Chemical Industry VISION2020 Technology Partnership

Accelerating Innovation and Technology Development





ANNUAL REPORT 2004

www.ChemicalVision2020.org

Report Card 2004

The Chemical Industry Vision2020 Technology Partnership brought together chemical companies, government, and academia to achieve the following in 2004:

✓ **Defined chemical industry priorities for pre-competitive R&D:**
Research and development (R&D) priorities agreed upon by chemical companies at Vision2020 forums are helping to focus R&D investments by chemical companies, federal agencies, universities, and the broader research community.
By forging consensus, Vision2020 speaks for the industry.

✓ **Created leading-edge research agendas:**
Vision2020 further explored selected R&D areas and, with help from experts at the national laboratories, scoped out promising avenues of research. The results are influencing the chemicals market and shaping new initiatives (see pages 6 and 7).

Vision2020 influenced corporate and federal R&D investment in the following topic areas in 2004:

- Nanomaterials by design
- Separations
- Bio-separations
- Ionic liquids
- Reactions
- Computations
- Sensors
- Materials
- Process heating and cooling

✓ **Built strategic partnerships through networking:** Vision2020 provided expert forums that helped chemical companies better understand R&D challenges, identify funding sources, and form collaborative partnerships (see page 5).

✓ **Leveraged government funding for R&D priorities—over $93 million in 2004:**
Federal programs look to Vision2020 to help them leverage research investments that can expand economic growth, increase energy efficiency, create new products, streamline processes, and enhance environmental performance. The growing frequency with which Vision2020 roadmaps and reports are cited in government solicitations reflects the importance of these documents in helping to guide government research agendas (see pages 4 and 6).

For background on Vision2020, see pages 10 and 11; for updated information, please visit our website at www.ChemicalVision2020.org

Priority Research Area	Key Results in 2004	Importance to the Chemical Industry
Nanomaterials and nanotechnology	Established National Nanotechnology Initiative-Chemical Industry Consultative Board for Advancing Nanotechnology (CBAN). Defined high-priority R&D areas for NNI & EPA. Created searchable database of ES&H literature, and identified R&D progress and needs. Developed proposal evaluation criteria for ONR. Established collaboration with Semiconductor Research Corporation and American Chemistry Council.	Nanomaterials are an opportunity for the U.S. chemical industry to introduce a host of new products that could energize the economy, solve major societal problems, revitalize existing industries, and create entirely new businesses.
Ionic liquids	✓ Published *Accelerating Ionic Liquid Commercialization Roadmap.* Featured ionic liquids as R&D topic at Vision2020/CCR Collaboration Workshop and American Institute of Chemical Engineers (AIChE) Spring Meeting.	The thermodynamics and kinetics of ionic liquids offer the potential for solvent-free processing and green chemistry. Research could pave the way for more efficient catalytic reactions, separations, electrochemistry, and combined reaction-separation processing.
Computational methods for chemical and physical properties	Estimated economic value of improved computational methods for materials design and development. Completed study *Advanced Modeling Techniques for Physical Property Estimation.*	Design of new, high-performance materials depends on leading-edge research into material properties, computational methods and models of thermodynamics, quantum mechanics, and solid-state physics.
Bio-separations	Implemented the "Driving Gas Phase Equilibrium Processes with Adsorbents and Membranes" Initiative, with roadmap planned for 2005. Guided NSF separations R&D planning. Initiated projects in the post-biotransformation capture of organic acids; polymer-grade diacids, polyols, and organic acid esters; solvents; and oils.	New bio-chemical separations technology is vital to improved productivity, energy efficiency, and environmental performance in chemical production.
Utility energy mapping and benchmarking	Helped develop and test new software tool for assessing plant-wide energy use and opportunities for energy savings. The Plant Energy Profiler (PEP) Tool will be available in late 2005.	About 53% of the primary energy associated with chemicals manufacture is lost prior to being used in processes. Energy systems account for 2.7 quadrillion Btu in losses annually (including generation and transmission losses at offsite utilities as well as losses at chemical plants). These losses offer a key opportunity for chemical plants to improve productivity and reduce costs.
Innovative energy systems integrated into chemical processes	DOE/EERE R&D solicitation will fund Vision2020 priorities in energy systems integrated with chemical processes. Developing technology specifications and performance metrics with University of Illinois.	
Biomass-to-energy	Vision2020's 2003 report *Highlights of Biopower Technical Assessment* continues to spark interest in biopower; the report was cited in state and regional planning documents in 2004.	Biomass derived from forestry and/or farming could be efficiently and cost-effectively transformed into a sustainable supply of renewable energy for chemical plants.
Materials of construction	DOE/Industrial Technologies Program-funded projects were completed: intermetallics and alloys for ethylene reactors, corrosion monitoring system, prediction of corrosion alloys in mixed solvents, metal dusting phenomenon and resistant materials, and alloy selection system for elevated temperatures.	R&D to create new solutions and materials is essential to reducing equipment failure, lengthening the time between equipment shutdowns, extending operating life, and consequently reducing the use of energy and other raw materials.

