

Agenda

A Compact for the Forest Products Industry

The Forest Products Program is a voluntary collaborative effort between the forest products industry and the U.S. Department of Energy. The purpose of the Compact covering Forest, Wood, Pulp and Paper is to provide the framework for identification of appropriate areas for joint research, development and technology demonstration. The result will be a research partnership between the Department of Energy and industry.

This collaborative agreement will go beyond the provisions of the Energy Policy Act of 1992, concerning a forest research program for the pulp and paper industry. Moreover, it is consistent with the Climate Change Action Plan, and is expected to make a contribution to reducing greenhouse gases.

The outcome from the research partnership will be the demonstration, evaluation and acceleration of new technologies and scientific insights that address several energy-saving national needs:

- ◆ To advance the global competitiveness of the forest products industry by building technological leadership in the face of substantially increased research & development subsidies in major competitor nations in recent decades.
- ◆ To continue improving the sustained management of the forest resource, recognizing its multiple uses and its essential position as an available, sustainable, cost-effective material base to the industry.
- ◆ To be capable of meeting demanding environmental requirements without the associated increases in capital expenditures, operating costs and energy consumption.
- ◆ To continue the significant progress in building energy self-sufficiency and to take full advantage of available by-product biomass as a fuel source.
- ◆ To increase further the economic viability and use of recycled wood and paper materials.

These are the critical long-range needs that must be met in order to take maximum advantage of the unique benefits of wood-based products exemplified by their low embodied energy and renewable as a raw material. These inherent benefits stem from the nature of the forest resource—the multiple uses for the various stand systems including a sustained timber harvest, ground water aquifer, habitat diversity, and ecosystem, and contribution to the atmospheric carbon dioxide balance.

The work that springs from the research partnership will be carried out in a joint federal/industry program designed to develop technologies for the use of industrial residues. It will be guided by collaboration among industry associations, agencies

of the federal government, universities and other major research institutions with expertise in the fields of interest.

The program will be structured into six operating task areas: 1. Sustainable forest management, 2. Environmental performance, 3. Energy performance, 4. Logistical/capital effectiveness, 5. Recycling, and 6. Biomass and control.

Each of these areas is relevant to all industry segments—forestry, wood products and pulp and paper products. The research agenda will also cover a spectrum of technology initiatives, from basic research to development and demonstration projects.

The agenda will address projects that benefit the industry broadly rather than specific product research and development work. Although product development is essential to the long-term success of the industry, it is a primary focus for commercializing among companies and is best left to the individual efforts of company research and development programs. However, studies of the fundamental chemical and physical characteristics of fibers and fiber structures will be addressed.

The Forest Products Program is also intended to re-emphasize and support the activities already underway in collaborative activities involving the government, industry, and academic institutions. Examples include advanced water control and drying systems for paper production; black liquor gasification; fluidized bed combustion of millwaste residue to characterize effective and efficient combustion; development of high performance wood products using low materials; development of composite materials to characterize accurately wood product performance; genetic tree improvement; forest site/soil management; atmospheric watershed studies; and ecological pest management.

The Compact expresses the intentions of the parties to pursue a collaborative relationship. It does not however create legal rights or obligations for either party, and either party may withdraw without penalty and without being subject to remedies at law or equity.

This compact shall become effective upon execution by representatives of the United States Department of Energy and of the American Forest & Paper Association for the industry. It shall remain in effect for two years, but it is to be extended by mutual agreement of the parties.

Signed on the 22nd of November, 1999


Hazel O'Leary, Secretary
Assistant, United States Department of Energy


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For the improved competitive marketplace

Agenda

A Compact for the Forest Products Industry

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The Path Forward An Implementation Plan

BACKGROUND

The Energy Policy Act of 1992 provided the Department of Energy with a mandate to work with the largest energy users in the industrial sector to create a “meaningful, five-year research program” for the purpose of encouraging those industries to adopt more energy-efficient practices and technologies, thereby reducing the Nation’s utilization of fossil energy and its emissions of greenhouse gases. This action occurred at a time when the U.S. forest and paper industry was facing one of the largest challenges to its global competitiveness ever encountered. Catalyzed by this DOE initiative, six vision industries (Glass, Metalcasting, Chemicals, Steel, Forest Products, and Aluminum) have now produced technology visions and research agendas for the future. The American Forest & Paper Association was the first to achieve this vision. Published in November of 1994, Agenda 2020 has become the basis for creating a path forward that goes well beyond the intent of the 1992 policy act.

On November 22, 1994, a Compact was signed calling for the development of a partnership between the Forest Products Industry and the Department of Energy. The basis for the partnership was to be the Agenda 2020 publication. In the Compact, five needs/drivers were identified that summarized the importance of the vision that Agenda 2020 represents to the industry. These drivers are:

- To advance the global competitiveness of the forest products industry by building technological leadership in the face of substantially increased research subsidies in major competitor nations in recent decades;
- To continue improving the sustained management of the forest resource recognizing its multiple uses and essential position as an available, stable, low-cost raw material basic to the industry;
- To be capable of meeting demanding environmental requirements without the predicted increases in capital expenditures, operating costs and energy consumption;
- To continue the significant progress in building energy self-sufficiency and to take full advantage of available by-product biomass as a fuel source; and
- To increase further the economic viability and use of recycled wood and paper materials.

This is the foundation on which the implementation of Agenda 2020 is based.

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EXECUTIVE SUMMARY

Agenda 2020 now has broad acceptance and significant influence—both directly in the forest and paper industry and with the wider community who work with and support the industry. It defines significant industry priorities and it raises expectations. It is seen as current, relevant and important. It galvanizes support for the industry and brings together key industry, university and government resources to pursue common goals. The Chief Technology Officers Working Group, which has maintained oversight of the implementation process, has nurtured a successful structure for working together on planning collaborative research. A “pathways model” originally developed and used by the Environmental Performance Task Group for Cluster Rule discussions with the EPA has been productively applied in all six focus areas of Agenda 2020. In addition to Environment, the other areas are Sustainable Forestry, Energy Performance, Capital Effectiveness, Recycling, and Sensors & Controls. Based on these pathways, each task group has identified over-arching needs and initial focus areas and—through the process of project evaluation and prioritization—at this writing has had a three-year history of recommending funding for those projects that both meet the needs of the industry and have a sound technical basis for success.

By involving people from government organizations, industry professional organizations, academia, suppliers to the industry and the industry’s technical leaders, the process has taken advantage of the diversity of those communities to concentrate on compelling, broadly applicable, pre-competitive research areas. The concepts underlying the implementation of Agenda 2020—provided by the CEO Executive Committee Working Group—are:

- The process is unequivocally led by industry with out-reach to experts to provide facts and data for decision making.
- American Forest & Paper Association’s role is establishing priorities and oversight. Research management is left to the experts.
- AF&PA oversight starts from the issues defined in Agenda 2020 which are of broad interest to the industry; then it provides guidance to future research direction, the measurement of success and the dissemination of results to its members.
- Bureaucracy is minimized by capitalizing on available committees and processes for communication of issues and progress throughout the industry.

Agenda 2020

- Funding is addressed by first improving the effectiveness of what is already being spent on industry's behalf through identification of areas of major need and cooperative effort between universities, government labs and corporate research efforts. Next, a share of the government dollars allocated to industrial research is sought. Where additional funds are justified, these projects will be dealt with on a case-by-case basis.
- Optimization of the process is achieved by taking advantage of experience gained through initiatives such as the presentation of industry research plans to the Environmental Protection Agency in connection with the Cluster Rules and benchmarking results against the independent efforts of activities such as TAPPI's Research Needs Conferences.

These concepts have been followed as closely as possible in building the currently funded program, in developing pathways for each of the six focus areas, in developing more detailed principles of execution to be used by individual committees and researchers and in developing the Agenda 2020 implementation plan, which is the subject of this publication.

The realization of the objectives of the six task forces should:

- provide a common vision for communication with and education of stakeholders and publics;
- enhance the industry's ability to conduct research and implement new technology more cost effectively;
- provide leverage to each company's internal development efforts; and
- improve individual companies' global competitiveness through easy and early access to new technology.

AGENDA 2020 — THE PATH FORWARD

An Implementation Plan

MISSION

The principle mission of Agenda 2020 is to maximize the efficiency and effectiveness by which the industry executes pre-competitive collaborative research and to ensure that programs that are undertaken are properly focused on the issues which address the industry's most pressing technology needs.

The basis for research planning is Agenda 2020, which defines the major gaps of broad interest and points out where new technology applications are required. The primary function is the recommendation of suitable research projects that will help to fill the technology gaps, as well as facilitating activities that will lead to commercial deployment of significant new process technologies and services. Based on this mission, the industry encourages the following:

- Support for the educational role of the universities and their continued supply of high-quality candidates for employment in the forest products industry over the long term.
- Broadening the base of researchers actively interested in the industry's issues and encouraging them to bring their talents to bear on them.
- Active solicitation of the chemical and equipment suppliers to the industry in the research process-particularly in their participation in the commercialization of the emerging technologies from this program.
- Contributing to technical and cost-effective environmental solutions.
- Continuing to improve and enhance the unique sustainability characteristics of the forest and paper industry.

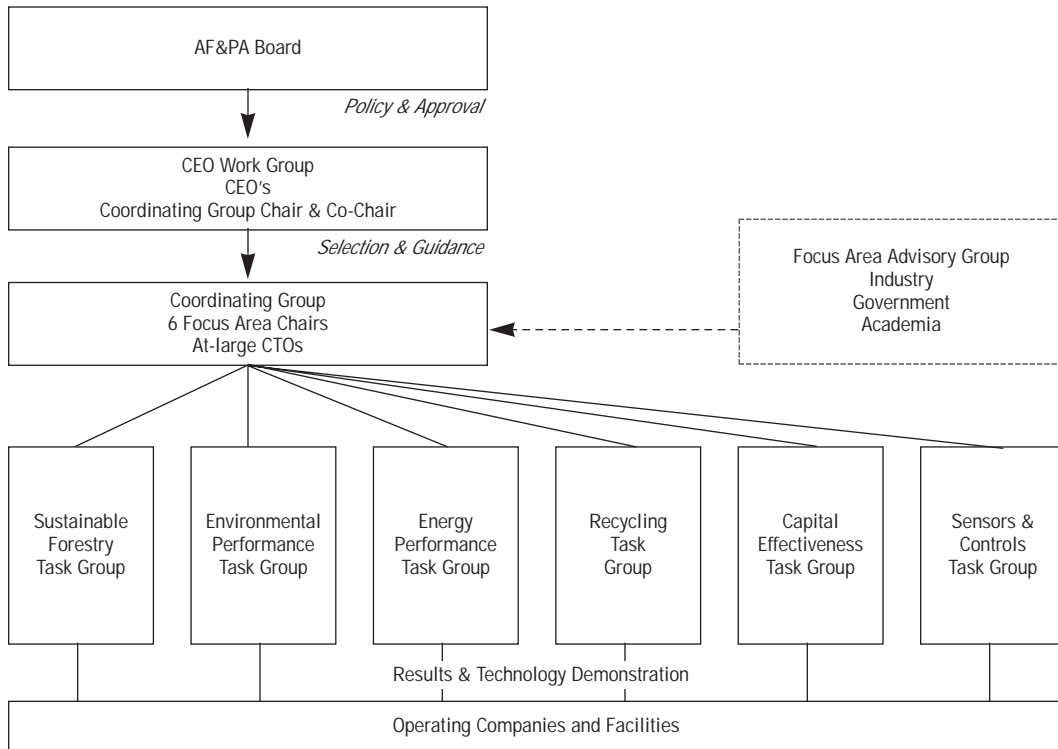
STRUCTURE

Agenda 2020 is structured so that both the policies under which it operates as well as the perspective for its direction are provided by the CEOs of the industry through the American Forest & Paper Association's Board of Directors. The selection and guidance of specific programs is provided by the Chief Technology Officers of the industry through the CTO Working Group, which is made up of the Co-chairs of each of the six operating task groups and other technology leaders. Figure 1 provides a graphical representation of the organizational structure.

