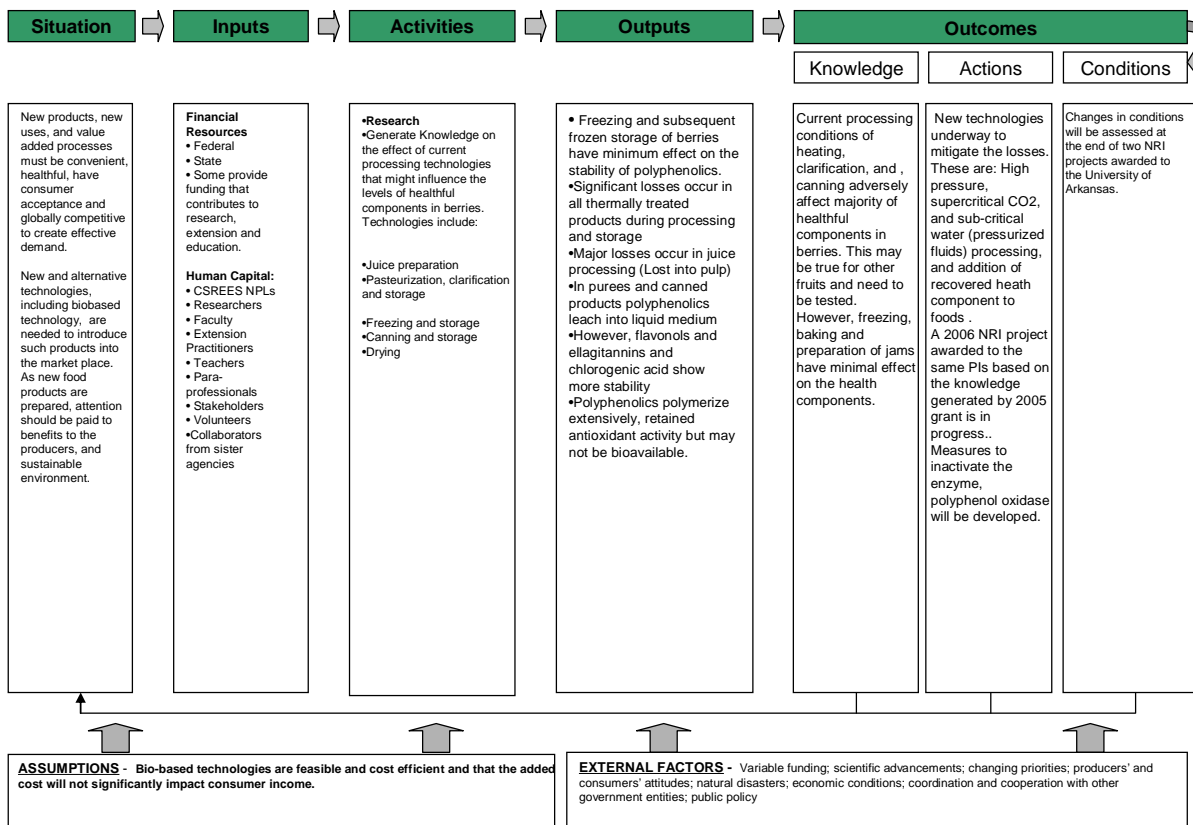
Version 1.3

Knowledge Area 501: New and Improved Food Processing Technologies



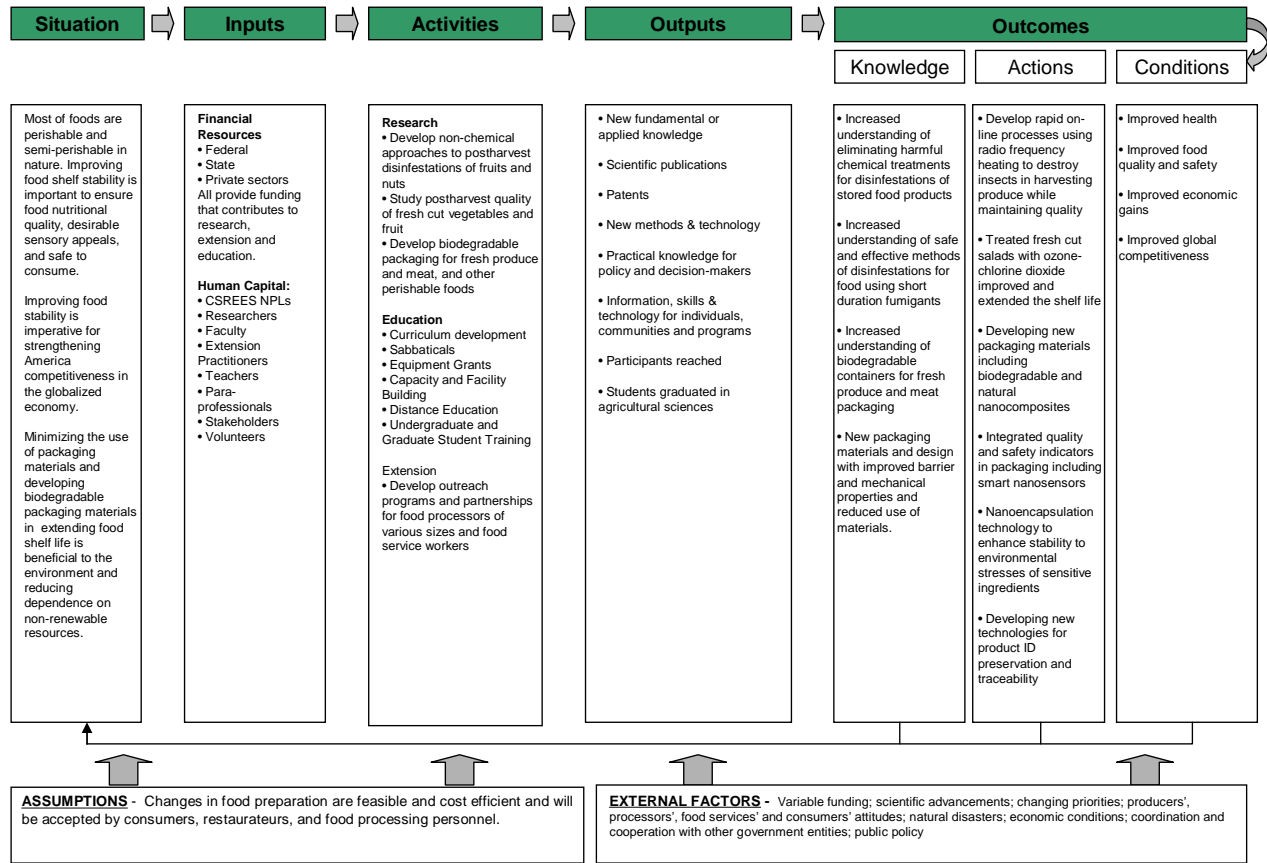
Version 1.2

Knowledge Area 502: New and Improved Food Products



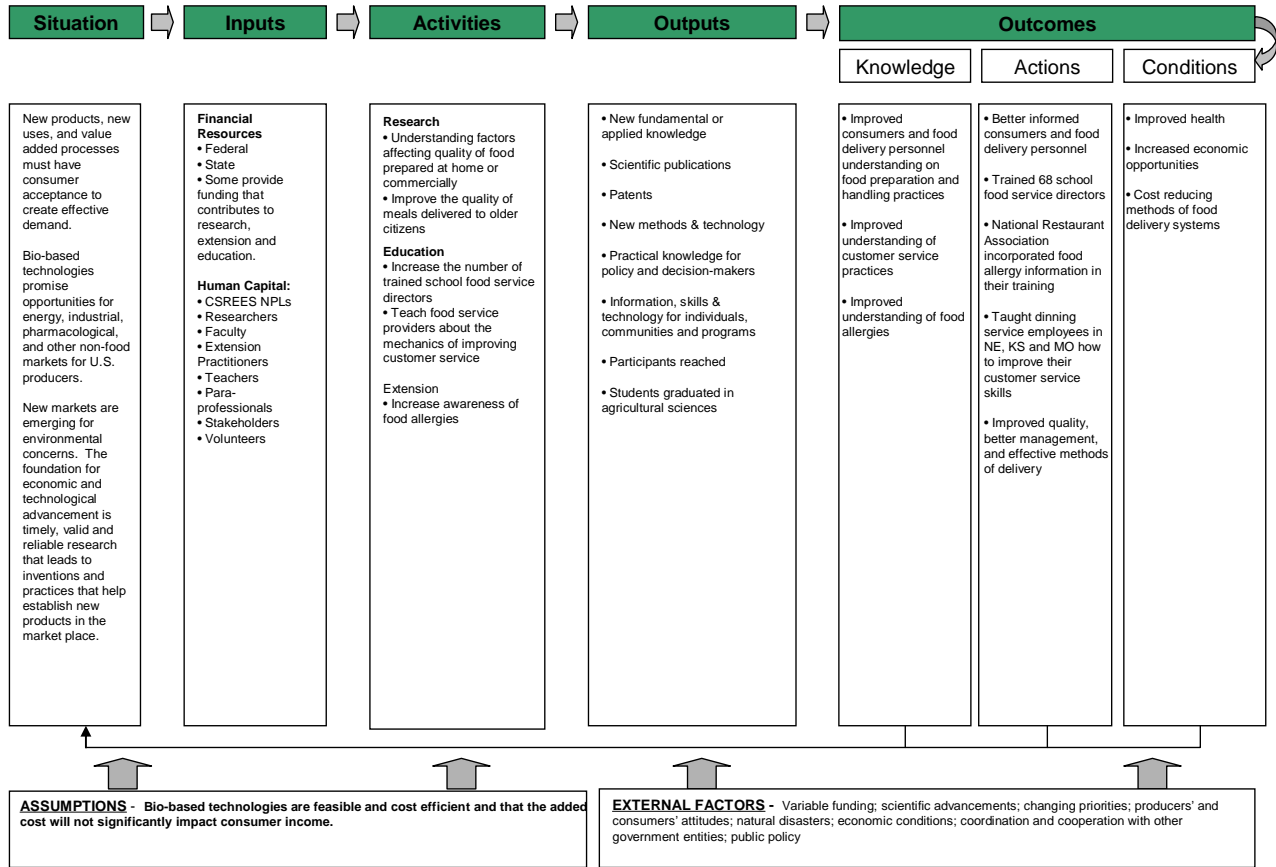
Version 1.2

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



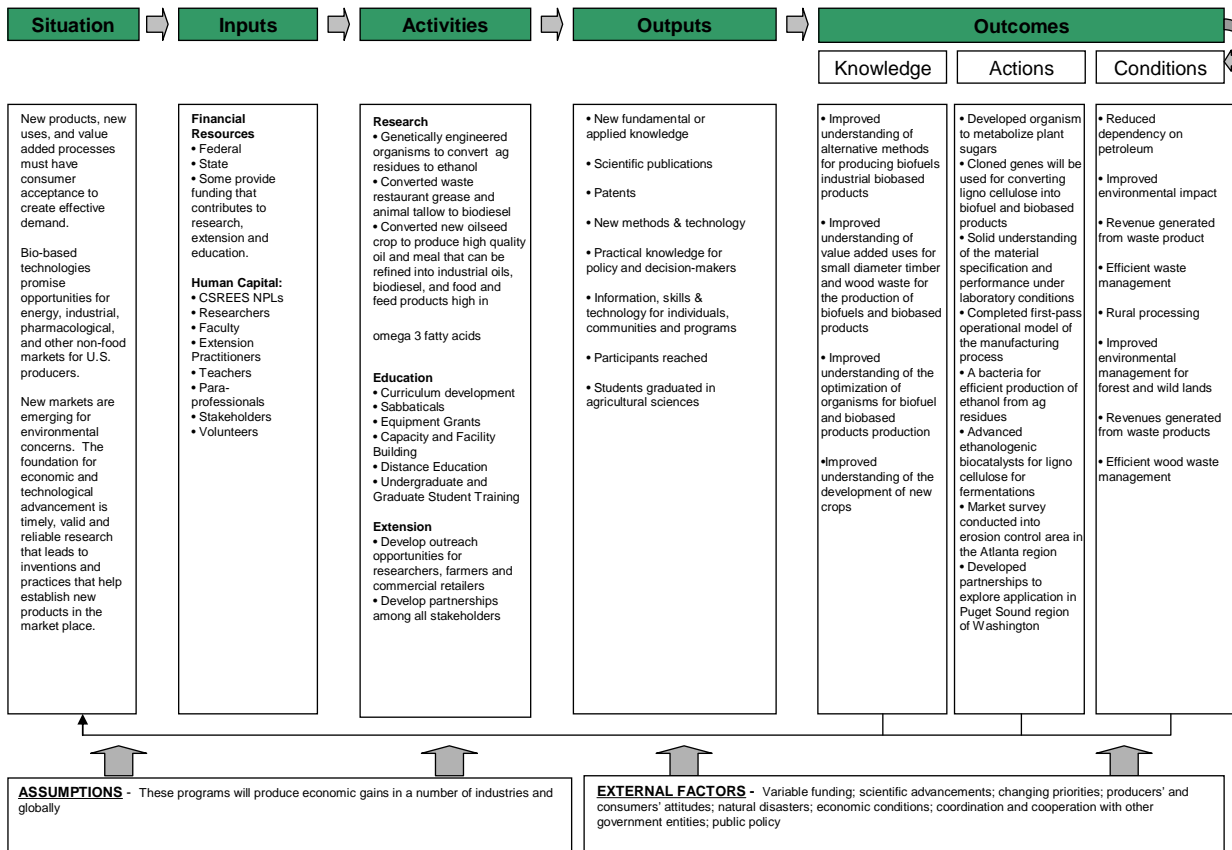
Version 1.2

Knowledge Area 504: Home and Commercial Food Service

