Energy Challenges in a New Era of Science

Energy, Politics, Society, and Science

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With thanks to Dr. Patricia M. Dehmer
Director, Office of Basic Energy Sciences

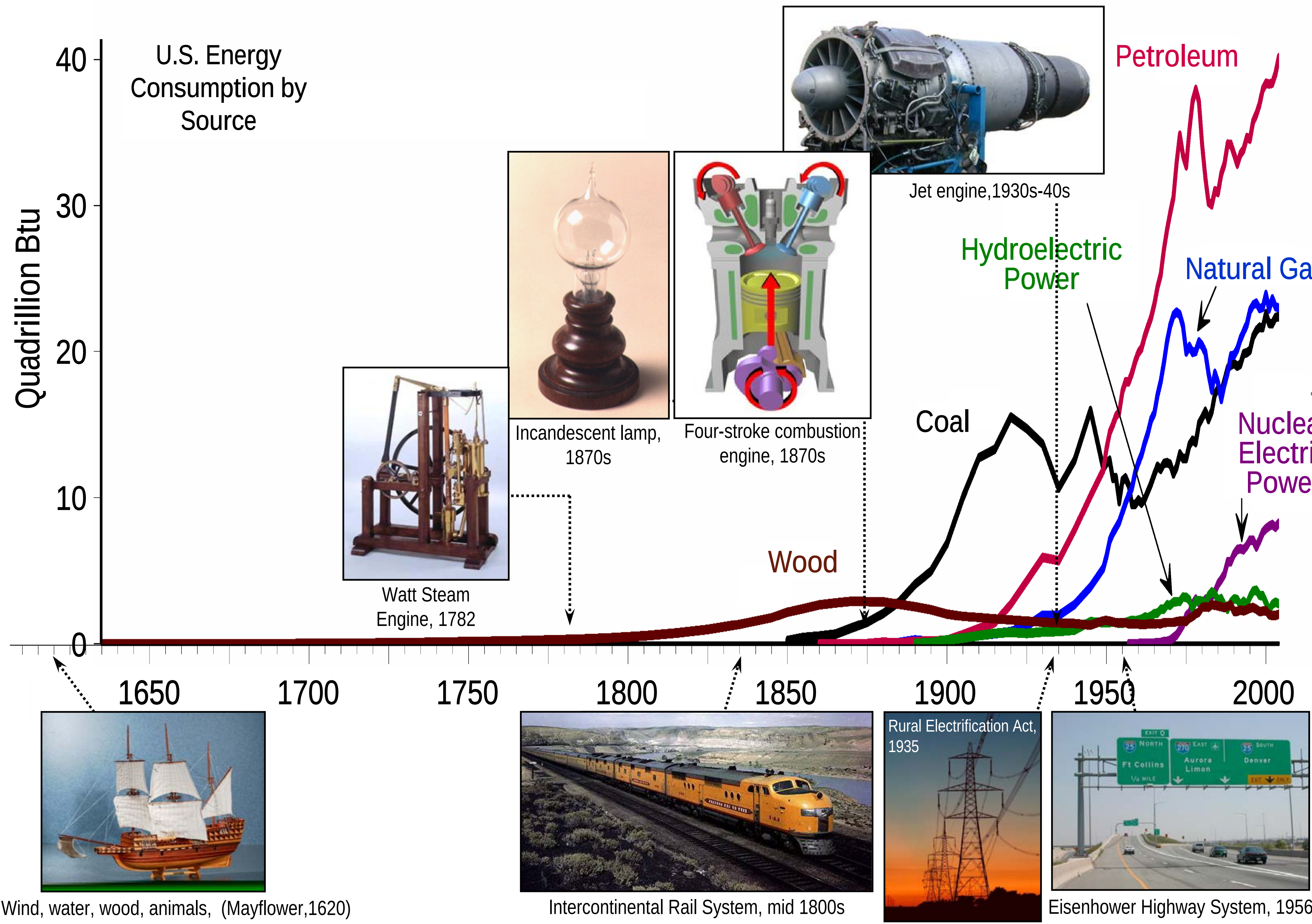
Presented to
The University Materials Council
The City Club at Franklin Square
Washington, DC
May 2, 2006

The Basis of Today's Talk is a presentation made by Dr. Dehmer to the OSTP Hydrogen Task Force on March 21, 2006
Other BES presentations may be found at: http://www.science.doe.gov/bes/presentations/index.html

OFFICE OF SCIENCE
U.S. DEPARTMENT of ENERGY

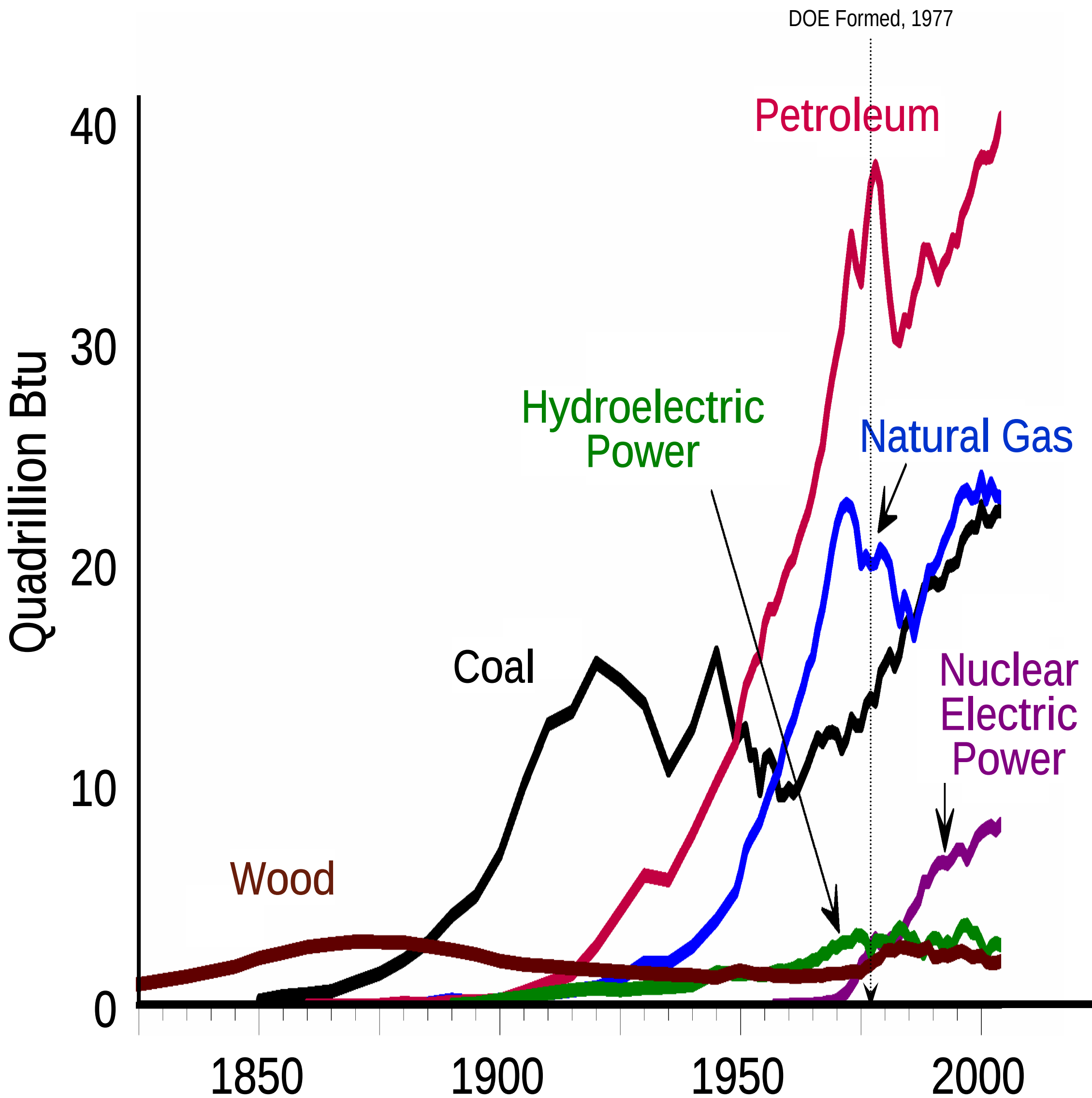
Technology, Energy, and Society are Inextricably Intertwined