The program execution is carried out within each of the six area task groups, whose roles are to:

- define essential technology needs for the long-term future of the industry
- develop pathways and execution strategies
- select technology areas amenable to pre-competitive, collaborative work
- seek out/encourage appropriate research organizations/consortia to address the needs
- document measurable criteria to determine success
- provide leadership and oversight to research program execution.

Figure 1



In carrying out these roles industry committees, institutions and existing professional societies are utilized to the maximum extent possible in keeping with the principles of minimizing-and where possible, reducing-bureaucracy.

Figure 2 exemplifies the various entities that each task group involves in carrying out its roles and responsibilities.

Figure 2



AF&PA Issues & Product Groups

To the greatest extent possible, existing AF&PA committees were utilized as the forum for discussion. This was done to ensure that any activities and directions undertaken by Agenda 2020 were fully consistent with the policies adopted by the Issues & Product groups. These include: the Forest Resources Research Committee (Sustainable Forestry); the Environmental Policy and Oversight Committees (Environmental Performance); the Energy Policy Committee of the Energy Council (Energy Performance); Advanced Sensors Working Group (Sensors & Controls); and the Paper Recycling Group (Recycling). Only in the case of Capital Effectiveness was there a need to evolve an additional structure. The membership of each task group is available through AF&PA's Agenda 2020 web page at www.agenda2020.org.

Host Facilities

It is envisioned that as research and development is completed within the Agenda 2020 program, technology demonstrations will be required as a step to commercial success. Those facilities within the industry that act as host for these demonstrations will become a valuable and integral element of commercial success.

Academic Institutions

A large share of ideas, innovations, proof of concept and teaching will come from the nation's university system. These institutions are sought out by task groups so that the best minds can be brought to bear on the highest priority issues. As a significant step in engaging key institutions in this process, the Pulp & Paper Education Research Alliance (PPERA) has been formed and provides effective links to the Agenda 2020 process.

The member institutions of PPERA are Auburn University, Georgia Institute of Technology, The Institute of Paper Science and Technology, Miami University of Ohio, North Carolina State University, the State University of New York at Syracuse, University of Maine, University of Minnesota, University of Washington, University of Wisconsin at Stevens Point and Western Michigan University. Each of these universities conducts education and research programs focused on the needs of the U.S. pulp and paper industry and is supported by a partnership with the industry through a corporate membership-based organization. Collectively, these institutions provide a major supply of BS, MS and Ph.D. scientists and engineers specifically educated for careers in the pulp, paper and allied industries. With industry advice and support, faculty at these institutions have a well established track record of providing research results for the industry's benefit. PPERA also affords Agenda 2020 an excellent basis to access the vast intellectual resources of the entire US academic community.

Industry Groups

The documentation of Agenda 2020 published in November, 1994, was supported by the National Council for Air & Stream Improvement (NCASI), Recycled Paperboard Technical Association (RPTA), Forest Products Society (FPS), Paper Industry Management Association (PIMA) and the Technical Association of the Pulp & Paper Industry (TAPPI). The relationships with these and other groups, such as the Adhesives Association, has matured since that time. TAPPI has played a large role in aligning its Research Needs Workshop activities with the Agenda 2020 vision. The TAPPI Journal and PIMA's Papermaker Magazine continue to act as major communication conduits. NCASI is playing a significant role in the oversight, guidance and management of the Environmental Performance and Sustainable Forestry programs. The Improved Capital Effectiveness task group has made an outreach to the American Paper Machinery Association and the Construction Industry Institute (CII).

National Laboratories

The National Laboratories represent an enormous resource, both in the form of intellectual assets and unique laboratory equipment and skills, and can reapply their experience working on other difficult technical questions outside the normal world of the forest products industry. Working with the DOE's Office of Industrial Technology and the National Laboratories Coordinating Council, the Agenda 2020 program has-for the first time-been able to focus this enormous resource on priority areas of importance to the industry. Like many other parts of Agenda 2020, this is an on-going activity where the participants are committed to becoming more efficient in the years ahead. Most recently, the National Laboratories Coordinating Council has designated a point person to become involved in all aspects of the collaboration between the industry and the National Laboratories. This individual will be available for all the research area operating task groups during their deliberations and, in this way, will be able to develop a unique perspective on how the process can keep improving.

Federal Government

The Federal government plays a very special role in the implementation of Agenda 2020. It was the stimulus of DOE's Office of Industrial Technology and the Secretary of Energy that catalyzed the birth and development of Agenda 2020. The long-standing support of the Forest Service, particularly from the Forest Products Laboratory in Madison Wisconsin, offers another unique opportunity in improving the efficiency and effectiveness of how public monies are used to support forestry and wood products activities. Priorities evolving through the President's Committee on Science & Technology-particularly as they relate to the global warming issue-may also hold promise in redirecting federal funding mechanisms toward areas of high priority.

Industry Suppliers

The industry's reliance on its suppliers has increased during the last decade-a trend that is likely to continue. Many, if not most, of the innovations developed through Agenda 2020 can become a reality for the industry only if the industry suppliers are intimately involved in the planning, execution and ultimately the commercialization of process technologies and services. An outreach to suppliers has been and is continuing to be made.

Company Members

Each research area operating task group has about twelve members from among the membership of the American Forest & Paper Association. These individuals have been delegated the responsibility from the Chief Technology Officers' Working Group for recommending the research area priority program. They make the assessments of proposals that have been submitted and agree on the final recommendation. The Chair(s) for the research area operating task groups are selected from among the company members.

PRINCIPLES OF EXECUTION

The following principles guide the task groups in carrying out their roles and responsibilities:

- The “Agenda 2020” vision is a partnership between the forest, wood and paper industry, government and academia and as such should strive to serve the legitimate needs of all parties.
- The partnership is meant to serve national needs and industry priorities. Industry plays a proactive role in defining goals, identifying research needs, and making specific recommendations on projects.
- The right program for the industry is developed and funding is sought, rather than fitting the program to the funds available. This assures that the high priority issues are addressed.
- Suppliers are engaged and encouraged to take on device- and equipment-oriented projects in a competitive mode as early as practical.
- Research, development & demonstration activities sponsored under “Agenda 2020” are pre-competitive to the producing industry where pre-competitive activities are considered as high risk; could include understanding a phenomenon; exploring a concept; and demonstration of commercial viability. Activities would not include dealing with product or process technologies that would likely provide competitive advantage or with taking a wood, paper or pulp product to market.
- In the spirit of partnership, the industry must support a recommended project with appropriate levels of direct or in-kind funds.
- Sunk costs in the form of past research expenses should normally not be considered as in-kind contribution but should be considered to justify path-forward matching funds.
- Decisions will be made with the greatest possible fairness to all parties with respect to resources provided as matching funds, in-kind contributions, and use of existing assets (land, forests, laboratories & manufacturing facilities). Land & timber as well as physical plant are valid capital assets in “Agenda 2020” program considerations.
- The outcome of the “Agenda 2020” partnership is anticipated to be an accelerated demonstration, evaluation and implementation of new technologies and scientific insights that will address several industry and national needs, including:
 - To advance the global competitiveness of the forest products industry by building technological leadership.
 - To continue improving the sustained management of the forest resource, recognizing its multiple uses and its essential position as an available, stable, low-cost raw material base to the industry.
 - To be capable of meeting demanding environmental requirements with minimal increases in capital expenditures, operating costs and energy consumption.
 - To continue the significant progress in energy efficiency, improving the economics of energy self-sufficiency and to take full advantage of biomass as a fuel source.
 - To increase the economic viability and use of recycled wood and paper materials.

THE PATH FORWARD

Beginning with a technology vision and research agenda in late 1994, considerable progress has been made to define the relationship and roles of the various entities that are necessary for the success of Agenda 2020, particularly in the areas of defining research targets and selecting projects. Still ahead lies the development of proven processes and procedures for demonstration and delivery of the technologies and services that will emerge from this undertaking. The remaining sections of this document discuss in detail the pathways, priorities and the path forward for each of the six task group areas of Agenda 2020.

Pathways

A major initial effort of each focus task group was to develop a detailed vision of the future in their specific area, to identify the technology gaps that would have to be filled to achieve that vision and to evolve a prioritized high-impact program that would fill the gaps. To do this, they began with the November 1994 Agenda 2020 document as it was approved by the AF&PA Board. They next determined what areas of continuing research were going on in addressing a particular focus area; and then identified what future research would be necessary-along with the knowledge and tools to be developed and assimilated-in order to realize the desired result.

Each task group was encouraged to keep clearly in mind that all areas should have high impact and a high probability that success will advance the industry's global competitiveness. The essence of Agenda 2020 emphasizes pre-competitive research that is being conducted in a collaborative way between companies and related institutions. The task groups were further challenged to maintain a balance between what is needed to achieve the ultimate objective and producing early results in order that the benefit and the momentum of the program could be identified and maintained.

Since the vision of Agenda 2020 is a long-range vision, there needs to be a consistent and continuous set of reasons why companies that make up the forest, wood and paper industry will continue to believe in the journey and to support it. The first basis is having a sound working process to develop an agreed priority research program. The second basis is being built on the links to the suppliers and a proven demonstration process. Importantly, as the process continues, it needs to be able to point to early successes. These elements together are necessary for continued broad-based support, growth and funding.

With these principles and objectives in mind, pathways were developed in each of the six focus areas. Since the specific directions and elements of these pathways must change as new things are learned and the world around us also changes, the pathways themselves will need to be revisited on a 3-5 year cycle.

Sustainable Forestry Task Group

Sustainable Forest Management is one of the key research areas identified in Agenda 2020. As its fundamental raw material, wood fiber is a common denominator to all facets of a diverse forest products industry. Maintaining an adequate, reliable, and cost-effective fiber supply is of vital strategic significance. This is a key element in maintaining the global competitiveness of the industry. Ever increasing regulatory and other restrictions have a cumulative impact in restricting fiber supply.

Agenda 2020 sustainable forestry research focuses on improving forest productivity. Four key research pathways have been identified:

- Biotechnology
- Basic Physiology
- Soil Productivity
- Remote Sensing.

These pathways focus research efforts on areas that are realistic for the industry to address. Sustainable forestry task group participants advocate a “bottom-up” approach to advancing this research agenda. Direct, ongoing communication of industry needs with individual agency, university, and national laboratory researchers will result in more viable research projects. Revitalizing regional industry forest research committees is the key to a more collaborative, local effort.

Examples of research priorities and current projects:

- Marker-aided gene selection
- Identifying and cataloguing useful genes
- Uptake and utilization of nutrients
- Carbon gain and allocation
- Determining physiological mechanisms of tree response to forestry practices
- Soil limitations to forest productivity and increased growth rates
- Improved and more efficient inventory techniques.