Leveraging Federal Resources

Through the Chemical Industry Vision2020 Partnership, chemical companies are communicating industry priorities and increasing federal investment in R&D that will benefit the chemical industry and all of society.

Federal Partners in 2004

- Department of Agriculture (USDA)
- Department of Commerce (DOC)
  - National Institute for Science and Technology (NIST)
- Department of Defense (DOD)
  - Office of Naval Research (ONR)
- Department of Energy (DOE), specifically the following offices:
  - Energy Efficiency & Renewable Energy (EERE):
    - *Industrial Technologies (ITP)*
    - *Bioenergy*
    - *Distributed Energy*
  - Fossil Energy
  - Science:
    - *Basic Energy Sciences (BES) Program*
    - *Biological and Environmental Research (BER)*
- Department of Homeland Security (DHS)
- Department of Health and Human Services (DHHS)
  - Food and Drug Administration (FDA)
  - National Institute for Occupational Safety and Health (NIOSH)
  - National Institute of Health (NIH)
- Environmental Protection Agency (EPA)
- International Trade Commission (ITC)
- Nanoscale Science, Engineering, and Technology (NSET) Subcommittee of the National Science and Technology Council's Committee on Technology
- National Aeronautics and Space Administration (NASA)
- National Nanotechnology Coordination Office (NNCO)
- National Science Foundation (NSF)

- Vision2020's *Chemical Industry Roadmap for Nanomaterials by Design: From Fundamentals to Function* is actively guiding federal research activities. As examples, the Office of Naval Research referred to the roadmap in a recent request for R&D proposals, and NSET has incorporated key elements of the roadmap into its 2004 *Strategic Plan for the Federal R&D Program in Nanotechnology.*

- Representatives from NSF and DOE described their agencies' technical focus areas at the December 2004 Workshop to Identify Research Collaborations. The event sponsored by Vision2020 and the Council for Chemical Research (CCR) helped chemical companies identify opportunities and funding for new R&D partnerships (see facing page).

- Vision2020 is helping to shape R&D portfolios at DOE. In fiscal year 2004, ITP provided cost-shared funding for over 23 R&D and technology deployment projects in separations, reactions, computations, sensors, process heating and cooling, and materials. See www.eere.energy.gov/industry/program_areas.

  Vision2020 has similarly influenced the R&D portfolio of DOE's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs. Over $19 million in FY04 was invested in catalysis; separations; measurement, communications, control, and sensors; materials; waste heat recovery; and nanotechnology. In 2005, categories for Phase I projects will include energy-efficient membranes, nanotechnology applications in industrial chemistry, and alternative reaction media. For more information, see www.er.doe.gov/sbir/.

Vision2020 leveraged over $93 million for chemical industry R&D in 2004

Vision2020 initiatives succeeded in obtaining $51 million in federal funds for priority research projects in 2004. Chemical companies provided an additional $42 million in matching funds and also contributed time for Vision2020 planning and collaborative activities—a clear indication of the strong public and private support for Vision2020 initiatives.