Today's Energy Technologies and Infrastructures are Firmly Rooted in the 20th Century

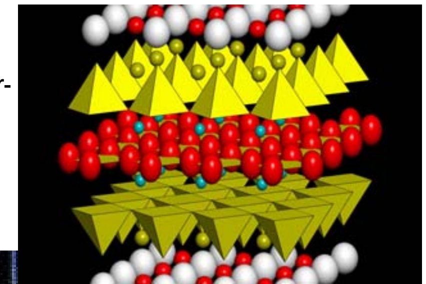


What Will the 21st Century Bring?

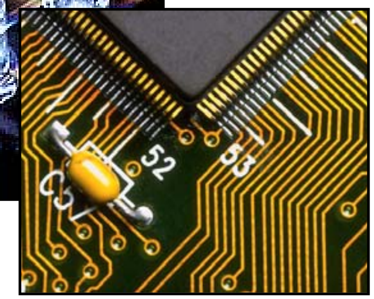
21st Century Science and Technology Will Exert Control at the Atomic, Molecular, and Nanoscale Levels



High Tc super-conductors

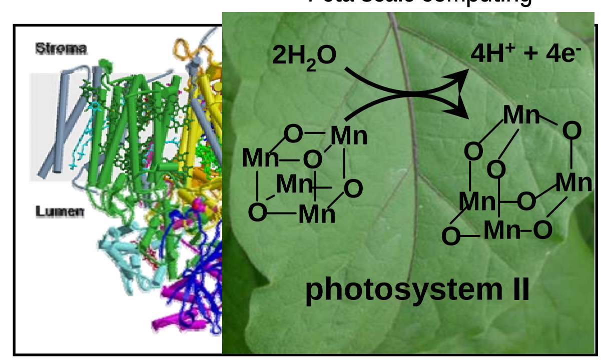


Solid-state lighting and many other applications of quantum confinement



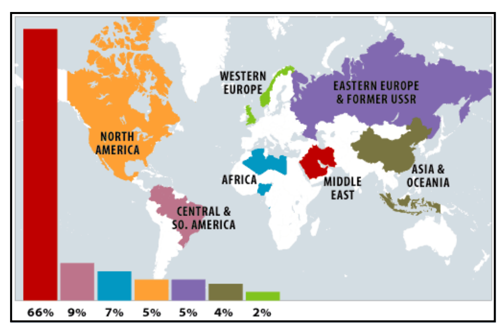
Peta-scale computing

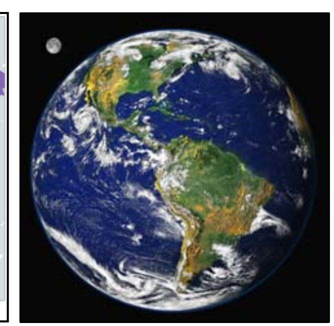
Bio-inspired nanoscale assemblies - self-repairing and defect-tolerant systems.



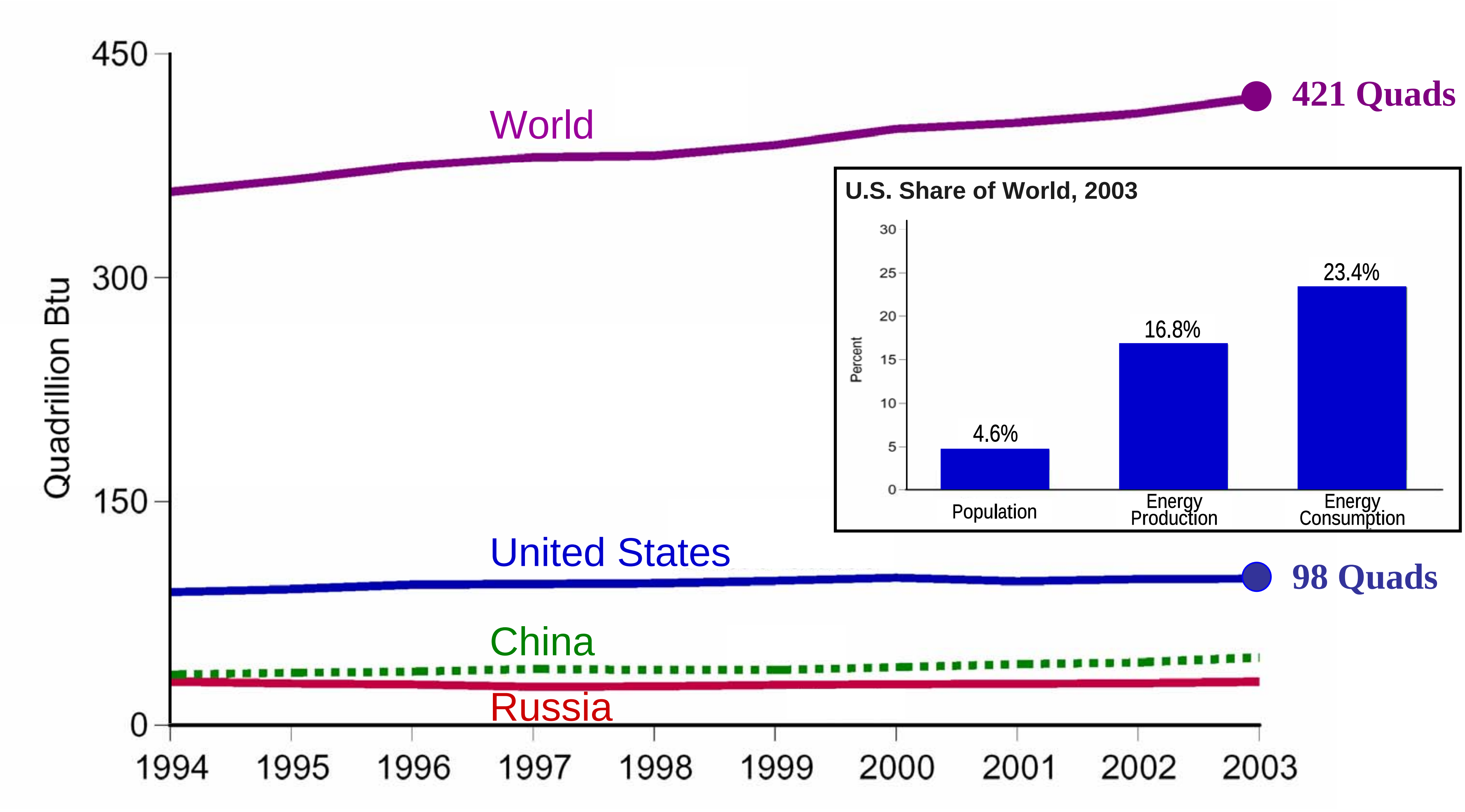
Why change?