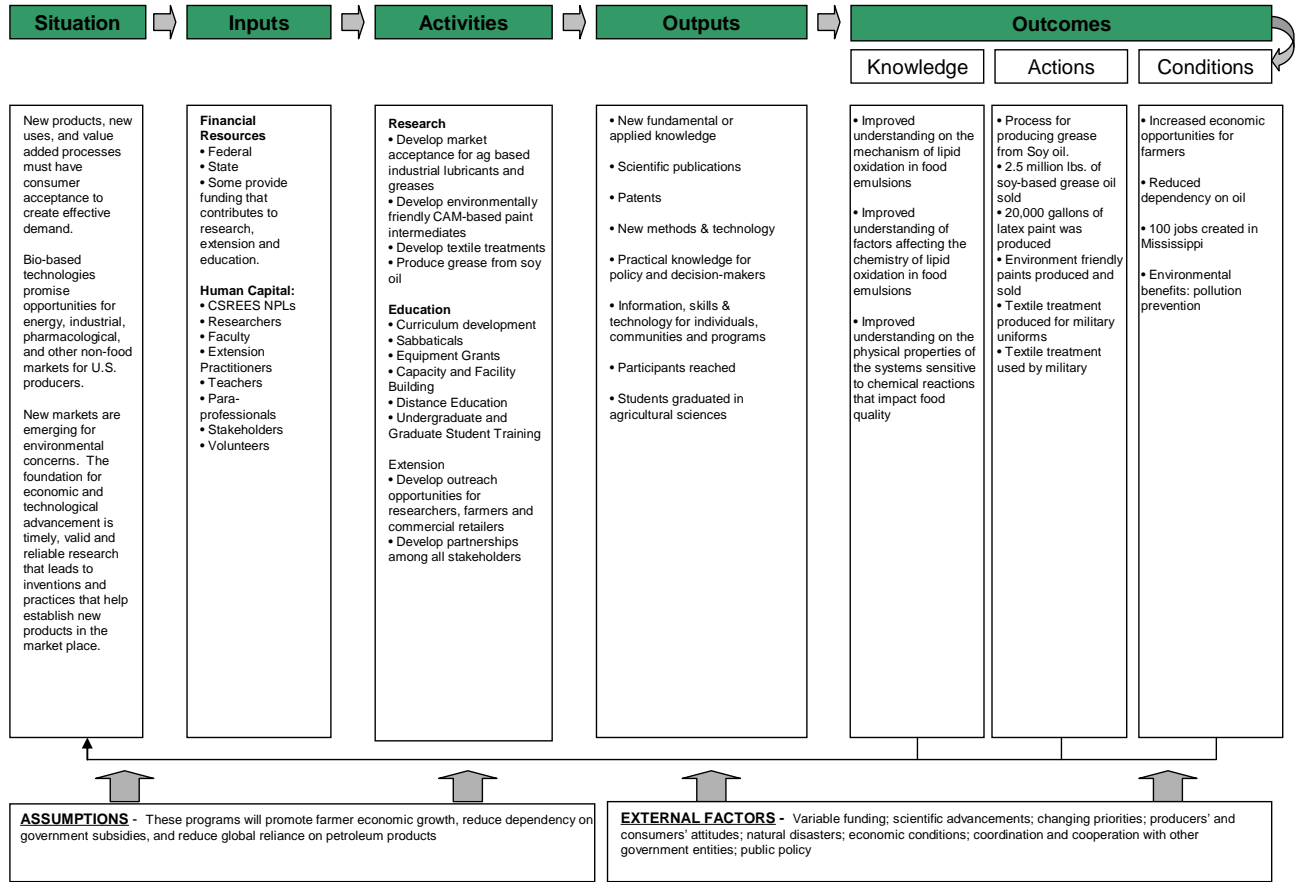


Version 1.2

Knowledge Area 511: New and Improved Non-Food Products and Processes



Knowledge Area 512: Quality Maintenance in Storing and Marketing Non-Food Products

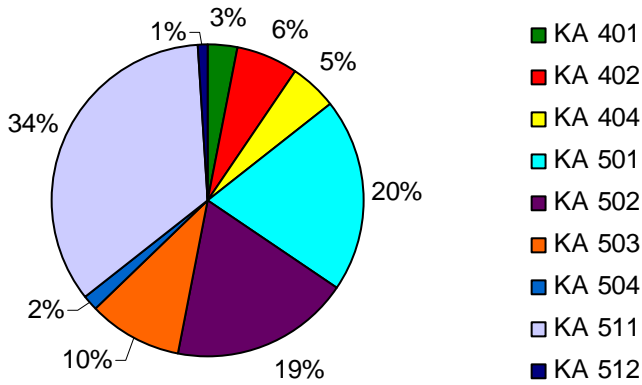


Version 1.2

**APPENDIX B
Funding Pie Charts**

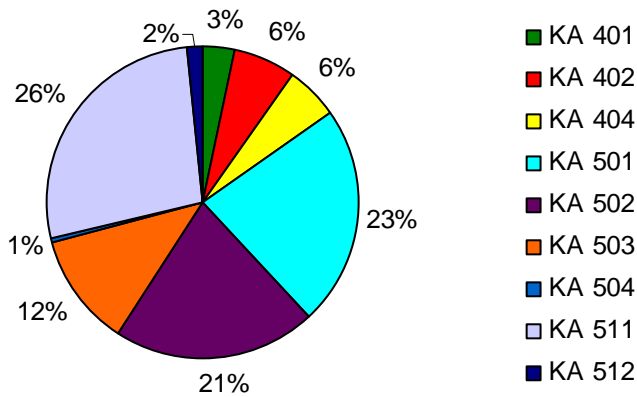
CSREES funding for Knowledge Areas as a percentage of portfolio:

CSREES Funding by KA