Helping chemical companies find research partners

Finding R&D partners with complementary skills, experience, and resources is the key to creating strategic research alliances. To assist partnership building, Vision2020 and the Council for Chemical Research (CCR) sponsored the **Workshop to Identify Research Collaborations** near Baltimore on December 2, 2004. This innovative event brought together 92 technical experts from industry, universities, and national laboratories. Program managers from DOE and NSF identified available funding and explained their research objectives in four focus areas:

- alternative energy production, storage, and transmission
- alternative fossil-based feedstocks and chemistries
- energy-efficient process alternatives
- energy conversion

Participants proposed R&D projects and potential collaborators identified projects of interest. Informal discussions helped researchers explore potential partnerships.

"We created the environment and the collaborators found each other. Companies were able to find partners for real needs without disclosing proprietary details."

– Jack Solomon, chair of Vision2020

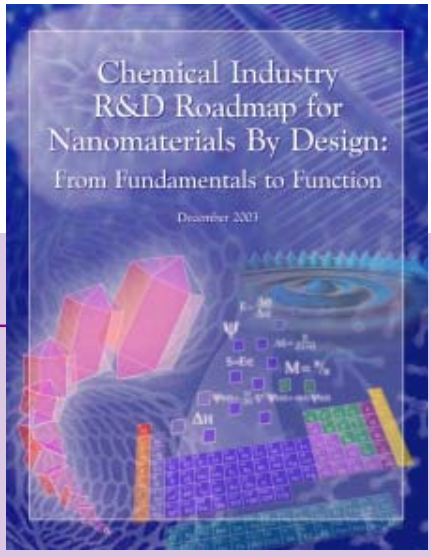
Encore to Success

Vision2020 and CCR will host another **Workshop to Identify Research Collaborations** as part of CCR's Spring Meeting in Pittsburgh on April 12-13, 2005. The workshop will focus on R&D opportunities with DOE, DHS, NIH, and NSF.

Nanomaterials By Design: implementing the roadmap

In 2004, Vision2020 turned its sites toward implementing its *Chemical Industry R&D Roadmap for Nanomaterials By Design: From Fundamentals to Function*. Published in 2003 at the request of the National Nanotechnology Initiative (NNI), the roadmap sets out the R&D priorities for developing the capability to design and tailor nanomaterials to enhance specific functions—potentially energizing the economy and solving major societal problems.

In March 2004, Vision2020 worked with NNI and CCR to successfully establish the chemical industry's only body for coordinating nanotechnology R&D with the federal government: the NNI-Chemical Industry Consultative Board for Advancing Nanotechnology (NNI-ChI CBAN). (See page 7 for details.)



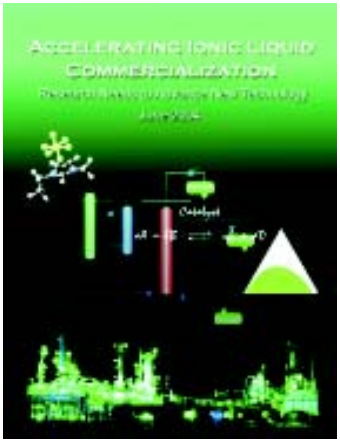
Vision 2020 Goal

Develop effective means of collaboration between the U.S. chemical industry and the Nanoscale Science, Engineering, and Technology (NSET) Subcommittee of the President's National Science and Technology Council.

Chemical Industry R&D Roadmap for Nanomaterials By Design

Results: Targeting Technology Opportunities

Ionic liquids roadmap facilitates commercialization



Ionic liquids are an underdeveloped branch of chemicals that could provide the basis for clean manufacturing. The unique thermodynamics and reaction kinetics of ionic liquids create new opportunities for catalytic reactions, separations, electrochemistry, and combined reaction/separation processes. Because ionic liquids remain liquid at room temperature, they potentially offer a "green" alternative to volatile organic compounds (VOCs).