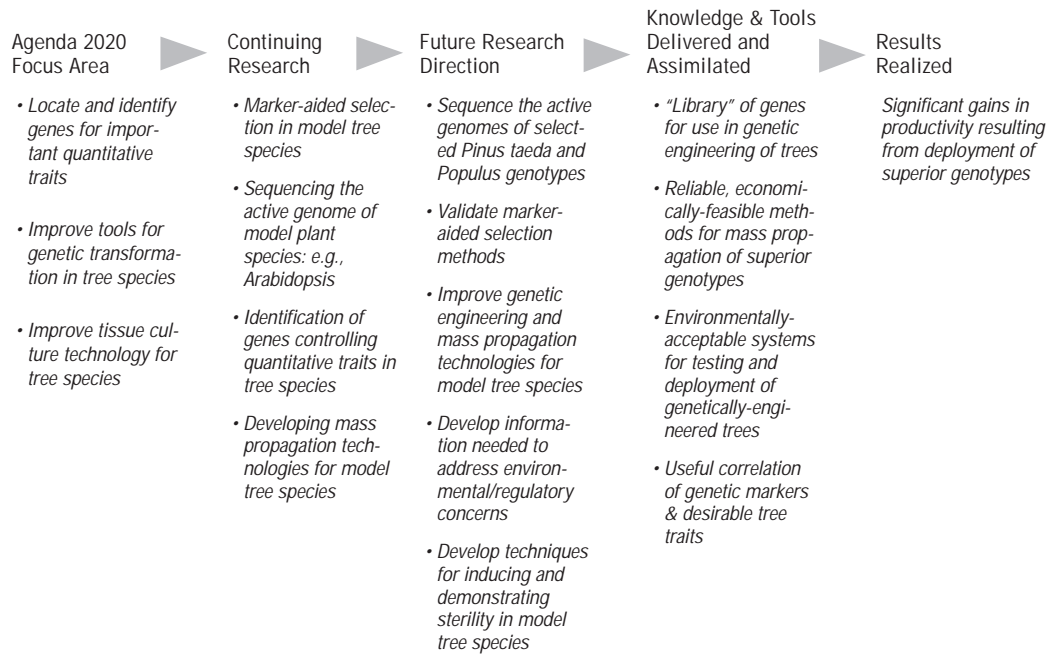
Positive New Developments

Significant recent developments have helped the SF2020 Program gain momentum.

- USFS Partnership: The FS&TC successfully expanded the SF2020 partnership to include the USFS. Strong support from the USFS on both the national and regional levels has already produced funding for four projects.
- Plant/Crop 2020: The DOE is currently developing a Plant/Crop Agenda 2020 program with the forestry and agricultural communities. This represents a potential source of new funding for research efforts under the Biotechnology Pathway and will be administered separately from the current program. AF&PA is participating in initial planning as a member of the Executive Steering Committee.
- NAPFSC Summit: It is hoped that this event will attract additional support for forestry research efforts.

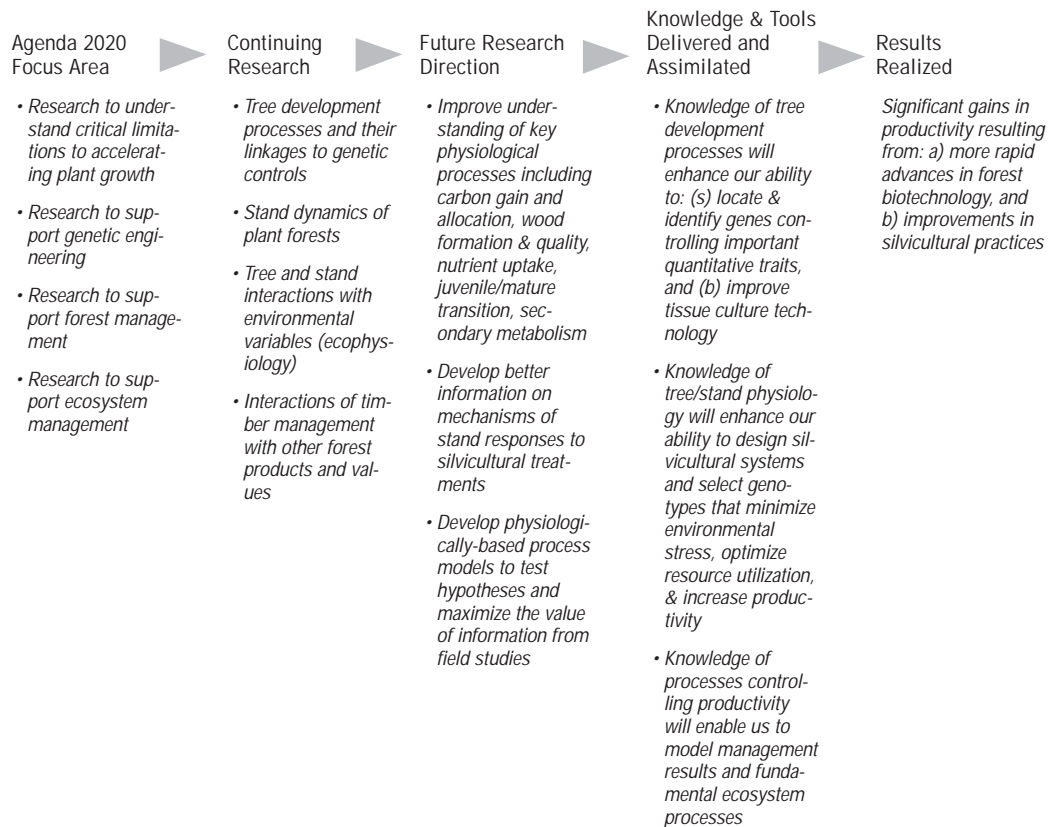
Pathway for Addressing Industry Information Needs Related to Sustainable Forestry —

Biotechnology

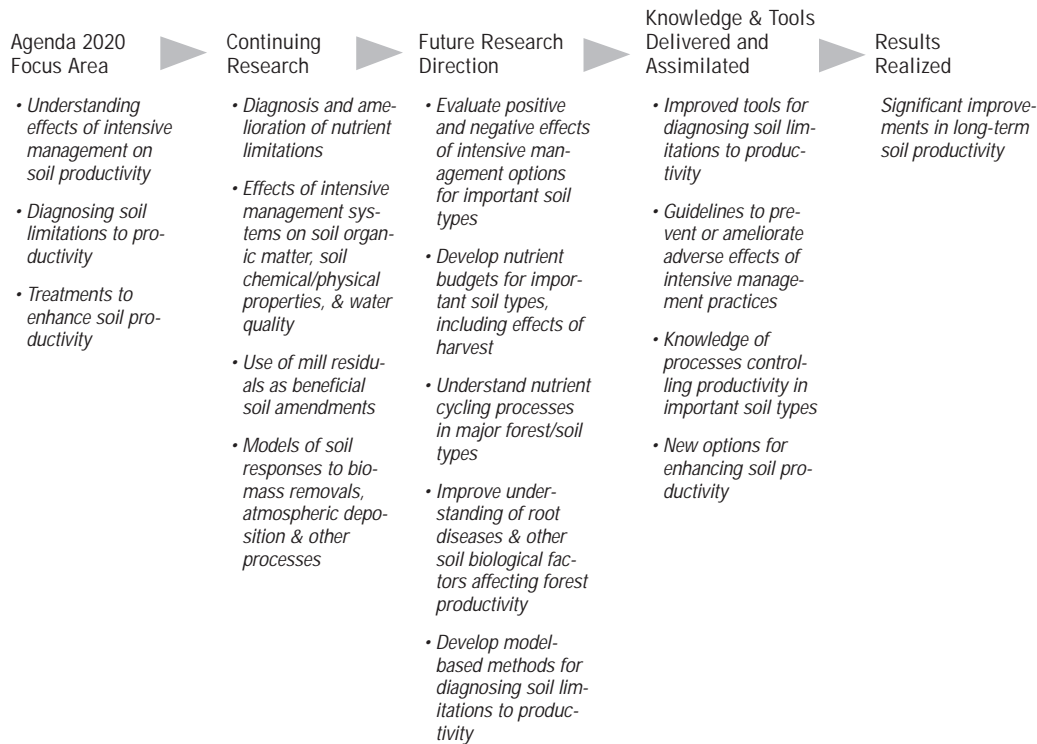


Pathway for Addressing Industry Information Needs Related to Sustainable Forestry —

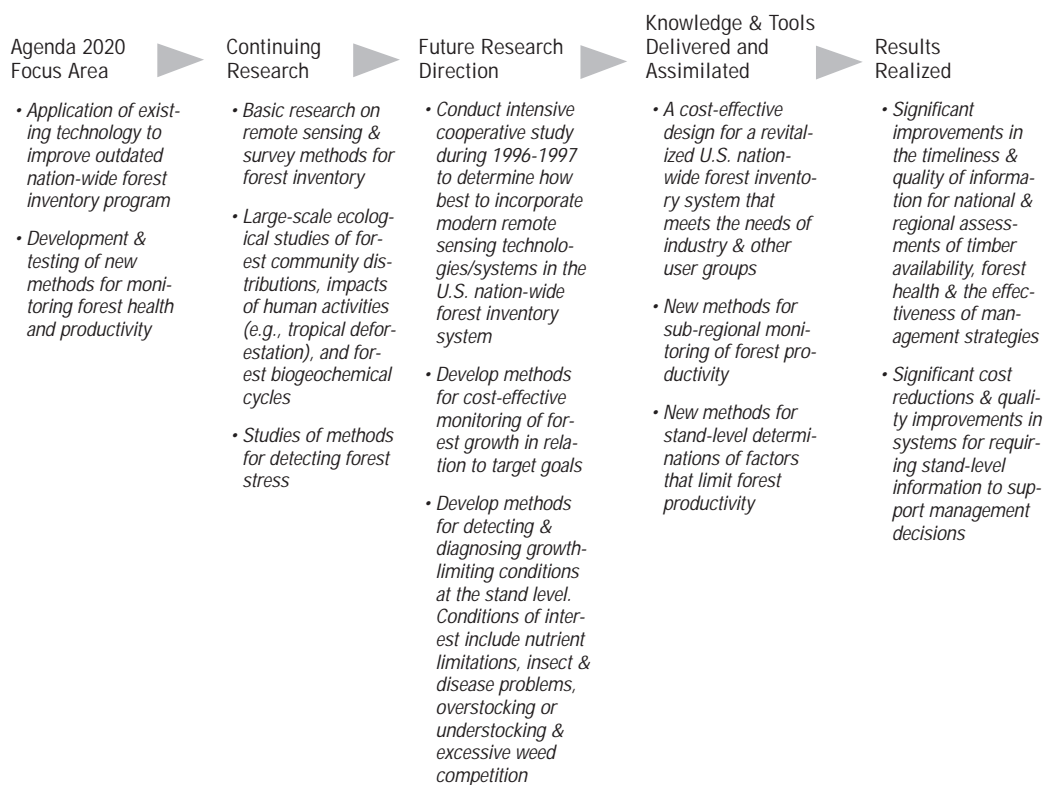
Basic Physiology of Forest Productivity



Pathway for Addressing Industry Information Needs Related to Sustainable Forestry —
Sustainable Soil Productivity



Pathway for Addressing Industry Information Needs Related to Sustainable Forestry —
Remote Sensing Technologies to Improve Forest Inventory and Stand Management



Environmental Performance Task Group

Environmental Performance continues to be a major improvement area for the industry. It is critically important to provide for an improved margin of environmental safety and to do so by improvements to the basic manufacturing processes, the identification of new process technologies that reduce or eliminate environmental releases, and by improvements to existing treatment systems or the development of economically attractive novel treatment options-including recycling and reuse. As knowledge of environmental impacts improves, the industry is in a better position to prioritize impact issues and guide the development of process and treatment alternatives.