Overall funding for Knowledge Areas as a percentage of portfolio:

Overall Funding by KA



Source: 2006 CRIS data

**Appendix C
KA Funding Tables**

KA 401: Structures, Facilities, and General Purpose Farm Supplies CSREES Funding									
(as reported by the Current Research Information System)									
\$ in the thousands									
Year	HATCH	MC-STN	Evans Allen	Animal Health	Special Grants	NRI Grants	SBIR Grants	Other CSREES	Total CSREES
2000	612	49	0	0	883	0	0	75	1,619
2001	546	38	0	0	1,375	0	270	75	2,304
2002	528	119	0	0	820	59	0	90	1,616
2003	425	99	0	0	820	216	38	84	1,682
2004	339	147	0	0	281	21	80	225	1,093
2005	354	169	0	0	359	246	0	49	1,177
KA 401 Total	2,804	621	0	0	4,538	542	388	598	9,491

KA 401: Structures, Facilities, and General Purpose Farm Supplies Overall Funding								
(as reported by the Current Research Information System)								
\$ in the thousands								
Year	CSREES Admin	Other USDA	Other Federal	State Appr.	Self-Gen	Ind/Gr Agrmt	Other Non-Fed	Total
2000	1,619	440	69	2,722	209	213	185	5,457
2001	2,303	396	142	2,932	193	192	215	6,374
2002	1,616	234	239	2,635	237	265	362	5,588
2003	1,681	487	303	2,683	305	217	419	6,094
2004	1,093	192	220	2,401	588	190	251	4,934
2005	1,177	113	347	3,589	790	383	506	6,906
KA 401 Total	9,489	1,862	1,320	16,962	2,322	1,460	1,938	35,353