A Vision2020 committee, with assistance from 40 experts and the American Chemical Society (ACS), identified the research needed to accelerate the commercialization of ionic liquids. These recommendations were published in the June 2004 roadmap *Accelerating Ionic Liquid Commercialization: Research Needs to Advance New Technology* (full text available on our website).

Impact: The DOE Office of Basic Energy Sciences included fundamental research in ionic liquids in its FY2005 SBIR solicitation, referring potential respondents to the *Ionic Liquids Roadmap* on the Vision2020 website.

Improved computational methods for materials promise significant economic benefits

Computational methods are used to predict and manage material behavior—capabilities that are essential for improving material and product design. Vision2020 worked with researchers from Oak Ridge National Laboratory and Stanford University to evaluate the impacts of improved computational methods on several industrial sectors (see inset). The researchers focused on physical and chemical properties of selected organic and inorganic chemicals used in commercial chemical manufacture. The final report *Advanced Modeling Techniques for Physical Property Estimation* stated that an additional $5 billion investment in research over a period of five years would yield tremendous results in 20 years, such as the following:

- More than 360,000 new jobs
- New capital investment of $10 billion
- A total technology value of more than $60 billion per year
- A net present value of $120 billion
- An internal rate of return of more than 40 percent per year

Advanced Modeling Techniques for Physical Property Estimation addresses this key question:

How will accelerated development of computational methods in these fields of science and technology…

- Nanomaterials by design
- Self-assembly of molecular systems
- Surface interactions
- Modeling of mesoscale systems
- Polymer science

. . . affect these economic sectors?

- Semiconductors
- Drug delivery
- Photovoltaic
- Electronic displays
- Catalysts
- Computer storage
- Membranes
- Composites
- Lubricants
- Adhesives
- Structural plastics

New government-industry partnership leads nanotechnology R&D

The NNI-ChI Consultative Board for Advancing Nanotechnology (CBAN) got off to a fast start after its launch in March 2003. This first-of-its-kind partnership between the National Nanotechnology Initiative and the chemical industry has moved quickly to begin fulfilling its mission to promote, plan, coordinate, and expand nanotechnology R&D.

CBAN is currently developing a five- to ten-year R&D implementation plan for the Vision2020-developed nanotechnology roadmap and has already chartered two working groups in which Vision2020 members have leading roles:

Corporate Participation in Vision2020 Nanotechnology Efforts:

- American Chemistry Council
- American Chemical Society
- Air Products and Chemicals, Inc.
- BP
- Ciba Specialty Chemicals
- Council for Chemical Research
- The Dow Chemical Company
- Eastman Chemical Company
- E.I. du Pont de Nemours and Company
- General Electric Company
- Honeywell International, Inc.
- Intel Corporation
- Materials Technology Institute, Inc.
- Praxair, Inc.
- Rohm and Haas Company

Nanotechnology Research Working Group: 2004 Accomplishments—

- Developed weighting criteria that reflect industrial R&D needs. The Office of Naval Research has already applied the criteria in evaluating proposals that explicitly address key issues in the *Nanomaterials By Design Roadmap*.
- Defined priority areas: coatings, catalysts, high-strength materials, sensors, energy, sorbents, and electronic materials.
- Communicated R&D priorities to NNI Research Directions II meeting.
- Recommended standards for international nomenclature.
- Initiated roadmap implementation plan for manufacturing and nano-engineering priorities.

Participating Agencies

- DOD
- DOE
- ITC
- NNCO
- NIST
- NSF
- ORNL

Environmental Safety & Health Working Group: 2004 Accomplishments—

- Recommended R&D directions to EPA and NNI in three areas: toxicity of nanomaterials; measurement and detection of nanomaterials; worker protection and industrial hygiene.
- Collected and evaluated ES&H-related literature for nanomaterials. Developed searchable database of nano-toxicity data that will be maintained by the Center for Biological and Environmental Nanotechnology (CBEN) at Rice University.
- Met with leaders from NIEHS, NTP, EPA, NIOSH, NSET, CBEN, Semiconductor Research Corporation, and ANSI-Nanotechnology Standards Panel.