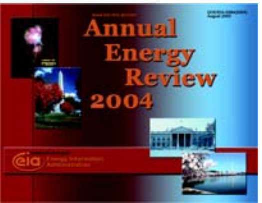
- World-wide supply and distribution of petroleum reserves
- Environmental impacts of fossil fuels





U.S. and World Energy Consumption Today



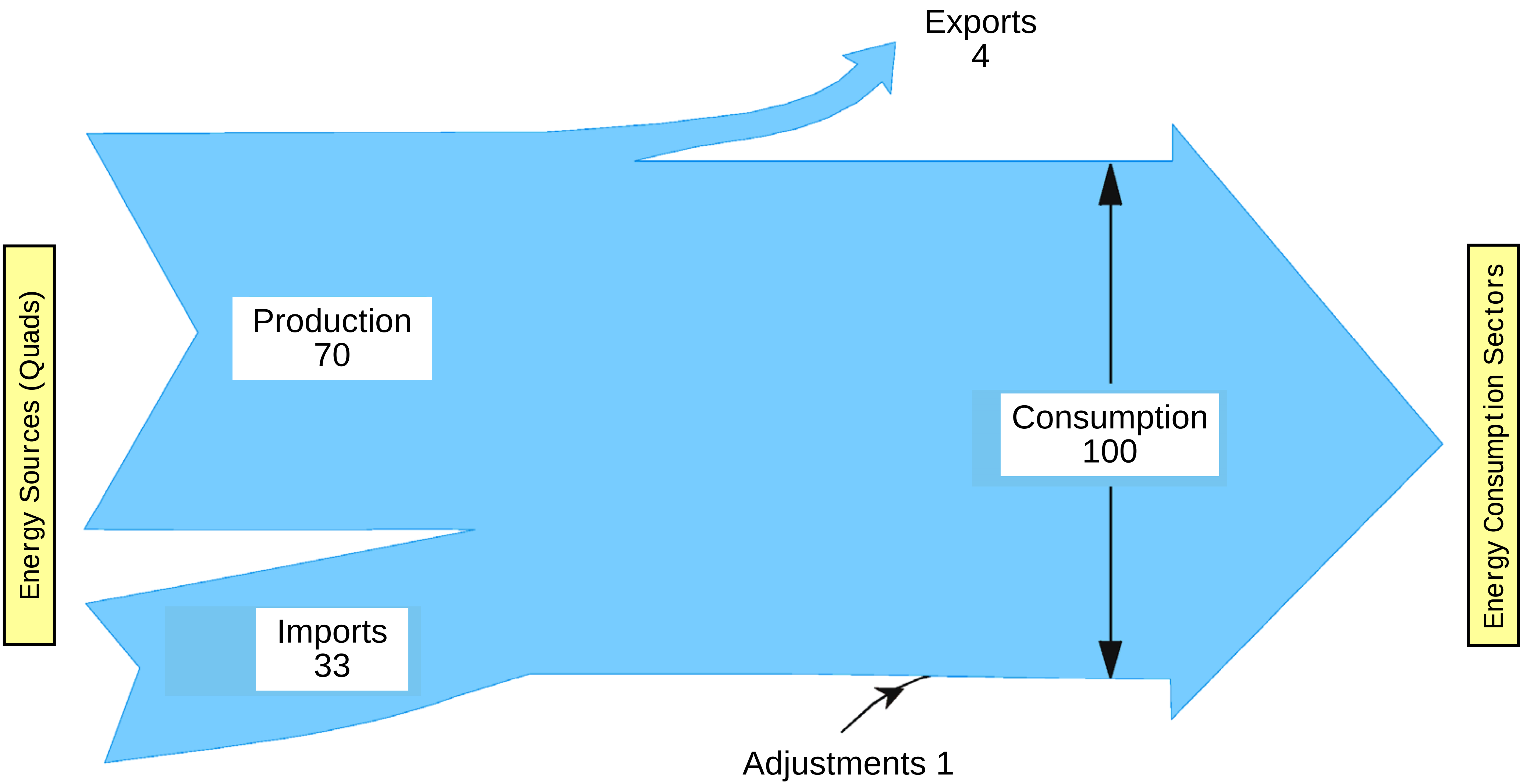


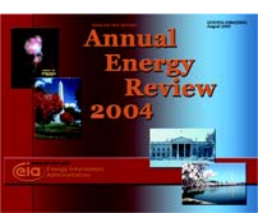
Some equivalent ways of referring to the energy used by the U.S. in 1 year (approx. 100 Quads)

100.0 quadrillion British Thermal Units (Quads)	U.S. & British unit of energy
105.5 exa Joules (EJ)	Metric unit of energy
3.346 terawatt-years (TW-yr)	Metric unit of power (energy/sec)x(#seconds in a year)

U.S. Energy Flow, 2004 (Quads)