KA 402: Engineering Systems and Equipment CSREES Funding									
(as reported by the Current Research Information System)									
\$ in the thousands									
Year	HATCH	MC-STN	Evans Allen	Animal Health	Special Grants	NRI Grants	SBIR Grants	Other CSREES	Total CSREES
2000	1,056	119	0	0	868	0	0	613	2,656
2001	783	108	0	0	409	135	381	1,485	3,301
2002	774	40	0	0	777	196	374	448	2,609
2003	1,095	34	0	0	694	388	403	1,110	3,724
2004	990	28	0	0	605	53	987	632	3,295
2005	905	44	53	0	674	493	1,090	523	3,782
KA 402 Total	5,603	373	53	0	4,027	1,265	3,235	4,811	19,367

KA 402: Engineering Systems and Equipment Overall Funding								
(as reported by the Current Research Information System)								
\$ in the thousands								
Year	CSREES Admin	Other USDA	Other Federal	State Appr.	Self-Gen	Ind/Gr Agrmt	Other Non-Fed	Total
2000	2,656	195	270	4,246	360	561	285	8,574
2001	3,301	264	795	5,019	718	565	343	11,005
2002	2,609	392	909	4,454	896	566	377	10,203
2003	3,725	273	611	4,704	660	847	506	11,326
2004	3,296	168	941	5,480	359	717	625	11,587
2005	3,782	320	969	5,967	1,040	1,270	856	14,205
KA 402 Total	19,369	1,612	4,495	29,870	4,033	4,526	2,992	66,900

KA 404: Instrumentation and Control Systems CSREES Funding									
(as reported by the Current Research Information System)									
\$ in the thousands									
Year	HATCH	MC-STN	Evans Allen	Animal Health	Special Grants	NRI Grants	SBIR Grants	Other CSREES	Total CSREES
2000	541	80	79	0	108	100	37	353	1,298
2001	566	71	0	0	699	880	99	705	3,020
2002	746	67	59	0	404	88	385	0	1,749
2003	879	75	53	0	759	289	743	172	2,970
2004	1,034	55	25	0	748	596	130	317	2,905
2005	990	20	124	0	579	782	830	415	3,740
KA 404 Total	4,756	368	340	0	3,297	2,735	2,224	1,962	15,682

KA 404: Engineering Systems and Equipment Overall Funding								
(as reported by the Current Research Information System)								
\$ in the thousands								
Year	CSREES Admin	Other USDA	Other Federal	State Appr.	Self-Gen	Ind/Gr Agrmt	Other Non-Fed	Total
2000	1,299	154	392	2,950	185	737	257	5,974
2001	3,020	211	398	3,529	232	780	323	8,494
2002	1,748	233	852	4,106	282	626	236	8,083
2003	2,969	245	1,162	4,705	553	637	468	10,739
2004	2,905	266	1,100	5,155	422	741	521	11,110
2005	3,740	277	2,569	5,681	646	1,074	1,040	15,027
KA 404 Total	15,681	1,386	6,473	26,126	2,320	4,595	2,845	59,427

KA 501: New and Improved Food Processing Technologies CSREES Funding									
(as reported by the Current Research Information System)									
\$ in the thousands									
Year	HATCH	MC-STN	Evans Allen	Animal Health	Special Grants	NRI Grants	SBIR Grants	Other CSREES	Total CSREES
2000	2,248	0	199	0	1,559	242	299	2,278	6,825
2001	2,339	0	150	0	2,297	2,314	390	2,397	9,887
2002	2,580	0	355	0	2,200	1,772	1,159	2,189	10,255
2003	2,781	0	395	0	2,526	2,932	594	1,249	10,477
2004	3,088	0	515	0	3,458	1,322	1,376	1,143	10,902
2005	3,512	0	704	1	3,391	3,533	511	1,167	12,819
KA 501 Total	16,548	0	2,318	1	15,431	12,115	4,329	10,423	61,165