Participating Agencies

- DOE
- EPA
- FDA
- ITC
- NNCO
- NIOSH
- NIST
- ORNL

The Vision2020 Nanotechnology Committee conducts ongoing activities that complement nano-related efforts described above. In 2004, the committee accomplished the following:

— Analyzed the potential impacts (energy efficiency, waste reduction, and economic competitiveness) of "materials by design" on nano-based products.

— Established collaboration with the Semiconductor Research Corporation (SRC) to identify overlapping R&D needs between the chemicals and semiconductor industries.

Looking Forward: Activities Planned in 2005

Offer guidance to the President on manufacturing

Vision2020 will serve as an industrial reviewer for white papers produced by the Interagency Working Group (IWG) on Manufacturing Research and Development established by the President's National Science & Technology Council (NSTC) in May 2004. Vision2020 plans to explore additional opportunities to support the IWG's mission to develop advanced manufacturing technologies for the benefit of the U.S. economy and manufacturing sector.

Promote government-wide understanding of the importance of materials

Vision2020 will continue its lead role in The Alliance for Materials Manufacturing Excellence (AMMEX), a coalition of more than 80 organizations informing government decision-makers on the pivotal function of materials manufacturing in maintaining U.S. economic and national security.

Aggressively foster federal funding in high-priority areas

Vision2020 will encourage federal agencies to pursue R&D in the following five priority, pre-competitive areas (examples provided in italics) to benefit U.S. chemical manufacturing:

Separations

Low-energy, low-capital separations; membranes
Hybrid separations systems
Aqueous separations

Alternative fossil-based feedstocks & chemistries

Gasification; synthesis gas
Remote methane; methane activation & coupling
Control of selective oxidation
Paraffins; selective conversion of paraffins

Energy-efficient process alternatives

Process intensification
Heat integration
Low-temperature heat recovery systems
Homogeneous catalyst recovery and reuse
Biocatalysis

New Materials

Bio-based materials
Nanomaterials
Coatings & films

Cross-cutting capabilities

High-throughput experimentation (HTE)
Modeling methods & tools
Databases
Interfacial science
Tools

Offer guidance to DOE's innovative energy systems project

Vision2020 was instrumental in developing the Innovative Energy Systems Project jointly administered by DOE's Industrial Technologies Program and Distributed Energy Program. Vision2020 will continue to assist these programs by providing guidance on technology performance specifications and project selection. The goal is to commercialize a portfolio of innovative energy systems that will yield plant energy savings of 10 to 20 percent in a large share of chemical and other industrial facilities.

Pursue next steps in materials nanotechnology development

Vision2020 will advance the implementation of its roadmap for *Nanomaterials by Design* in 2005. Members of Vision2020 will meet with NNI and other government agencies to raise awareness of the chemical industry's R&D needs for nanomaterials and encourage funding through mechanisms that require industry participation. Vision2020 will also encourage Congress to consider how these needs can best be addressed through government investment in nanomaterials R&D. Additional activities will include the following:

- Review NNI's current R&D portfolio to assess impacts, identify gaps, and suggest future directions for funding.
- Propose development of a nanotechnology center to address chemical industry priorities and develop capabilities for application-based problem solving.

Benchmark energy savings opportunities plant-wide with software tool

Vision2020 and DOE/ITP are now in the final stages of developing a software tool that can identify top energy-savings opportunities plant-wide. The Plant Energy Profiler Tool will enable manufacturers to analyze plant energy-use patterns. The tool has been beta tested by Dupont, Millennium, Rohm and Haas, Reilly Industries, Celanese, 3M, and Formosa Plastics and can be run on a stand-alone PC with an internet browser. The tool will be available on the Vision2020 website in late 2005.

Reach consensus on R&D priorities in process intensification for security

Process intensification involves equipment redesign and process synthesis to intensify and miniaturize process plants and make them more efficient, environmentally friendly, and flexible in responding to market demand. Benefits of these condensed systems include swifter manufacturing and reduced requirements to store potentially dangerous inventory. Vision2020 will work with industry, government, and academia to develop a research roadmap for creating cost-effective chemical plant security solutions based on process intensification.