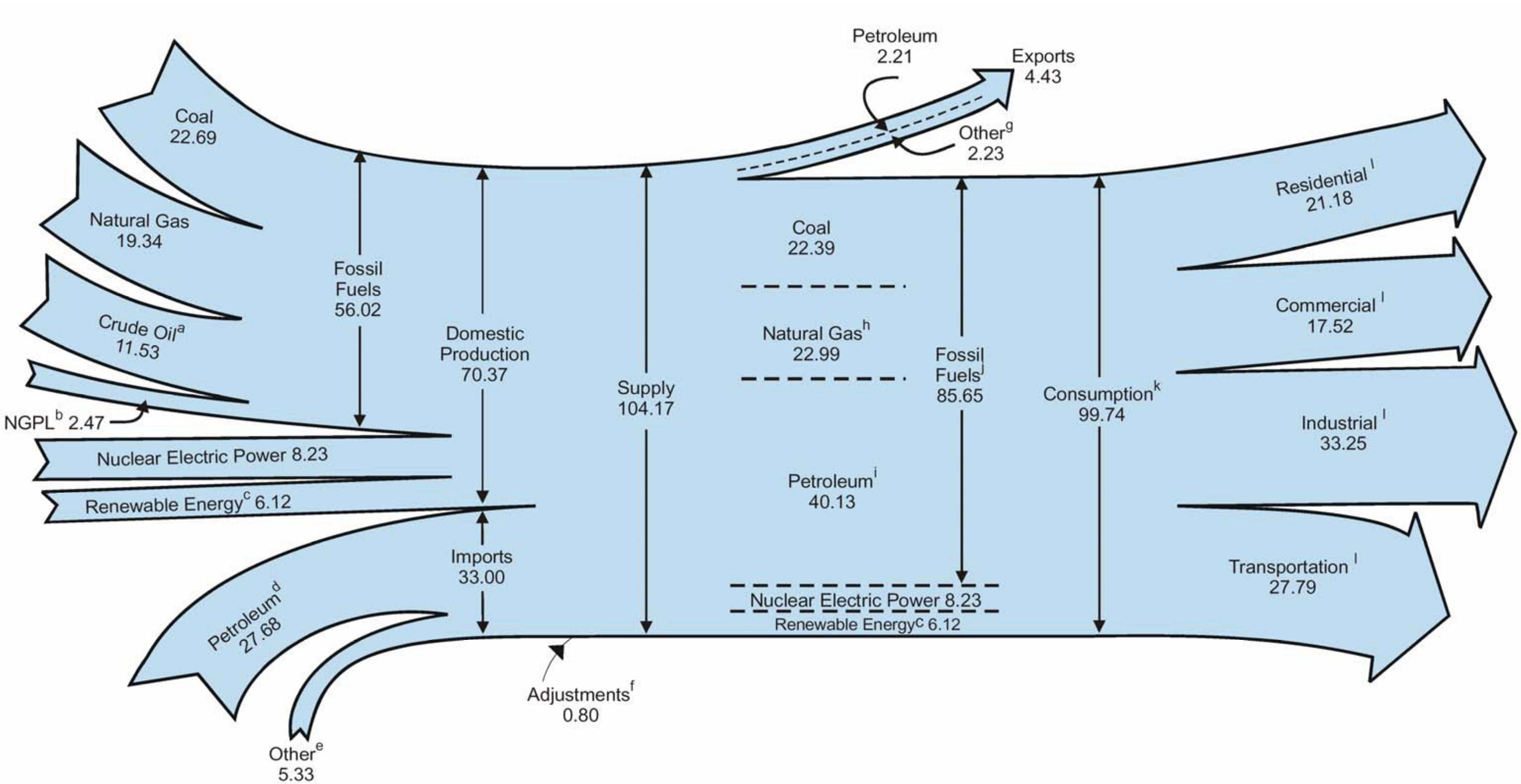
33% of U.S. primary energy is imported

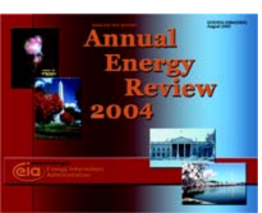




U.S. Energy Flow, 2004 (Quads)

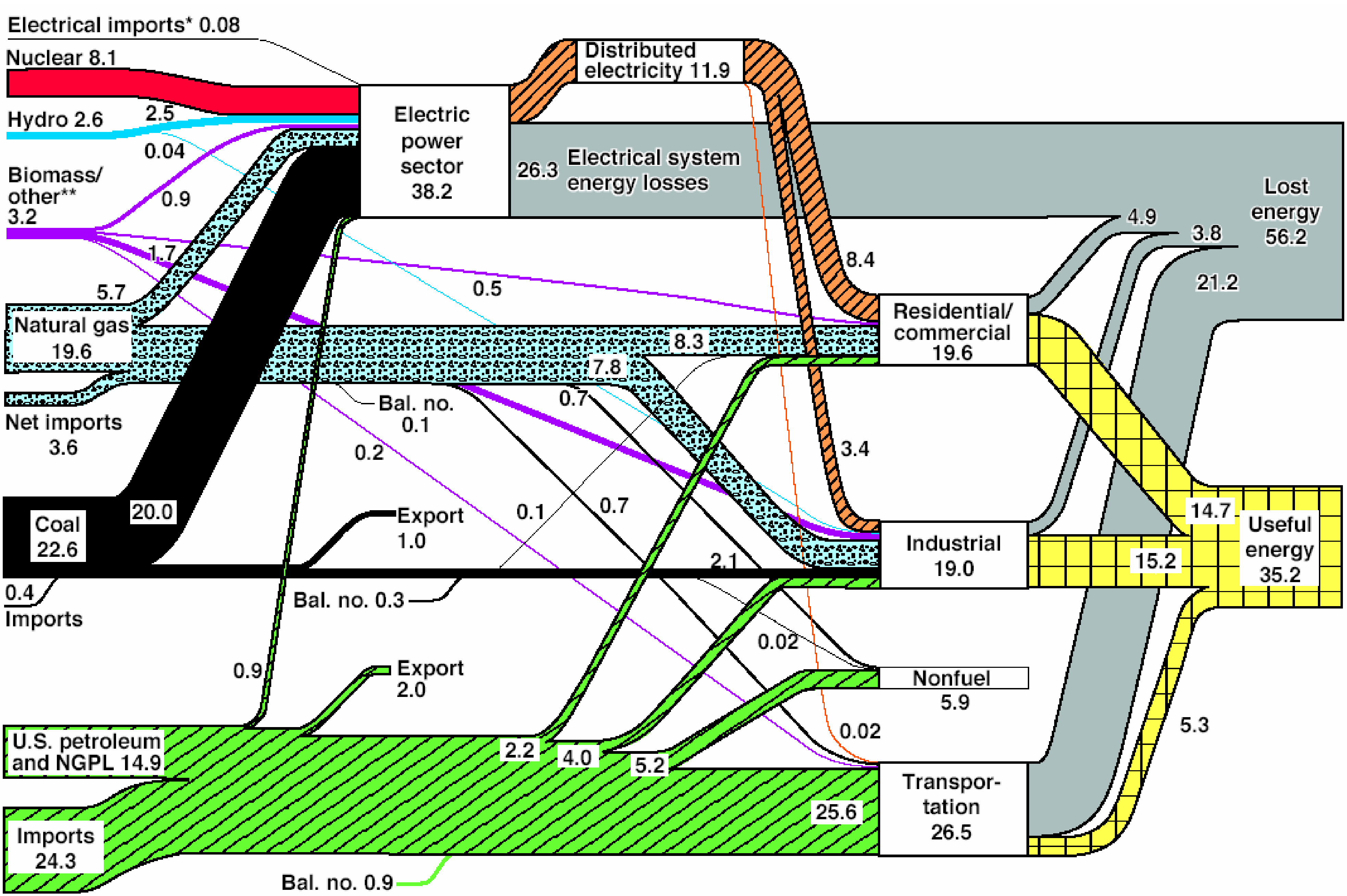
86% of primary energy is from fossil fuels, with 69% of the petroleum imported





U.S. Energy Flow, 2002 (Quads)

80% of energy for the transportation sector and 69% for electricity generation/use is lost



June 2004
Lawrence Livermore National Laboratory
http://eed.llnl.gov/flow

Science for Comprehensive Decades-to-Century Energy Plan

Research for a Secure Energy Future
Supply, Carbon Management, Distribution, Consumption

Decision Science and Complex Systems Science

- **Carbon Energy Sources**
  - Coal
  - Petroleum
  - Natural Gas
  - Oil shale, tar sands, hydrates,...
- **Carbon Management**
  - CO_2 Sequestration
    - Geologic
    - Terrestrial
    - Oceanic
  - Carbon Recycle
  - Global Climate Change Science
- **No-net-carbon Energy Sources**
  - Nuclear Fission
  - Nuclear Fusion
  - Renewables
    - Hydropower
    - Biomass
    - Geothermal
    - Wind
    - Solar
    - Ocean
- **Distribution/ Storage**
  - Electric Grid
  - Electric Storage
  - Hydrogen
  - Alternate Fuels
- **Energy Consumption**
  - Transportation
  - Buildings
  - Industry

Energy Conservation, Energy Efficiency, and Environmental Stewardship

The BES "Basic Research Needs for …" Series of Studies

BASIC RESEARCH NEEDS
TO ASSURE
A SECURE ENERGY FUTURE

A Report from the
Basic Energy Sciences Advisory Committee

RECOMMENDATION: Considering the urgency of the energy problem, the magnitude of the needed scientific breakthroughs, and the historic rate of scientific discovery, current efforts will likely be too little, too late. Accordingly, BESAC believes that a new national energy research program is essential and must be initiated with the intensity and commitment of the Manhattan Project, and sustained until this problem is solved.