KA 501: New and Improved Food Processing Technologies Overall Funding								
(as reported by the Current Research Information System)								
\$ in the thousands								
Year	CSREES Admin	Other USDA	Other Federal	State Appr.	Self-Gen	Ind/Gr Agrmt	Other Non-Fed	Total
2000	6,826	819	3,063	15,451	863	3,088	1,945	32,054
2001	9,887	1,277	2,912	16,293	1,171	3,376	1,971	36,886
2002	10,255	1,072	1,587	18,411	1,466	5,176	2,064	40,031
2003	10,478	1,730	2,276	18,143	1,396	5,302	2,593	41,918
2004	10,900	1,892	2,999	17,331	1,204	4,649	2,503	41,478
2005	12,819	787	5,368	19,531	2,687	5,856	3,174	50,222
KA 501 Total	61,165	7,577	18,205	105,160	8,787	27,447	14,250	242,589

KA 502: New and Improved Food Products CSREES Funding									
(as reported by the Current Research Information System)									
\$ in the thousands									
Year	HATCH	MC-STN	Evans Allen	Animal Health	Special Grants	NRI Grants	SBIR Grants	Other CSREES	Total CSREES
2000	2,968	101	424	0	1,543	425	112	1,771	7,344
2001	3,169	8	423	0	2,386	2,059	169	3,190	11,404
2002	3,150	8	536	0	2,160	2,033	211	260	8,358
2003	3,045	1	654	0	3,220	584	453	597	8,554
2004	2,929	0	570	0	2,470	2,732	776	493	9,970
2005	2,435	0	341	0	3,228	3,638	374	1,178	11,194
KA 502 Total	17,696	118	2,948	0	15,007	11,471	2,095	7,489	56,824

KA 502: New and Improved Food Products Overall Funding								
(as reported by the Current Research Information System)								
\$ in the thousands								
Year	CSREES Admin	Other USDA	Other Federal	State Appr.	Self-Gen	Ind/Gr Agrmt	Other Non-Fed	Total
2000	7,343	640	1,641	15,388	1,576	3,914	1,664	32,165
2001	11,404	1,047	1,679	18,275	1,635	3,454	2,541	40,035
2002	8,357	876	1,541	17,810	1,353	3,422	2,553	35,912
2003	8,553	415	1,688	15,859	1,460	3,929	2,781	34,685
2004	9,971	394	2,535	16,820	1,679	3,684	2,953	38,036
2005	11,194	915	1,898	18,138	2,037	5,324	2,612	42,118
KA 502 Total	56,822	4,287	10,982	102,290	9,740	23,727	15,104	222,951

KA 503: Quality Maintenance in Storing and Marketing Food Products CSREES Funding									
(as reported by the Current Research Information System)									
\$ in the thousands									
Year	HATCH	MC-STN	Evans Allen	Animal Health	Special Grants	NRI Grants	SBIR Grants	Other CSREES	Total CSREES
2000	2,020	0	614	0	1,212	85	254	1,238	5,423
2001	1,901	0	558	0	685	782	523	1,097	5,546
2002	1,748	0	520	0	757	263	268	389	3,945
2003	1,758	0	440	0	1,019	591	741	225	4,774
2004	1,148	0	307	0	1,116	608	936	1,142	5,257
2005	1,508	0	318	0	1,139	1,544	587	170	5,266
KA 503 Total	10,083	0	2,757	0	5,928	3,873	3,309	4,261	30,211

KA 503: Quality Maintenance in Storing and Marketing Food Products Overall Funding								
(as reported by the Current Research Information System)								
\$ in the thousands								
Year	CSREES Admin	Other USDA	Other Federal	State Appr.	Self-Gen	Ind/Gr Agrmt	Other Non-Fed	Total
2000	5,423	514	1,062	11,067	660	2,235	1,275	22,234
2001	5,545	522	695	12,093	697	2,322	1,238	23,111
2002	3,944	751	912	9,999	888	1,959	1,215	19,668
2003	4,773	1,119	447	8,664	675	2,791	847	19,316
2004	5,257	996	603	8,397	856	2,126	821	19,056
2005	5,266	895	839	9,770	1,235	2,169	1,001	21,176
KA 503 Total	30,208	4,797	4,558	59,990	5,011	13,602	6,397	124,561