To help the industry move toward the goal of meeting ever changing and more demanding environmental requirements without increases of capital expenditures, operating costs and energy consumption, Environmental Performance focuses on three strategic pathways:

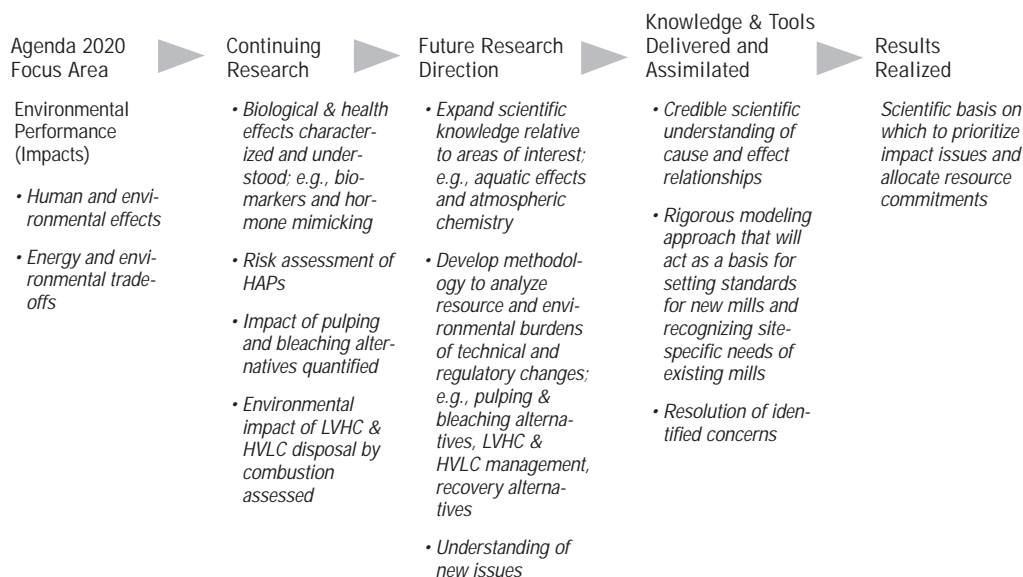
- Improved Margins of Environmental Safety (understanding impacts)
- Process Alternatives Consistent with Pollution Prevention (in-mill improvements)
- Treatment Areas (treatment system improvements, new treatment options, waste utilization)

The resulting pathways are described on the following pages.

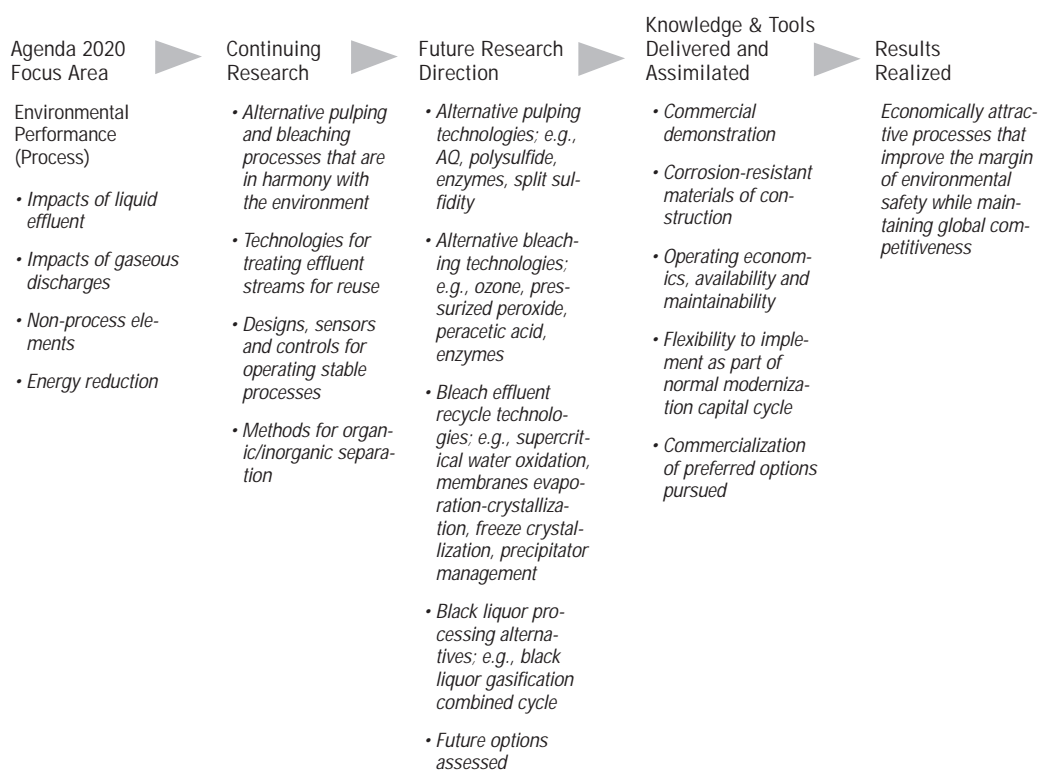
Environmental Performance Priority Areas of Interest

- Impacts and control of non-process elements, soluble ions and organics
- Improved delignification and bleaching technologies
- Odor reduction
- In-process water reuse technologies
- Beneficial use of by-products (Pulp & Paper and Wood Products)
- Biomass fuels from wastes
- Energy efficient wastewater treatment technologies
- VOC/HAP's reduction from wood products manufacture
- Enhanced wood recycling

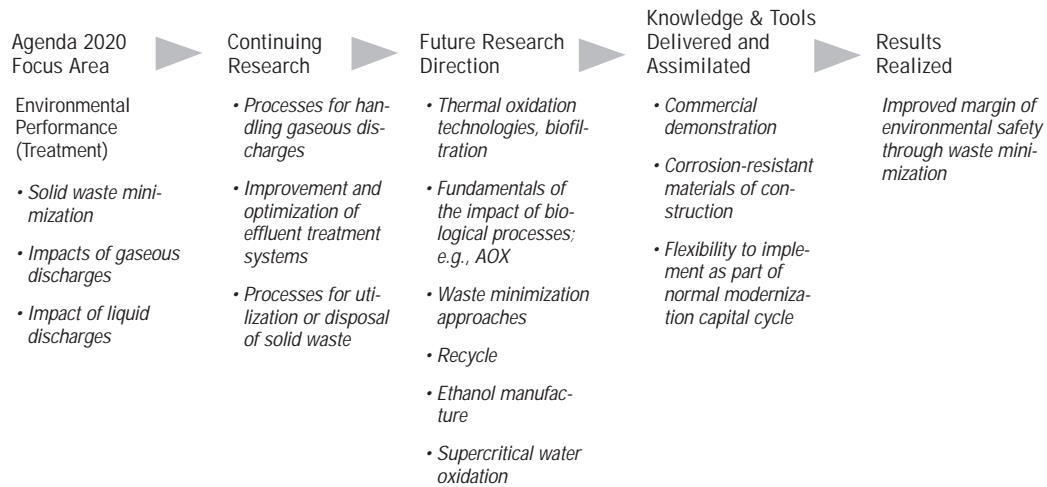
Pathway for Achieving Goals Relating to **Improved Margins of Environmental Safety**



Pathway for Achieving Environmental Goals Relating to **Process Alternatives Consistent with Pollution Prevention**



Pathway for Achieving Environmental Goals Relating to **Treatment Areas**



Energy Performance Task Group

Energy Performance, a fundamental research area for Agenda 2020, has identified five subject areas central to a successful program for the next few decades. They include:

- Fuel Production and Enhancement
- Fuel Conversion and Electricity Production
- Manufacturing Process Efficiency and Heat Recovery
- Environmental Impact of Energy Production & Utilization
- Wider Use of Renewable Resources

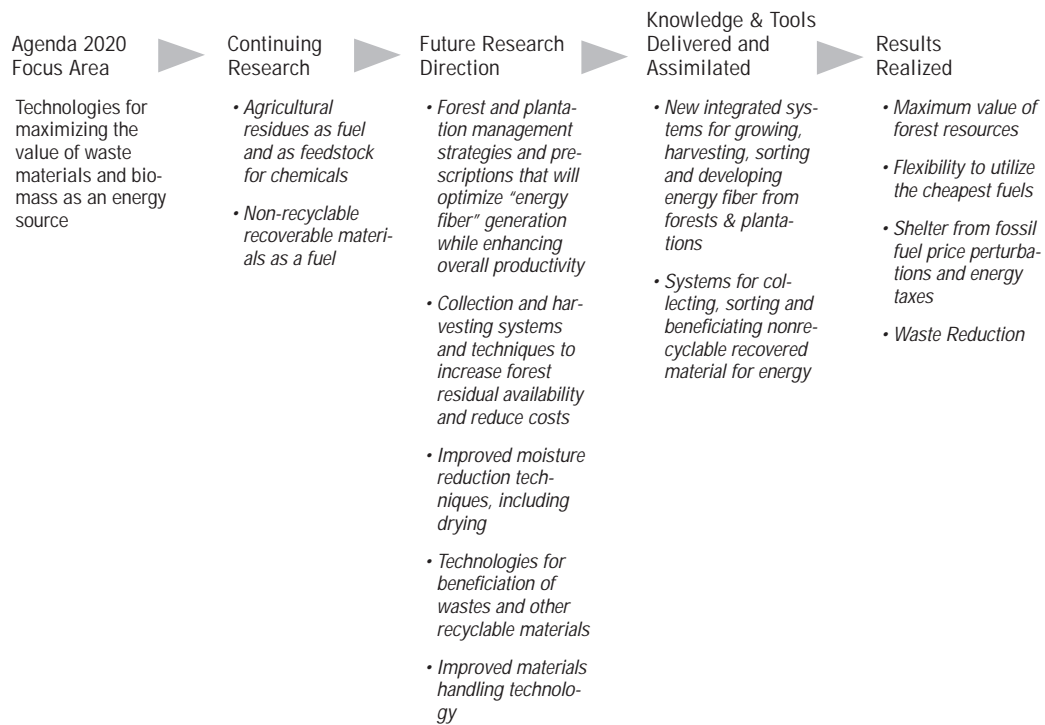
Pathways for these five research areas are shown in the following pages.

Examination of the pathways should begin with the fundamental understanding that the forest products industry's raw material is a fuel. Upgrading the fuel to higher valued products-including wood products, paper, electricity, chemicals, etc.-is what the industry does. In these many processes, energy is consumed and some material is not utilized. The economic arena in which the Energy Performance Task Group focuses on precompetitive research involves the utilization of non-upgraded materials for an energy source, the use and efficiency of use of energy, the environmental impacts of energy use and the production of products in two areas-energy and chemicals. Research in these areas overlaps all of the Agenda 2020 program areas.

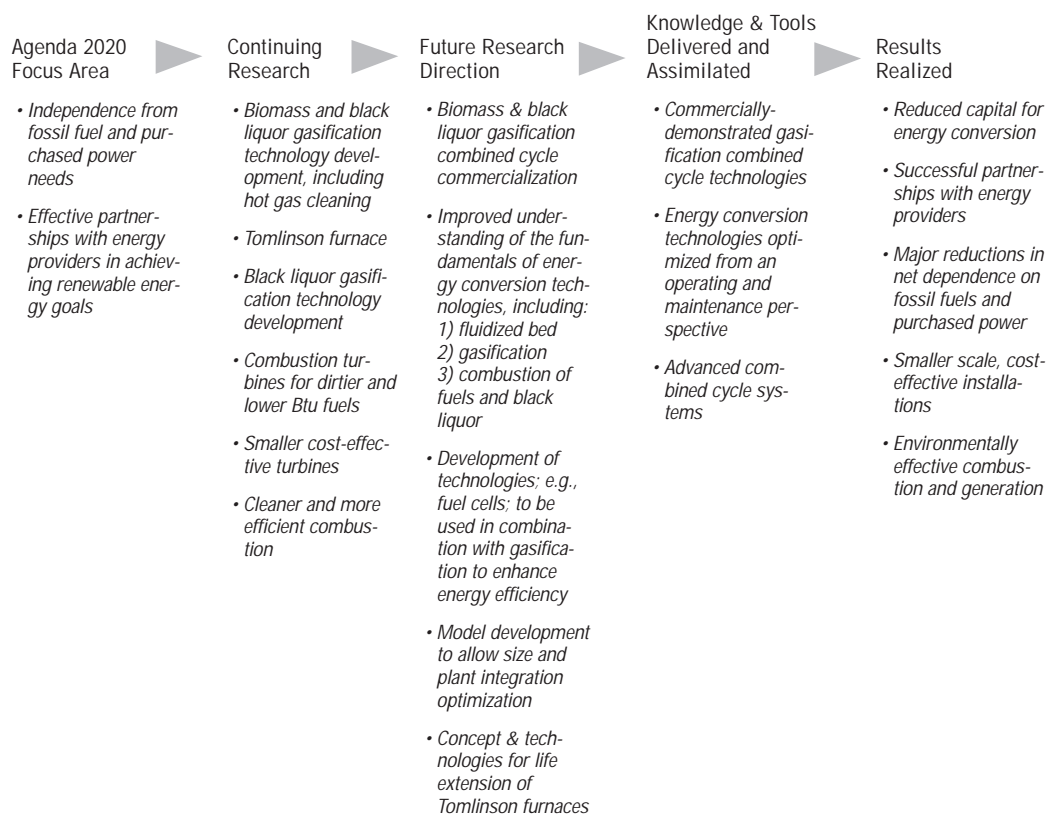
Some of the areas that have received considerable research proposal interest and acceptance include:

- Fundamental Understanding of the Thomlinson Recovery Furnace
- The Role of Impurities in Pulping Liquors on Recovery Operation
- Black Liquor and Biomass Gasification
- Non-Combustion Environmental Control Processes
- Utilization of Unused Biomass

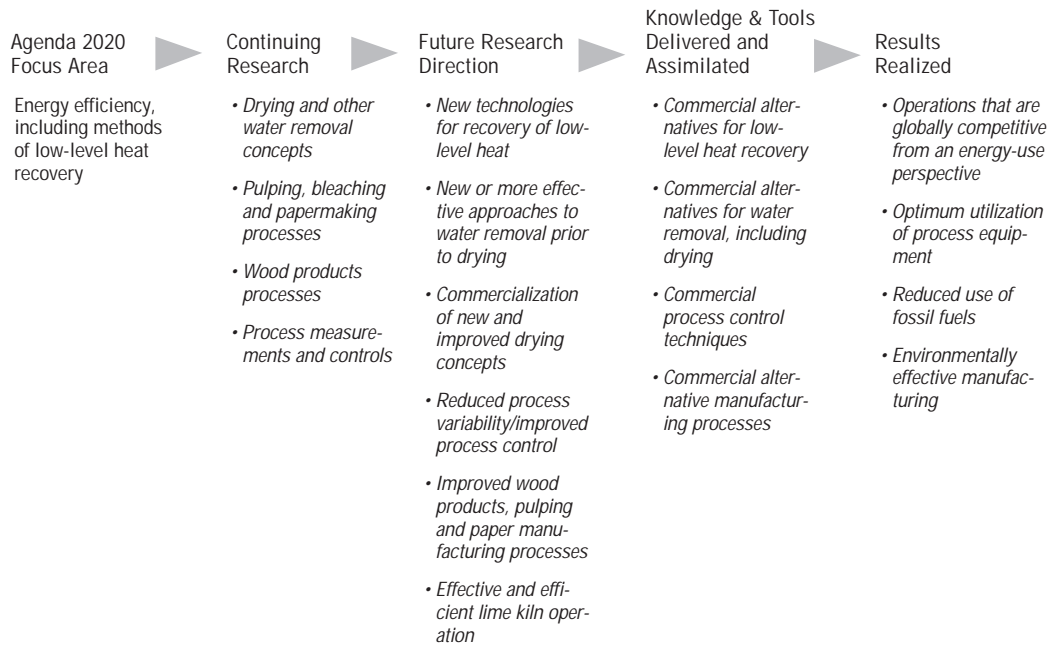
Pathway for Addressing Energy Performance Needs Related to **Fuel Production and Enhancement**



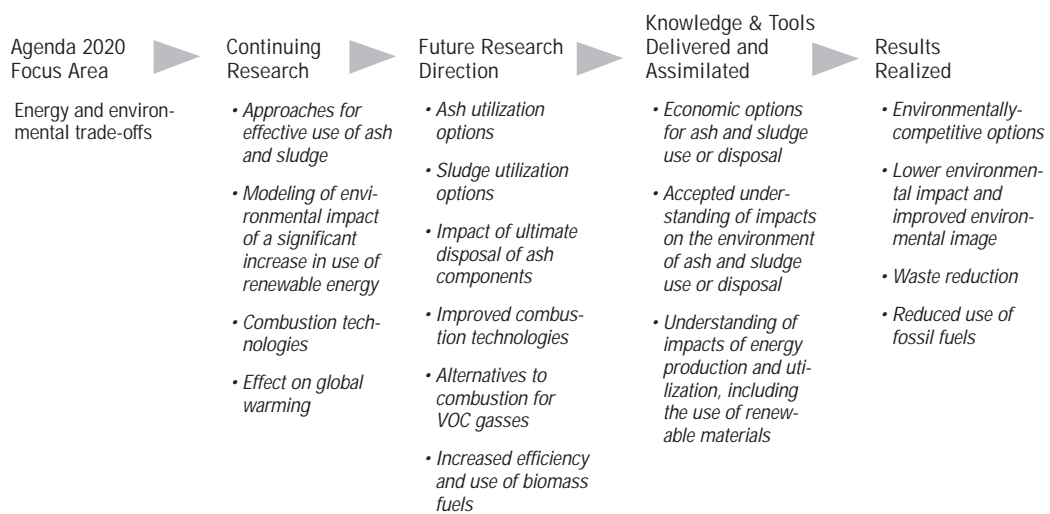
Pathway for Addressing Industry Energy Performance Needs Related to **Fuel Conversion and Electricity Production**



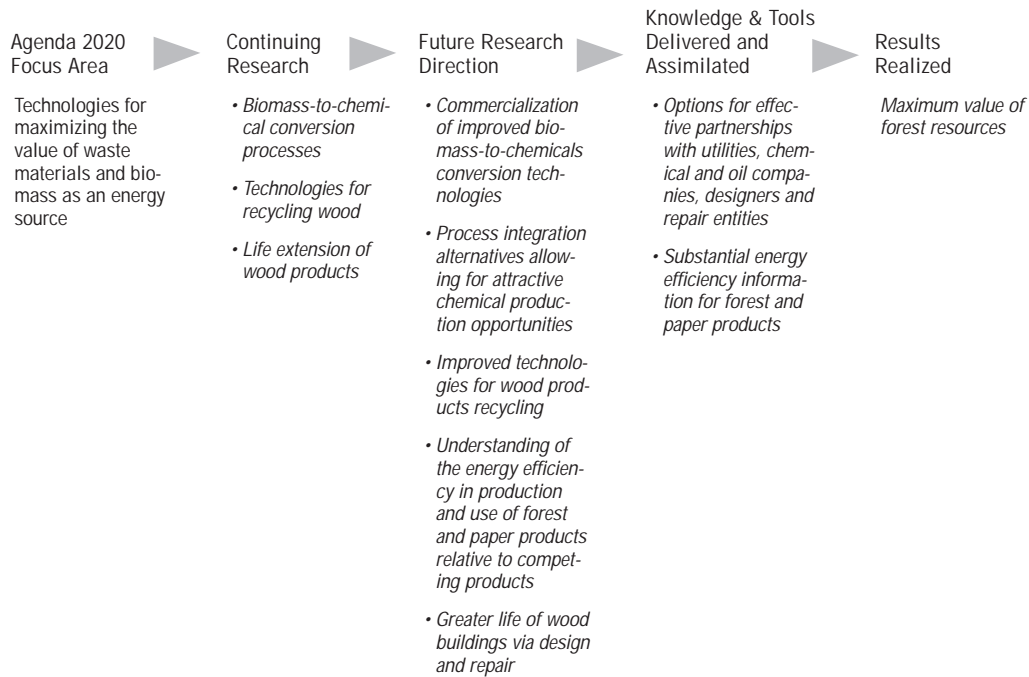
Pathway for Addressing Industry Energy Performance Needs Related to **Manufacturing**
Process Efficiency & Heat Recovery



Pathway for Addressing Industry Energy Performance Needs Related to **Environmental**
Impact of Energy Production & Utilization



Pathway for Addressing Industry Energy Performance Needs Related to **Wider Use of Renewable Resources**



Capital Effectiveness Task Group

One of the key research areas described in Agenda 2020 was Capital Effectiveness. A team has been trying to bring strategic focus to this complex area. This team identified major industry research needs and ways to link with specific research proposals. It recognized the benefits to the industry of Agenda 2020, which go beyond the planning of research, and includes the communication of a long-term sense of responsibility and stewardship. This is important as the industry seeks to build and further its reputation-including the attractiveness to potential new technically skilled resources, as well as other stakeholders.

It was agreed that Capital Effectiveness should be looked at more broadly than just invested capital, but rather on a total basis, considering the “life cycle” of the investment. This would include the initial capital, operating, service and maintenance costs, as well as operating efficiency. This approach resulted in three strategic pathways:

- Systems and Process Technologies (what is built)
- System Fabrication and Construction (how it is built)
- System Efficiency (how it is operated)

The resulting detailed pathways are presented on the following pages. The goal is to support research and development work in areas that likely will have the greatest significance to the industry’s long-term success.

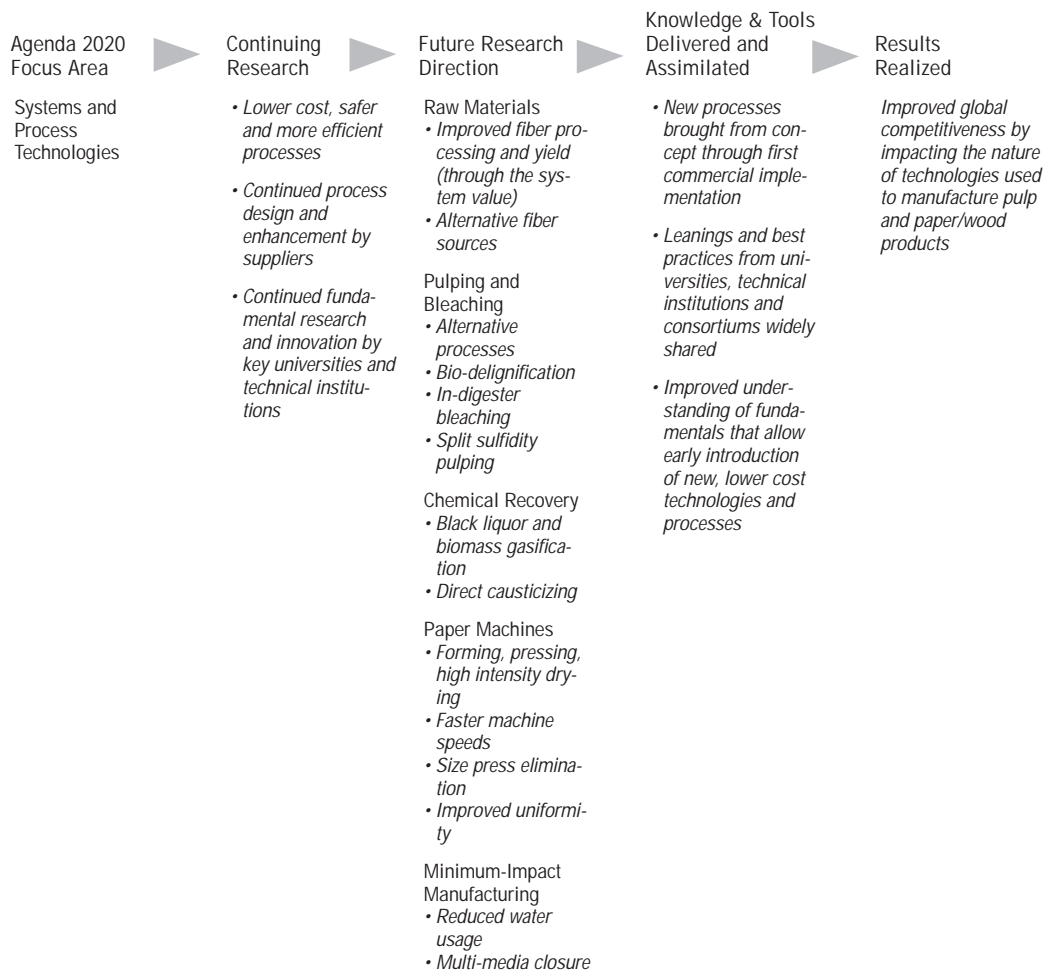
Since significant impacts are being sought, it is critical that input from the industry’s owners, suppliers and technical institutions is obtained. It is also critical that the scope of requests are narrowed-recognizing that resources are limited. The Task Group believes

that it is also critical to have teams of investigators from various resources that reflect true expertise. More intense collaboration between universities, research institutes, national laboratories and industry associations is highly encouraged and valued.