February 2003

"Basic Research Needs …" and Other Workshops

Help Define Research Directions and Provide the Links to Societal Needs

- Basic Research Needs to Assure a Secure Energy Future
  BESAC Workshop, October 21-25, 2002
  The foundation workshop that set the model for the focused workshops that follow.
- Basic Research Needs for the Hydrogen Economy
  BES Workshop, May 13-15, 2003
- Nanoscience Research for Energy Needs
  BES and the National Nanotechnology Initiative, March 16-18, 2004
- Basic Research Needs for Solar Energy Utilization
  BES Workshop, April 18-21, 2005
- Advanced Computational Materials Science: Application to Fusion and Generation IV Fission Reactors
  BES, ASCR, FES, and NE Workshop, March 31-April 2, 2004
- The Path to Sustainable Nuclear Energy: Basic and Applied Research Opportunities for Advanced Fuel Cycles
  BES, NP, and ASCR Workshop, September 2005
- Basic Research Needs for Advanced Nuclear Energy Systems
  BES Workshop, July 31-August 3, 2006
- Basic Research Needs for Superconductivity
  BES Workshop, May 8-10, 2006
- Basic Research Needs for Solid-state Lighting
  BES Workshop, May 22-24, 2006
- Basic Research Needs for Combustion of Alternate Fuels
  BES Workshop, October 30-November 1, 2006 (tentative)
- Basic Research Needs for Energy Storage
  BES Workshop, mid FY 2007