KA 504: Home and Commercial Food Service CSREES Funding									
(as reported by the Current Research Information System)									
\$ in the thousands									
Year	HATCH	MC-STN	Evans Allen	Animal Health	Special Grants	NRI Grants	SBIR Grants	Other CSREES	Total CSREES
2000	52	0	0	0	0	0	0	434	486
2001	26	0	0	0	0	0	0	68	94
2002	24	0	0	0	0	25	0	285	334
2003	26	0	0	0	0	0	0	1,383	1,409
2004	16	0	0	0	0	65	0	435	516
2005	7	0	0	0	0	219	0	1,607	1,833
KA 504 Total	151	0	0	0	0	309	0	4,212	4,672

KA 504: Home and Commercial Food Service Overall Funding								
(as reported by the Current Research Information System)								
\$ in the thousands								
Year	CSREES Admin	Other USDA	Other Federal	State Appr.	Self-Gen	Ind/Gr Agrmt	Other Non-Fed	Total
2000	487	0	66	522	14	84	63	1,236
2001	94	0	81	464	12	69	70	791
2002	334	31	347	238	12	39	0	1,002
2003	1,409	5	89	160	66	35	0	1,766
2004	516	3	147	140	6	107	6	925
2005	1,833	4	68	401	6	111	27	2,450
KA 504 Total	4,673	43	798	1,925	116	445	166	8,170

KA 511: New and Improved Non-Food Products and Processes CSREES Funding									
(as reported by the Current Research Information System)									
\$ in the thousands									
Year	HATCH	MC-STN	Evans Allen	Animal Health	Special Grants	NRI Grants	SBIR Grants	Other CSREES	Total CSREES
2000	1,132	1,402	310	0	2,849	2,198	943	7,136	15,970
2001	1,180	1,289	348	0	3,602	5,609	1,665	8,242	21,935
2002	1,041	1,223	0	0	4,133	1,354	2,198	892	10,841
2003	1,282	1,086	0	2	5,391	6,478	3,502	2,099	19,840
2004	1,255	823	0	1	6,351	3,218	2,106	2,769	16,523
2005	1,377	784	145	5	6,570	7,899	1,471	2,200	20,451
KA 511 Total	7,267	6,607	803	8	28,896	26,756	11,885	23,338	105,560

KA 511: New and Improved Non-Food Products and Processes Overall Funding								
(as reported by the Current Research Information System)								
\$ in the thousands								
Year	CSREES Admin	Other USDA	Other Federal	State Appr.	Self-Gen	Ind/Gr Agrmt	Other Non-Fed	Total
2000	15,969	1,486	3,433	14,507	1,466	4,265	1,903	43,030
2001	21,935	1,494	3,900	16,243	1,631	4,739	2,256	52,198
2002	10,840	2,232	2,942	16,551	1,834	2,857	2,531	39,787
2003	19,840	1,919	2,258	15,410	1,754	2,418	2,041	45,641
2004	16,524	1,423	4,619	14,058	2,811	2,738	1,818	43,992
2005	20,451	2,027	7,250	18,751	2,710	4,259	4,082	59,529
KA 511 Total	105,559	10,581	24,402	95,520	12,206	21,276	14,631	284,177

KA 512: Quality Maintenance in Storing and Marketing Non-Food Products CSREES Funding									
(as reported by the Current Research Information System)									
\$ in the thousands									
Year	HATCH	MC-STN	Evans Allen	Animal Health	Special Grants	NRI Grants	SBIR Grants	Other CSREES	Total CSREES
2000	227	37	0	0	0	0	0	68	332
2001	125	0	0	0	132	0	70	0	327
2002	114	0	0	0	177	1	337	0	629
2003	185	0	0	0	216	247	155	146	949
2004	319	0	0	0	152	0	0	132	603
2005	258	0	0	0	109	2	80	171	621
KA 512 Total	1,228	37	0	0	786	250	642	517	3,461

KA 512: Quality Maintenance in Storing and Marketing Non-Food Products Overall Funding								
(as reported by the Current Research Information System)								
\$ in the thousands								
Year	CSREES Admin	Other USDA	Other Federal	State Appr.	Self-Gen	Ind/Gr Agrmt	Other Non-Fed	Total
2000	332	16	222	1,077	145	286	129	2,206
2001	327	10	309	907	49	159	163	1,924
2002	629	28	243	870	31	136	130	2,067
2003	949	134	731	1,385	35	219	279	3,731
2004	603	158	893	1,175	70	180	351	3,430
2005	621	463	1,011	1,608	266	130	923	5,022
KA 512 Total	3,461	809	3,409	7,022	596	1,110	1,975	18,380