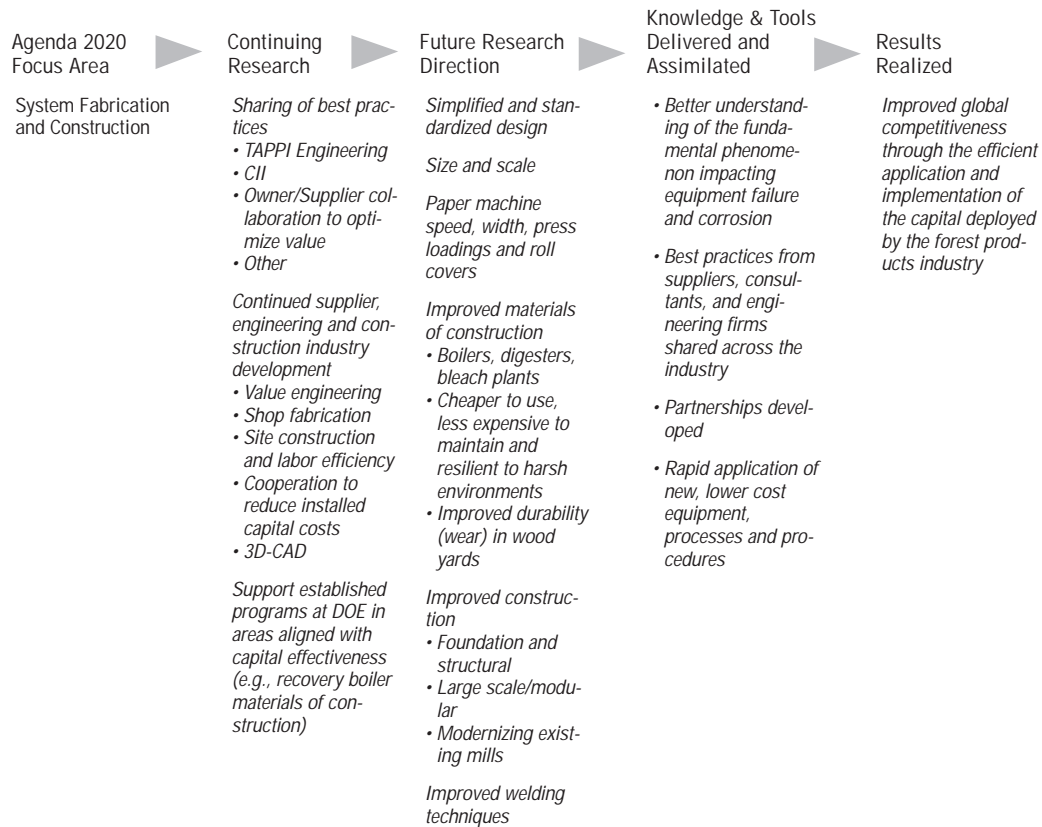
Capital Effectiveness Priority Areas of Interest

- Developing and sharing best capital management practices
- Black liquor and biomass gasification
- Paper machine production and quality improvements
- Improved materials of construction
- Improved modeling, simulation, optimization and operator training
- Biotechnology - raw materials/pulping and bleaching
- Minimum-impact manufacturing
- Intelligent maintenance approaches
- Direct causticizing

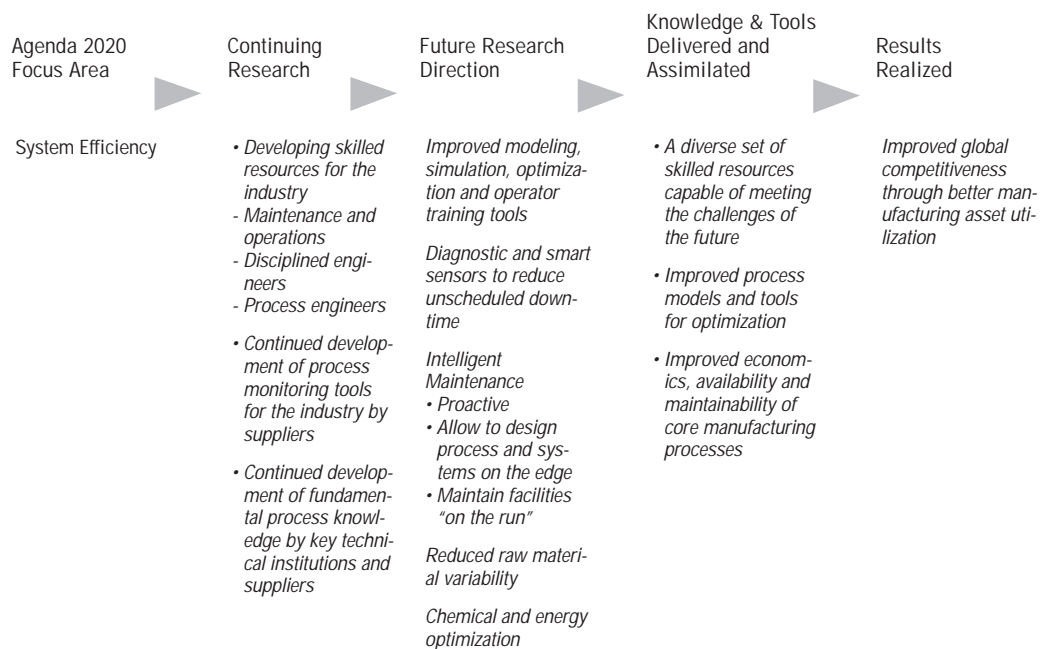
Pathway for Addressing Industry Capital Effectiveness Needs Related to **System and Process Technologies**



Pathway for Addressing Industry Capital Effectiveness Needs Related to **System Fabrication and Construction**



Pathway for Addressing Industry Capital Effectiveness Needs Related to **System Efficiency**



Recycling Task Group

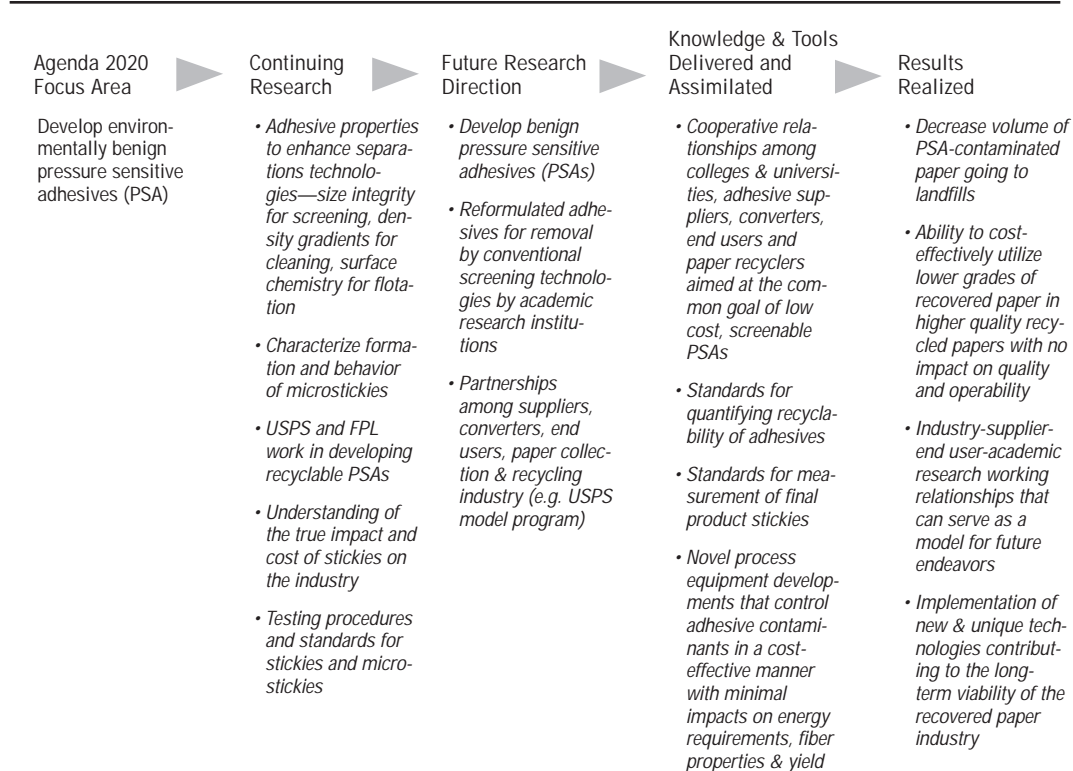
Research in the Agenda 2020 Recycling area is aimed at reducing energy usage, improving fiber yield, and eliminating stickies contamination. These activities form the basis to significantly improve and expand the use of recycled fiber. The targeted research pathways encourage development toward these goals.

A new, top priority research pathway was also defined to support the development and characterization of new pressure sensitive adhesives. Breakthrough work is sought to commercialize removable adhesives that help circumvent high processing costs associated with stickies.

The recycling research pathways below are listed in order of priority:

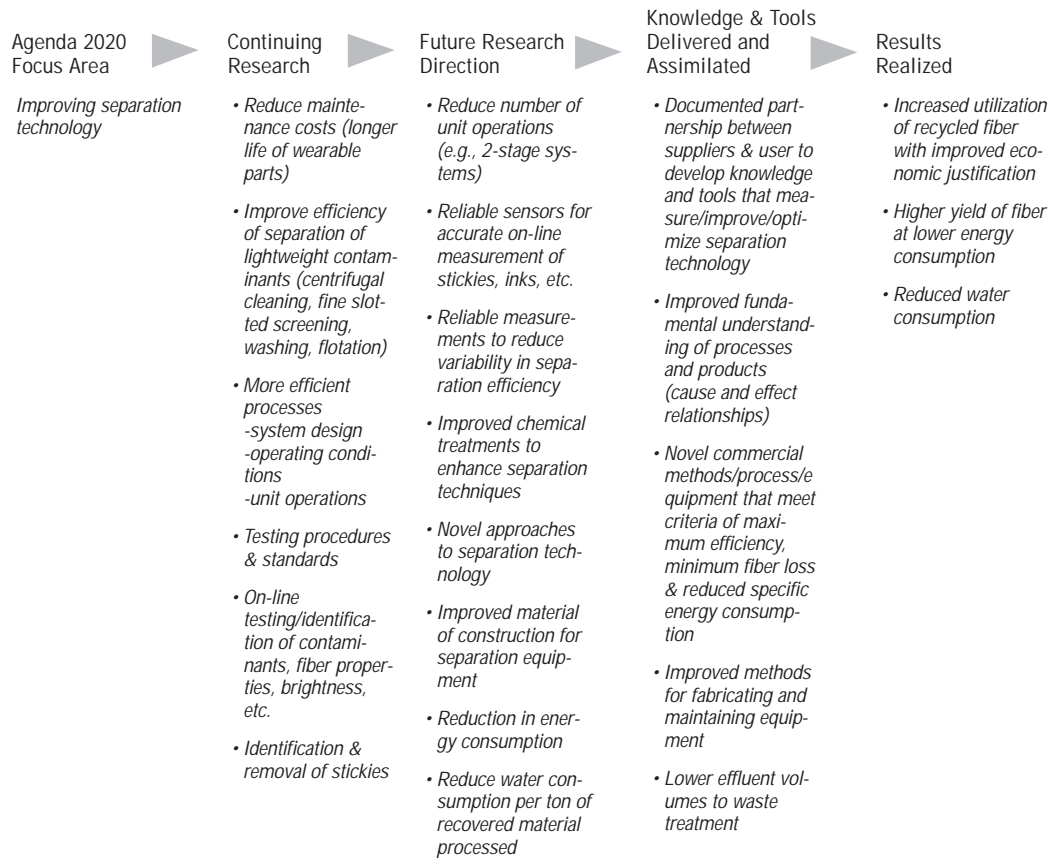
- Develop environmentally benign pressure sensitive adhesives (PSA).
- Improving separation technologies.
- Develop tools and methodologies that establish a valid statistical characterization of raw material streams and to develop innovative sorting and collection techniques, systems, and equipment.
- Understand surface chemistry and fiber to fiber bonding.
- Develop new technologies for sludge use and disposal.