Explore distillation technologies to boost separation efficiency

New distillation technologies could improve the energy efficiency of separation processes—and the greatest energy savings could be in the manufacture of commodity chemicals. In 2005, Vision2020 will help identify high-priority areas of distillation research for the DOE/ITP Chemicals Program. The results will be published in a roadmap.

Identify critical research needs for next-generation bio-separations

Vision 2020 has identified Driving Gas Phase Equilibrium Processes With Adsorbents and Membranes as a priority bio-based separation technique that could provide significant energy, environmental, security, and economic benefits to the U.S. chemical, petrochemical, and pharmaceutical industries. In 2005, Vision2020 will complete a literature review of commercial practices; analyze energy, environmental, and safety impacts; and conduct a roadmap workshop to establish an R&D agenda.

New roadmap on gas phase equilibrium will target six membrane and adsorbent processes:

- H_2 industrial production in the chemical, petrochemical, and refining industries
- Olefins production (light hydrocarbons)
- Hybrid distillation of azetropes
- Driving reactions by dehydration processing
- CO_2 separation
- Isomerization

About Vision2020

Vision2020 brings chemical companies, academia, and government together

Investing in innovative technology is one of the most effective means to ensure long-term competitiveness in the chemical industry. In today's competitive environment, however, short-term financial expectations and the complexity of research limit a company's ability to independently develop needed technologies. As a result, chemical companies are now sharing the risks and costs of research through collaboration, marking a major milestone for this fiercely competitive industry.

Participating Companies Reap Benefits

- Reducing risks and costs of complex, multidisciplinary R&D
- Leveraging and guiding government R&D investments
- Understanding long-term technology needs and trends
- Gaining access to top scientific expertise and facilities
- Forming collaborative technology relationships and teams to respond to government solicitations

The **Chemical Industry Vision2020 Technology Partnership (Vision2020)** accelerates innovation and technology development in the chemical industry. By bringing together industry, academia, and government on collaborative research and development (R&D) projects, we reduce the risks and enhance the probability of success. Vision 2020 leverages financial and technical resources to establish R&D collaborations to explore promising or emerging technologies that offer broad benefits for the industry. Participating companies work together toward common goals to protect the economic interests of shareholders and to foster a sustainable, internationally competitive chemical industry characterized by continued economic growth, new products, improved processes, and environmental responsibility.

Through collaborative efforts, Vision2020 fosters revolutionary technology innovation. Stakeholders identify common problems and leverage resources to develop the critical enabling technologies of the future. To help maintain U.S. leadership as the world's largest chemical producer, Vision2020 performs the following functions:

- **Organizes forums to reach consensus on priority pre-competitive R&D needs**
- **Provides guidance for government R&D investments**
- **Fosters development of research collaborations**

Technology Advances Propel the Growth of the U.S Chemical Industry and the U.S. Economy

A robust U.S. chemical industry is critically important to the U.S. economy. Chemicals are essential to millions of consumer goods and enable hi-tech advances in our aerospace, computing, and telecommunications industries. Growth of the chemical industry is sustained by technology advances, including the development of basic enabling technology. Partnership among government, industry, and academia is essential to technology advancement and maintaining our competitive edge in a rapidly expanding global market. Federally cost-shared research builds the foundation for future innovation, boosting competitiveness and improving energy and environmental performance throughout the entire economy.

Chemical Industry Snapshot

Percent of Annual GDP	2.0%
Value of Shipments	$459 billion
Employment	908,000
Capital Expenditures	$21.8 billion
Net Trade Balance	-$9.6 billion
Net Energy Consumption	7.3 quads

Vision2020 develops and maintains technology roadmaps that establish consensus on R&D priorities. These roadmaps are powerful tools for guiding academic and government R&D investments that can benefit the entire industry. Vision2020 also publishes reports on diverse topics of broad interest to the chemical industry.