The "Basic Research Needs for …" Format

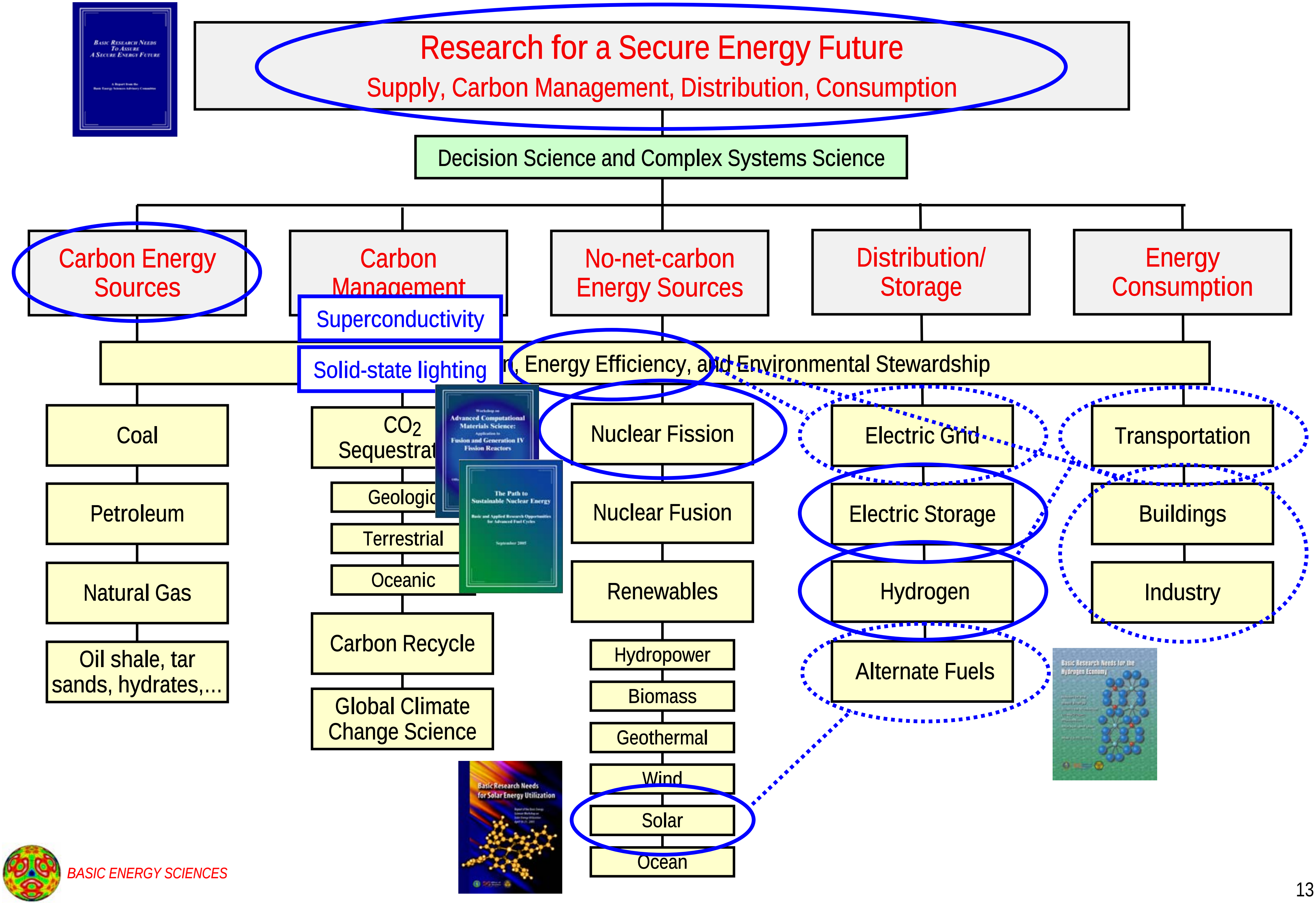
CONTENTS

New Section for Future Workshops:
Crosscutting Science and Grand Challenges

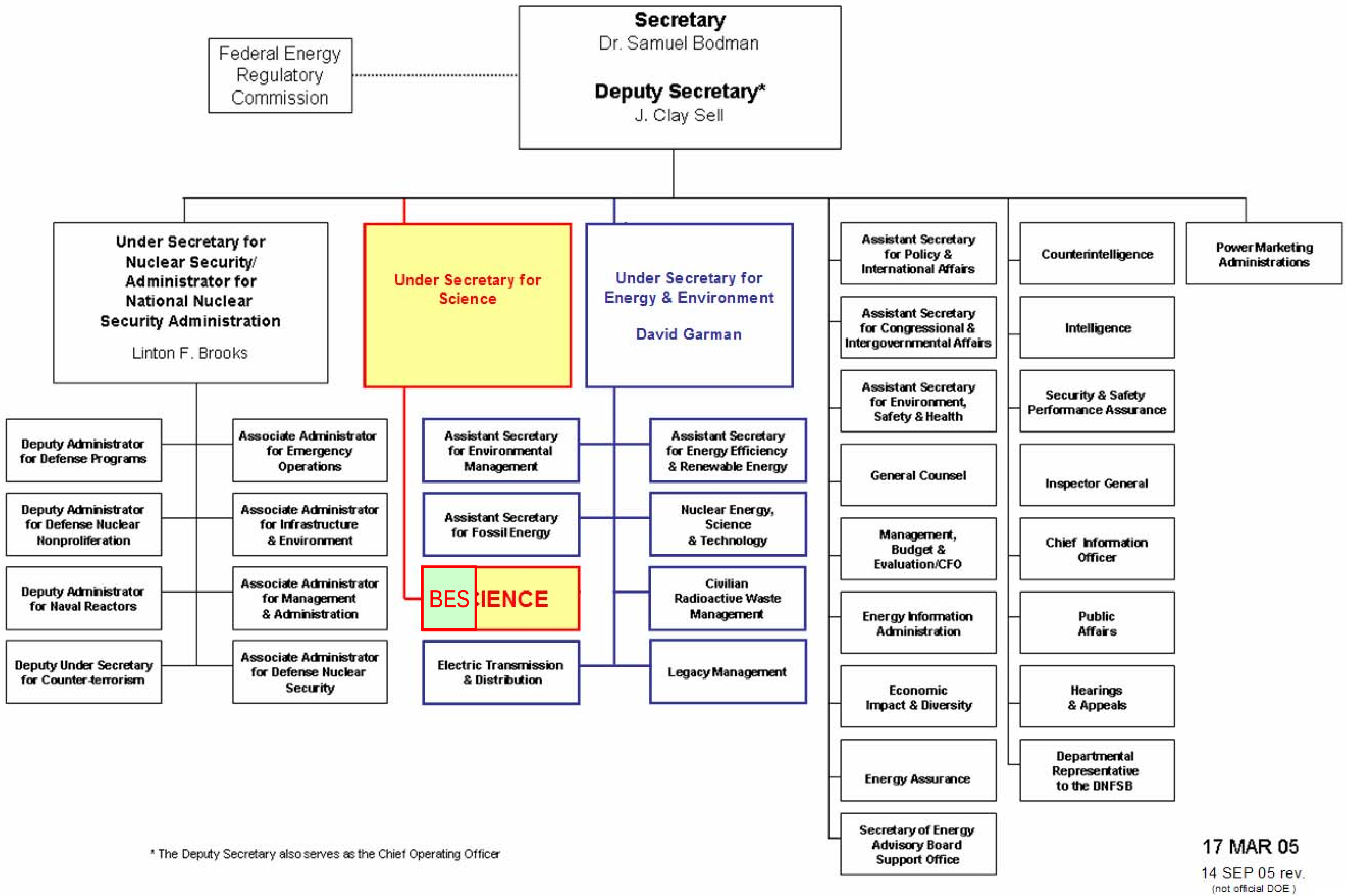
Many Crosscutting Science Research Areas Emerged from the Workshops

- New materials discovery, design, development, and fabrication, especially materials that perform well under extreme conditions
- Science at the nanoscale, especially low-dimensional systems that promise materials with new and novel properties
- Methods to “control” photon, electron, ion, and phonon transport in materials for next-generation energy technologies
- Structure-function relationships in both living and non-living systems
- Designer catalysts
- Interfacial science and **designer membranes** in both chemistry and materials sciences
- Bio-materials and bio-chemical interfaces, especially at the nanoscale where soft matter and hard matter can be joined
- New tools for:
  - Spatial characterization, especially at the atomic and nanoscales and especially for in-situ studies
  - Temporal characterization for studying the time evolution of processes
  - Theory and computation

Tackling the Parts of a Decades-to-Century Energy Plan



DOE's R&D Portfolio – Integrating Science and Technology



* The Deputy Secretary also serves as the Chief Operating Officer

The FY 2007 Congressional Budget Request for BES and SC

(dollars in thousands)

	FY 2005 Approp.	FY 2006 Approp.	FY 2007 President's Request	FY 2007 vs. FY 2006
Basic Energy Sciences...	1,083,616	1,134,557	1,420,980	+286,423
Total, Science...	**3,635,650**	**3,596,391**	**4,101,710**	**+505,319***

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* One half of the $505 million increase is for operations of our scientific facilities, including operations at new facilities: the Spallation Neutron Source and the Center for Nanophase Materials Sciences at Oak Ridge; the Center for Nanoscale Materials at Argonne; the Molecular Foundry at Berkeley; and the Center for Integrated Nanotechnologies at Sandia and Los Alamos National Laboratories. Research is increased by $237 million, 47% of the $505 million increase.

FY 2007 Solicitations and Program Web Announcements

	$ in thousands	FY 2005 Conf. Approp.	FY 2006 Rescission	FY 2007 President's Request	Delta FY06-FY07	% increase
	Research	**477,524**	**433,125**	**536,001**	**102,876**	**23.8%**
BAA*	Core Research	448,341	400,625	409,454	8,829	2.2%
S	Hydrogen	29,183	32,500	50,000	17,500	53.8%
S	Solar Energy Utilization			34,115	34,115	
S	Advanced Nuclear Energy Systems			12,432	12,432	
A	Ultrafast Science			10,000	10,000	
S	Mid-Scale Instrumentation			10,000	10,000	
S in FY05	Chemical Imaging			5,000	5,000	
A	Complex Systems/Emergent Behavior			5,000	5,000	

* BAA = Broad Agency Announcement for research within the core programs. Note that about $10 million for X-ray and neutron scattering instrumentation within the core will be competed with mid-scale instrumentation in the same solicitation.

Basic Research for Solar Energy Utilization

- http://www.science.doe.gov/grants/FAPN06-15.html
  http://www.science.doe.gov/grants/LAB06_15.html
- $34.1 million increase requested for FY2007!
- Workshop report: *Basic Research Needs for Solar Energy Utilization* may be found at
  http://www.sc.doe.gov/bes/reports/files/SEU_rpt.pdf
- **PREAPPLICATIONS REQUIRED:** June 5, 2006; Notification of results by August 11, 2006; For the successful preapplicants, full applications will be due November 14, 2006.
- **"This Notice solicits innovative basic research proposals to establish the scientific basis that underpins the efficient *capture, conversion, and utilization* of solar energy in a cost-effective manner. We seek to support outstanding fundamental research programs that will lead to key discoveries and conceptual breakthroughs to make sunlight as the practicable solution to meet our compelling need for clean, abundant sources of energy. As in the workshop report, three broad areas that encompass many of the priority research directions will be the subject of this solicitation. They are:**

  1. Solar to Electric Conversion
  2. Solar Fuels Production
  3. Solar Thermal Energy Utilization"

Basic Research for the Hydrogen Fuel Initiative

- http://www.science.doe.gov/grants/FAPN06-17.html
  http://www.science.doe.gov/grants/LAB06_17.html
- $17.5 million increase requested for FY2007!
- Workshop report: *Basic Research Needs for the Hydrogen Economy* may be found at http://www.science.doe.gov/bes/hydrogen.pdf
- **PREAPPLICATIONS REQUIRED:** July 6, 2006, 4:30 pm Eastern Time. Notification of results by September 12, 2006; For the successful preapplicants, full applications will be due December 12, 2006.
- **"We seek to support outstanding fundamental research programs potentially leading to discoveries and breakthroughs, focused on primarily three broad areas:**