Pathway for Addressing Industry Recycling Needs Related to Developing Environmentally Benign Pressure Sensitive Adhesives (PSA)

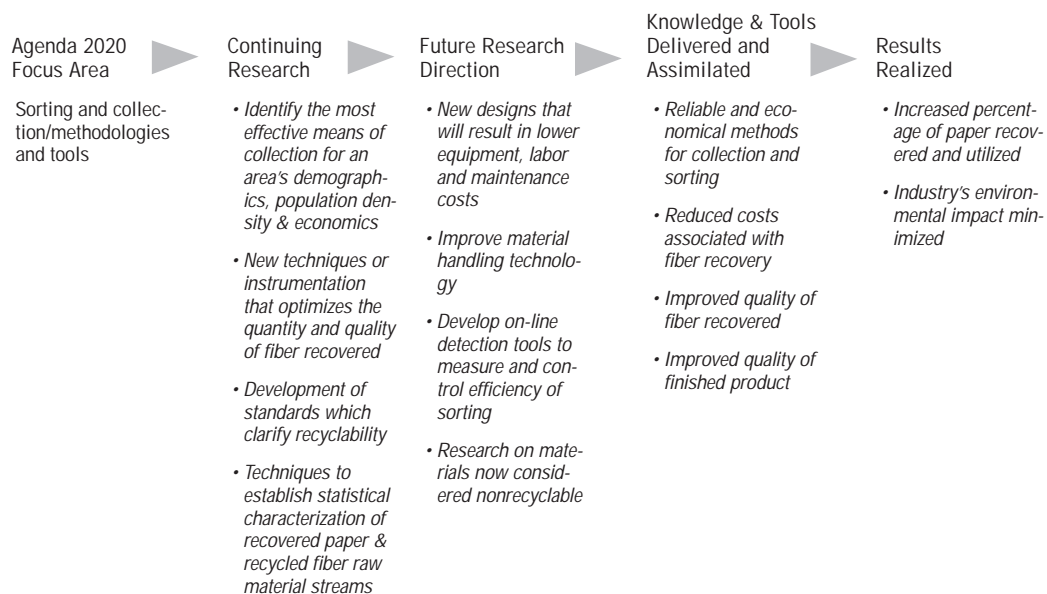


Pathway for Addressing Industry Recycling Needs Related to **Improving Separation**

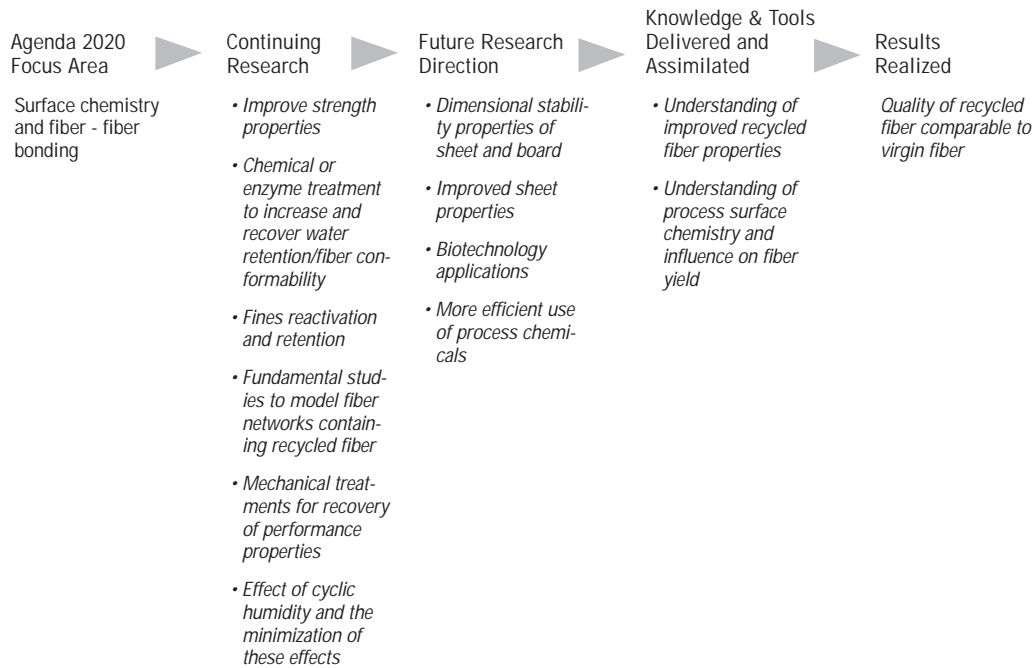
Technology



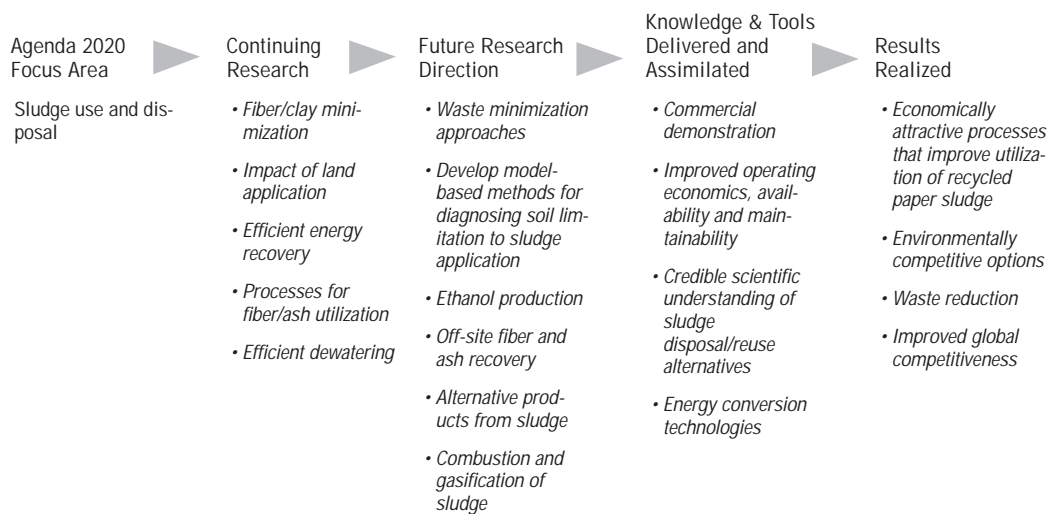
Pathway for Addressing Industry Recycling Needs Related to **Sorting and Collection/Methodologies and Tools**



Pathway for Addressing Industry Recycling Needs Related to Surface Chemistry and Fiber-Fiber Bonding



Pathway for Addressing Industry Recycling Needs Related to New Technologies for Sludge Use and Disposal



Sensors & Controls Task Group

Efficient manufacture of wood and paper products requires effective control of production processes to achieve precision in operations and uniformity in products. Good control in turn requires timely knowledge of process parameters, including accurate measurement or estimation of key variables. The Sensors and Controls Task Group identified a diverse set of needs that should be fulfilled in order to accomplish the Agenda 2020 vision for the industry. These needs are grouped in five pathways as follows:

- Actuators and control devices
Final control devices that reduce variability
- Measurement and diagnostics
Reliable cost-effective sensors for critical properties
- Process and product models
Optimal control facilitated by robust and accurate models
- Data presentation, interpretation, and human interface
Systems that help human operators manage processes safely and efficiently
- Control system effectiveness
Systems that achieve and sustain efficient operations

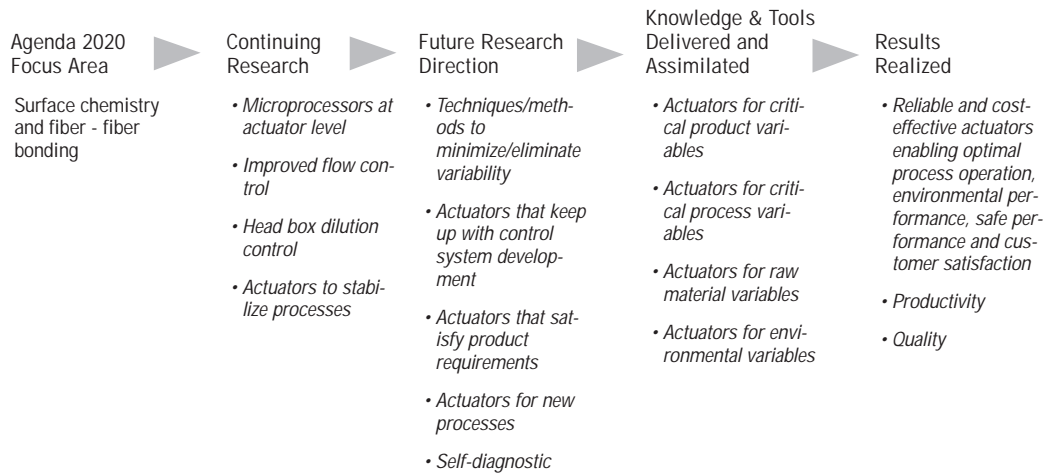
Together, these pathways cover almost all aspects of process control systems. For the past three years, the Task Group has emphasized sensor development in recommending projects for funding and in soliciting project proposals. The priority given to new sensors recognizes the inherent difficulties the industry faces in getting useful process measurements. These difficulties arise because the primary raw material is naturally variable and because the process operations often prevent timely and accurate measurements.

The members of the Task Group regularly review the priorities before new project proposals are requested. For the 1999 project selection process, specific need areas are targeted as described below.