Publications on the following topics are available at www.ChemicalVision2020.org:

- Agile Manufacturing
- Biocatalysis
- Biopower
- Catalysis
- Combinatorial Chemistry
- Computational Chemistry
- Computational Fluid Dynamics
- Energy Systems
- Ionic Liquids
- Materials of Construction
- Materials Technology
- Nanomaterials
- New Process Chemistry
- Process Measurement and Control
- Process Equipment Materials Technology
- Reaction Engineering
- Separations

How Vision2020 Came to Be

In 1994, the White House Office of Science and Technology Policy requested an industrial perspective on how the U.S. government could better allocate R&D funding to advance the manufacturing base of the U.S. economy. In response, chemical industry leaders created the report *Technology Vision 2020: The U.S. Chemical Industry,* which spawned the creation of Vision2020.

The Steering Committee guides the program

The Vision2020 Steering Committee meets quarterly to plan, coordinate, prioritize, and initiate activities for the benefit of all stakeholders—industry, academia, and the public. Member companies have pledged their time and resources to guide the partnership, and also contribute $5,000 annually to cover organization operating costs.

Steering Committee Members:

- Air Products and Chemicals Inc.
- BP
- Ciba Speciality Chemicals
- The Dow Chemical Company
- Eastman Chemical Company
- E.I. du Pont de Nemours and Company
- General Electric Company
- Praxair, Inc.
- Rohm and Haas Company
- Shell
- Solutia
- American Chemical Society
- American Institute of Chemical Engineers
- Council for Chemical Research
- Materials Technology Institute of the Chemical Process Industries, Inc.

The Vision2020 Steering Committee will implement the planned activities in 2005 and respond to opportunities that arise during the year.

Your chemical company can become a member and/or participate on Technical Subcommittees.

For more information, contact:

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Vision2020 Participation in 2004

Companies	**73**
Government Organizations	**17**
Universities	**15**
Professional Organizations	**4**

3D-ID
3M
ACS
AEA Technology
AIChE/DIPPR & CoMSEF
Air Liquide-MEDAL
Air Products and Chemicals, Inc.
Akzo-Nobel
Analytical Specialties
ANL
Archer Daniels Midland
AspenTech
BASF
BOC
BP
Caterpillar
CCR
CDTECH
Ceramatec
CeraMem
Chemical Alliance Zone
ChevronTexaco
Ciba Specialty Chemicals
Colgate-Palmolive
ConocoPhillips
Creusot-Loire
DOC
DOD
DOE
Dow
Dow Corning
DSM
DuPont
Duraloy
Eastman Chemical
Ecole Polytechnique de Montreal
Energy Concepts Co.
Energy Industries of Ohio
Engelhard Corp
EPA
Equistar
ExxonMobil
Fairfield
FDA
Ford
Foster Wheeler
Fluent
Fluor Daniel
GE
Haynes International
Honeywell
Humberside Solutions
Illinois Institute of Technology
Inco Alloys
Integrated Genomics
Intel
Iowa State
KCC Process Equipment
Kellogg Brown & Root
KEMA
Koch-Glitsch
LANL
MATRIC
Membrane Technology & Research
Millennium
MTI
Nanomaterials Research
NETL
NIOSH
NIST
NNCO
Nooter Fabricators
Notre Dame
NSF
ORNL
Particulate Solids Research
Pall
PhotoSense LLC
PNNL
Praxair
Princeton
Purdue
Rampant Technology Partners
Reaction Design
Rice University
Rohm and Haas Company
Rolled Alloys
Royal Military College of Canada
SACHEM
Sandvik Steel
Shell
Siemens Westinghouse
Special Metals Corp
SNL
SRI
Sulzer Chemtech
United Technologies, Inc.
University of Alabama
University of Colorado
University of Michigan
University of Minnesota
University of South Carolina
University of Texas
UOP LLC
U.S. International Trade Commission
U.S. Nanotechnology Coordination Office
VDM
Velocys
Washington University

Vision2020 Steering Committee Members

AIR PRODUCTS
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ROHM AND HAAS
SOLUTIA
Solutions for a better life
DOW
MTI Materials Technology Institute
AIChE
Council for Chemical Research