  1. Novel Materials for Hydrogen Storage
  2. Functional Membranes
  3. Nanoscale Catalysts"

Basic Research for Advanced Nuclear Energy Systems

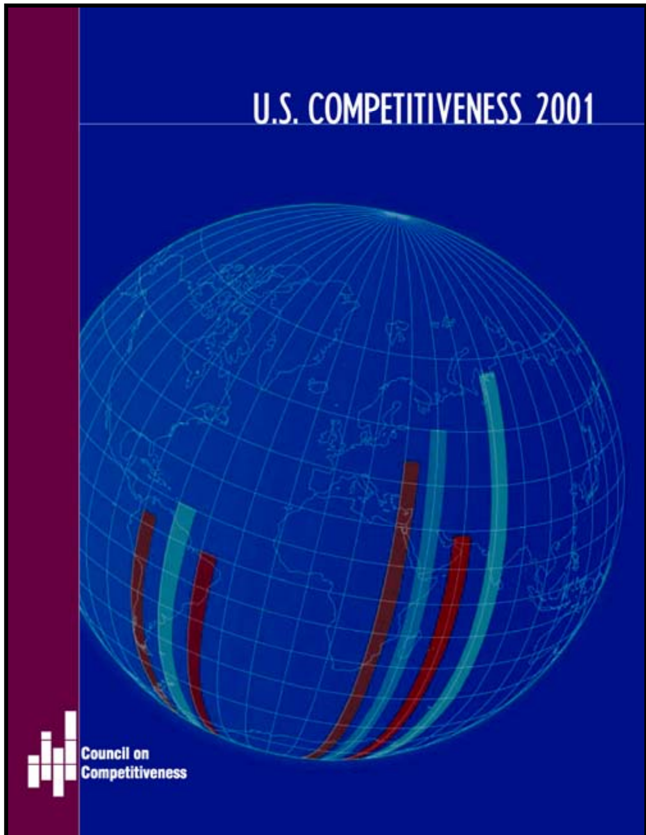
- Announcement of intent to issue solicitation: February 16, 2006. Anticipated posting of solicitation, October 1, 2006.
- $12.4 million increase requested for FY2007!
- PREAPPLICATIONS WILL BE REQUIRED: anticipated due date in early December 2006; Anticipated notification of results by early January 2007; For the successful preapplicants, it is anticipated that full applications will be due in either late March or early April 2007.

Many deserve our thanks …

…in DOE, EOP, OSTP, OMB, Congress, NAS, and the science communities.

So, … how did these increases happen?

U.S. Competitiveness – A Theme that Runs Deep



U.S. Competitiveness 2001: Strengths, Vulnerabilities and Long Term Priorities, Council on Competitiveness

http://www.compete.org/pdf/Highlights.pdf

"Given the rising bar for competitiveness, the United States needs to be in the lead or among the leaders in every major field of research to sustain its innovation capabilities."

- Increase national investment in frontier research
- Strengthen support for fundamental disciplines that have been neglected
- Expand the pool of U.S. scientists and engineers
  - upgrade K-12 math and science education
  - broaden the S&E pipeline to include women and minorities
  - create incentives for higher education institutions to increase the numbers of graduates in scientific, engineering and technical disciplines
- Modernize the nation's research infrastructure

Congressman Wolf Letter to President Bush – Triple Basic R&D

May 3, 2005

Dear Mr. President:

America today finds herself at a crossroads when it comes to leading the world in science and innovation. We can continue down the current path, as other nations continue to narrow the gap, or we can take bold, dramatic steps to ensure U.S. economic leadership in the 21st century and a rising standard of living for all Americans.

I know you share my concern about the future competitiveness of American industry and are committed to improving job opportunities for all Americans. However, our current levels of investment in innovative research and development are not enough to keep us at the forefront. Countries such as China and India are quickly gaining ground on the United States and few people realize it. This trend should be setting off alarm bells, especially as more high-tech products, and the high-tech jobs behind them, are located elsewhere. …

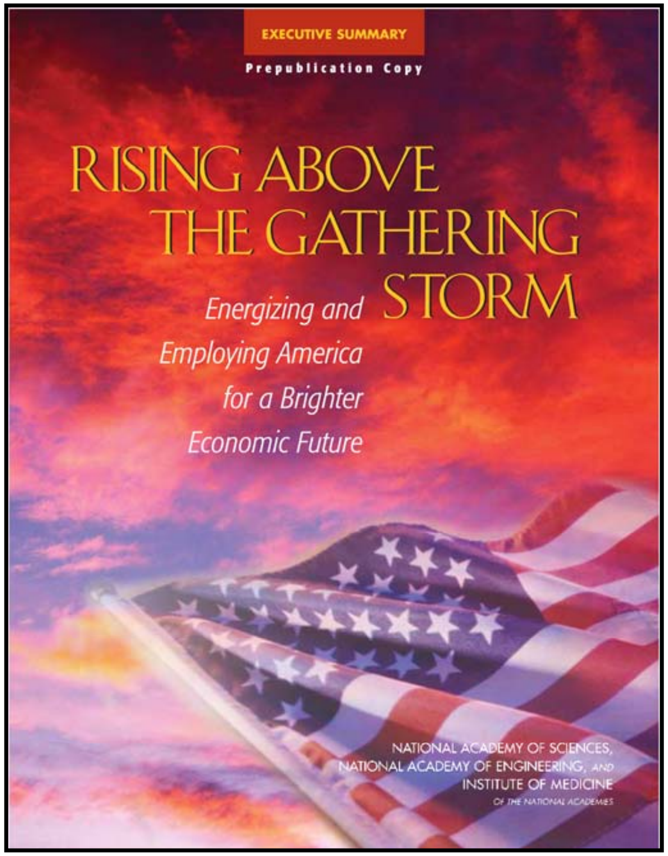
Federal research support serves two essential purposes. First, it supports the research required to fuel continued innovation and economic growth. Second, because much of it takes place at the nation's colleges and universities, it plays a critical role in training our next generation of scientists, engineers, mathematicians and others who will comprise the future scientific and technological workforce. I am concerned that with the current levels of federal investment in research and technology our country will fall victim to the fierce manpower competition we face from developing countries.

America has a proud history of rising to the occasion. We need to be mobilized as we were after the former Soviet Union launched Sputnik, when we made a commitment in the late 1950s to build our space program and greatly enhance our educational system in the name of national defense through the passage of the National Defense Education Act. Most recently we fulfilled the commitment to double the National Institutes of Health budget to jump-start work on medical research to help find cures to debilitating and fatal diseases.

Our nation must make a similar bold commitment to invest in the future of our country by tripling the innovation budget - federal basic research and development - over the next decade. We need to inspire young people to study math and science. As chairman of the Science-State-Justice-Commerce Appropriations subcommittee, I understand the difficult budget environment the nation is facing. But bold leadership from the White House will help establish this as a national priority in your next budget request to the Congress.

We must ensure for future generations that America continues to be the innovation leader of the world. Investing in research and development is a critical part of optimizing our nation for innovation, a process that will require strong leadership and involvement from government, industry, academia and labor. We must choose whether to innovate or abdicate.

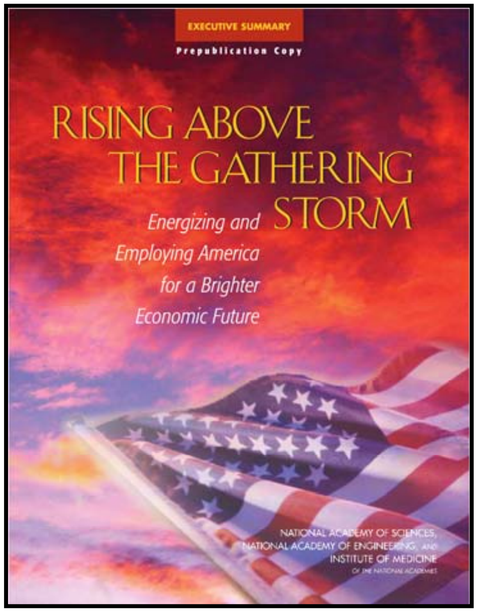
Rising Above the Gathering Storm:
Energizing and Employing America for a Brighter Economic Future



http://newton.nap.edu/books/0309100399/html
http://newton.nap.edu/execsumm_pdf/11463.pdf

- In the late spring of 2005, the National Academies were charged by Congress through two letters, one from Senators Lamar Alexander (R, TN) and Jeff Bingaman (D, NM) *[Energy and Natural Resources Committee]* and one from Representatives Sherwood Boehlert (R, NY) and Bart Gordon (D, TN) *[Committee on Science]*, to address the subject of America's competitiveness.
- The National Academies' Committee on Science, Education, and Public Policy (COSEPUP) established the Committee on Prospering in the Global Economy of the 21st Century: An Agenda for American Science and Technology.
- The Committee of 20 was chaired by Norman Augustine, retired Chairman and CEO of Lockheed Martin.
- The committee assembled issue papers and convened focus groups in K-12 education, higher education, research, innovation and workforce issues, and national and homeland security.
- The key thematic issues underlying the discussions were the nation's need to create jobs and the need for affordable, clean, and reliable energy.
- The report was released on October 12, 2005.