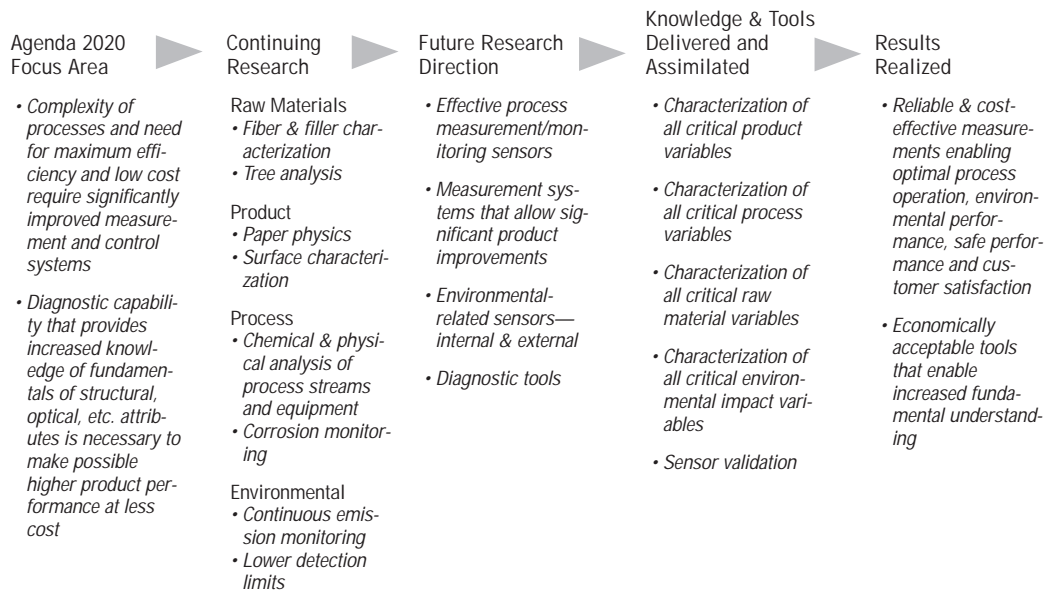
Current Priorities for Sensors and Controls

- Final control elements that achieve more uniform fiber distribution in papermaking
- Reliable, affordable real-time sensors to measure non-process elements in harsh pulping, bleaching and recovery processes
- On-line measurement and control of colloidal chemistry in paper machine water systems
- Cost-effective on-line sensors for pulp and fiber properties prior to papermaking
- Non-contacting sensors for the paper machine that measure paper properties critical to high-quality printing
- Diagnostic tools that aid process understanding and more efficient operation, with emphasis on pulping and papermaking
- Techniques and systems that sustain effective performance of control systems without deterioration over time

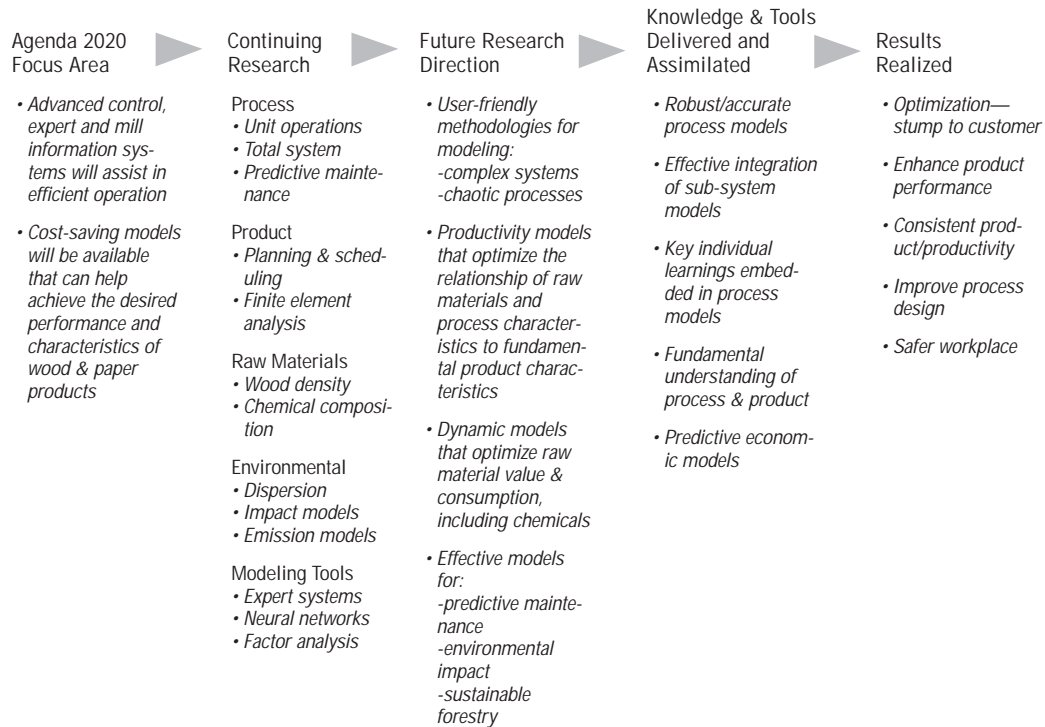
Pathway for Addressing Industry Sensors & Controls Needs Related to Actuators and Control Devices



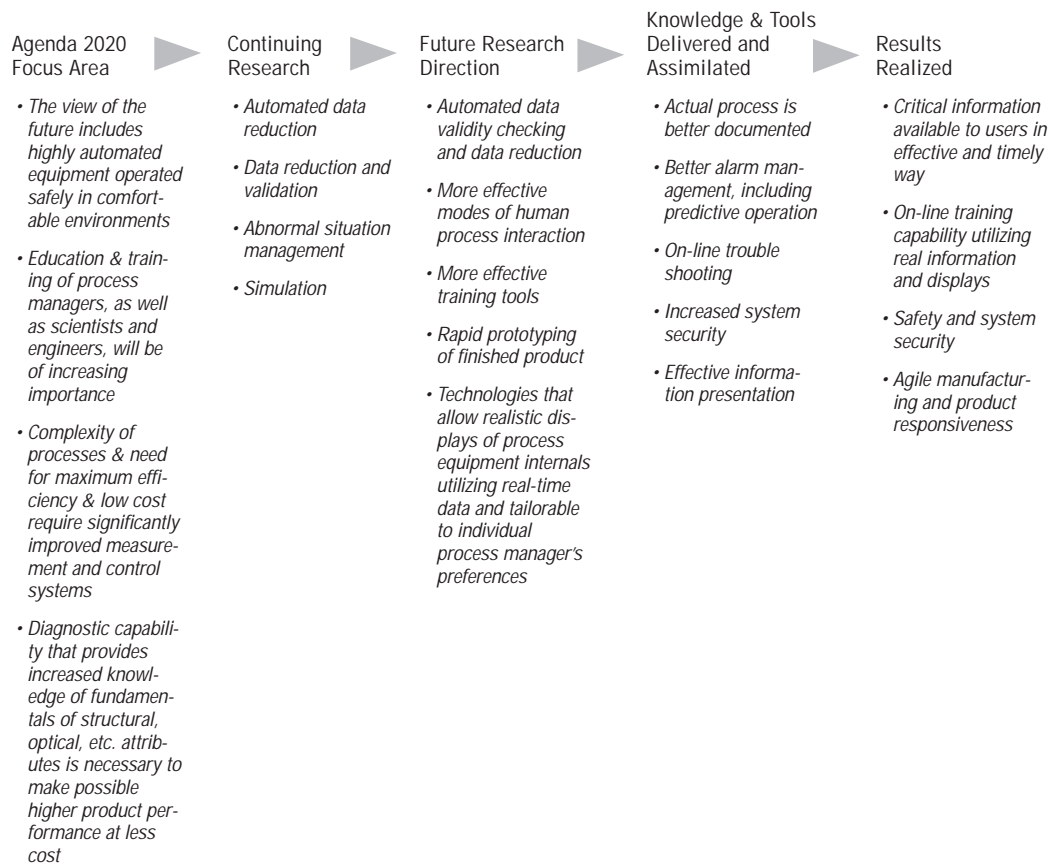
Pathway for Addressing Industry Sensors & Controls Needs Related to Measurement and Diagnostics



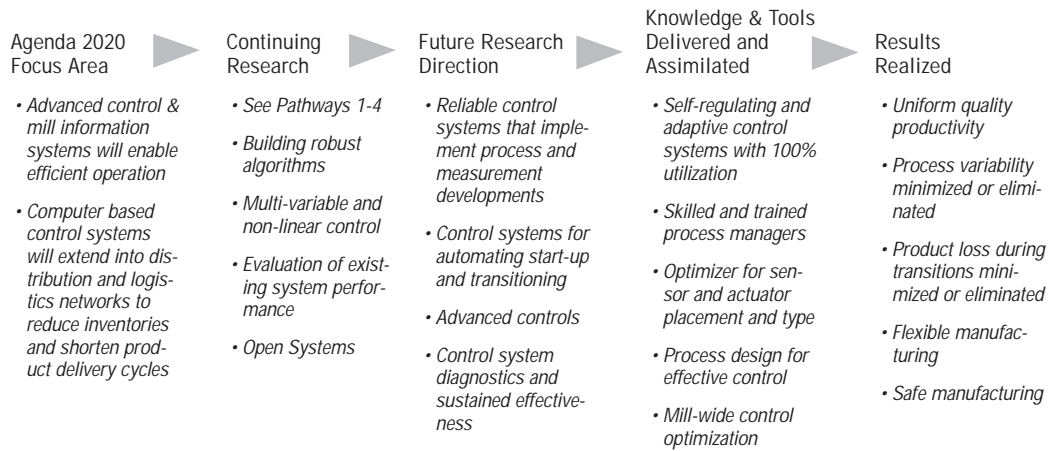
Pathway for Addressing Industry Sensors & Controls Needs Related to **Process and Product Models**



Pathway for Addressing Industry Sensors & Controls Needs Related to **Data Presentation, Interpretation & Human Interface**



Pathway for Addressing Industry Sensors & Controls Needs Related to **Control System Effectiveness**



Current Status

As Agenda 2020 matures, it is resulting in a new paradigm for industry, academia, and government cooperation. The universities are aggressively responding through networks and consortia such as the PPERA. The DOE National Laboratories are closely linked to the process through the National Laboratory Coordinating Council. The Forest Service Laboratory in Madison, Wisconsin, is a full participant. NCASI is integrally involved in providing oversight and management in environmental activities. TAPPI plays a key role in information transfer through its unique ability of communication with the industry's professionals. PIMA is acting as a communication link to the industry's management as well.

Suppliers are becoming involved in increasing numbers and in diverse ways, and the industry is facing its first major commercialization challenge. Agenda 2020 foresaw that the industry would need significantly more efficient and self-sufficient energy generation. The gasification combined cycle co-generation technologies have been developed to the point where the industry has a specific demonstration plan. Through the "Request for Proposals" process, the industry is also seeking additional research and deployment ideas. As a result of the published plan, entitled "The Forest Products Industry Gasification Initiative", the industry has agreed to seek significant matching funds from the Department of Energy to enable the large-scale demonstration of biomass and black liquor gasification combined cycle technologies. These technologies have the potential for making major impacts on the energy, environmental and capital performance of the industry. This initiative represents the first time the AF&PA has been authorized to seek additional government funding for research, development and demonstration aimed at improving the industry's global competitiveness.

The Agenda 2020 vision represents the first time that the US pulp & paper industry has achieved a high degree of alignment around a set of strategic goals. Agenda 2020 has received significant attention and respect from such institutions as suppliers, universities, and the forest products community of other countries. The industry's thoughtful commitments outlined in Agenda 2020 command respect and are a basis for attracting new people into the member companies.

Guided by Agenda 2020, a research, development, and demonstration program is in progress. This is the structure that will allow the industry to fulfill the commitments in Agenda 2020-the results of which will have significant impact on the Industry's competitiveness in the very near future. A common review process has been established for overseeing the program. The research area operating task groups are the leaders of these reviews in the same way as they lead the prioritization of new projects. Their recommendations go to the Chief Technology Officers for any action that might be needed.

The quality and standard of the proposals submitted continues to improve and is at a very high level. The DOE continues to be engaged, and the knowledge of how to effectively utilize the vast resources of the national laboratories continues to increase. Already significant and increasingly interesting ideas have come forth by virtue of being involved in the visioning process with other industries and crosscutting technological concepts have been identified.

In its first three years, Agenda 2020:

- Was a significant factor in Cluster Rule negotiations
- Is the basis for a similar impact on the Administration's Global Climate Change initiative
- Is already showing early winners
- Has resulted in excellent cooperation between academic institutions
- Has facilitated significant understanding and engagement of national laboratory capabilities
- Has leveraged identification of technology needs
- Has produced pathways and leveraged industry-guided research projects in each of the 6 focus areas
- Has become a communication vehicle, with a common voice, for a wide range of constituencies
- Has been an added basis for improving the industry's reputation
- Has enabled an appropriate level of industry collaboration
- Has significantly increased the awareness and willingness of talented people to work on the Industry's issues (technical respectability).

The vision that Agenda 2020 established in 1994 is being aggressively pursued in 1999 and, with continuous improvement and growing success, will become a reality in the years ahead.

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