SUMMARY OF RECOMMENDATIONS: Rising Above the Gathering Storm



RECOMMENDATION A: Increase America's talent pool by vastly improving K–12 science and mathematics education.

RECOMMENDATION B: Sustain and strengthen the nation's traditional commitment to long-term basic research that has the potential to be transformational to maintain the flow of new ideas that fuel the economy, provide security, and enhance the quality of life.

Action B-1: *Increase the federal investment in long-term basic research by 10% a year over the next 7 years.*

Action B-5: *Create in the Department of Energy (DOE) an organization like the Defense Advanced Research Projects Agency (DARPA) called the Advanced Research Projects Agency-Energy (ARPA-E).*

RECOMMENDATION C: Make the United States the most attractive setting in which to study and perform research so that we can develop, recruit, and retain the best and brightest students, scientists, and engineers from within the United States and throughout the world.

RECOMMENDATION D: Ensure that the United States is the premier place in the world to innovate; invest in downstream activities such as manufacturing and marketing; and create high-paying jobs that are based on innovation by modernizing the patent system, realigning tax policies to encourage innovation, and ensuring affordable broadband access.

ALL RECOMMENDATIONS: Rising Above the Gathering Storm

RECOMMENDATION A: Increase America's talent pool by vastly improving K–12 science and mathematics education.

Action A-1: Annually recruit 10,000 science and mathematics teachers by awarding 4-year scholarships and thereby educating 10 million minds.

Action A-2: Strengthen the skills of 250,000 teachers through training and education programs at summer institutes, in master's programs, and Advanced Placement and International Baccalaureate (AP and IB) training programs and thus inspire students every day.

Action A-3: Enlarge the pipeline by increasing the number of students who take AP and IB science and mathematics courses.

RECOMMENDATION B: Sustain and strengthen the nation's traditional commitment to long-term basic research that has the potential to be transformational to maintain the flow of new ideas that fuel the economy, provide security, and enhance the quality of life.

Action B-1: Increase the federal investment in long-term basic research by 10% a year over the next 7 years.

Action B-2: Provide new research grants of $500,000 each annually, payable over 5 years, to 200 of our most outstanding early-career researchers.

Action B-3: Institute a National Coordination Office for Research Infrastructure to manage a centralized research-infrastructure fund of $500 million per year over the next 5 years

Action B-4: Allocate at least 8% of the budgets of federal research agencies to discretionary funding.

Action B-5: Create in the Department of Energy (DOE) an organization like the Defense Advanced Research Projects Agency (DARPA) called the Advanced Research Projects Agency-Energy (ARPA-E).

Action B-6: Institute a Presidential Innovation Award to stimulate scientific and engineering advances in the national interest.

RECOMMENDATION C: Make the United States the most attractive setting in which to study and perform research so that we can develop, recruit, and retain the best and brightest students, scientists, and engineers from within the United States and throughout the world.

Action C-1: Increase the number and proportion of US citizens who earn physical-sciences, life-sciences, engineering, and mathematics bachelor's degrees by providing 25,000 new 4-year competitive undergraduate scholarships each year to US citizens attending US institutions.

Action C-2: Increase the number of US citizens pursuing graduate study in "areas of national need" by funding 5,000 new graduate fellowships each year.

Action C-3: Provide a federal tax credit to encourage employers to make continuing education available (either internally or though colleges and universities) to practicing scientists and engineers.

Action C-4: Continue to improve visa processing for international students and scholars.

Action C-5: Provide a 1-year automatic visa extension to international students who receive doctorates or the equivalent in science, technology, engineering, mathematics, or other fields of national need at qualified US institutions to remain in the United States to seek employment. If these students are offered jobs by United States-based employers and pass a security screening test, they should be provided automatic work permits and expedited residence status.

Action C-6: Institute a new skills-based, preferential immigration option.

Action C-7: Reform the current system of "deemed exports."

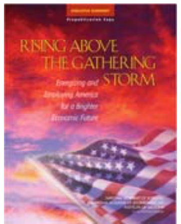
RECOMMENDATION D: Ensure that the United States is the premier place in the world to innovate; invest in downstream activities such as manufacturing and marketing; and create high-paying jobs that are based on innovation by modernizing the patent system, realigning tax policies to encourage innovation, and ensuring affordable broadband access.

Action D-1: Enhance intellectual-property protection for the 21st century global economy.

Action D-2: Enact a stronger research and development tax credit to encourage private investment in innovation.

Action D-3: Provide tax incentives for United States based innovation.

Action D-4: Ensure ubiquitous broadband Internet access.



COMMITTEE MEMBERSHIP: Rising Above the Gathering Storm

NORMAN R. AUGUSTINE [NAE*] (Chair) is the retired chairman and CEO of the Lockheed Martin Corporation. He serves on the President's Council of Advisors on Science and Technology and has served as undersecretary of the Army. He is a recipient of the National Medal of Technology.

CRAIG BARRETT [NAE] is chairman of the Board of the Intel Corporation.

GAIL CASSELL [IOM*] is vice president for scientific affairs and a Distinguished Lilly Research Scholar for Infectious Diseases at Eli Lilly and Company.

STEVEN CHU [NAS*] is the director of the E.O. Lawrence Berkeley National Laboratory. He was a cowinner of the Nobel prize in physics in 1997.

ROBERT GATES is the president of Texas A&M University and served as Director of Central Intelligence.

NANCY GRASMICK is the Maryland state superintendent of schools.

CHARLES HOLLIDAY JR. [NAE] is chairman of the Board and CEO of DuPont.

SHIRLEY ANN JACKSON [NAE] is president of Rensselaer Polytechnic Institute. She is the immediate past president of the American Association for the Advancement of Science and was chairman of the US Nuclear Regulatory Commission.

ANITA K. JONES [NAE] is the Lawrence R. Quarles Professor of Engineering and Applied Science at the University of Virginia. She served as director of defense research and engineering at the US Department of Defense and was vice-chair of the National Science Board.

JOSHUA LEDERBERG [NAS/IOM] is the Sackler Foundation Scholar at Rockefeller University in New York. He was a cowinner of the Nobel prize in physiology or medicine in 1958.

RICHARD LEVIN is president of Yale University and the Frederick William Beinecke Professor of Economics.

C. D. (DAN) MOTE JR. [NAE] is president of the University of Maryland and the Glenn L. Martin Institute Professor of Engineering.

CHERRY MURRAY [NAS/NAE] is the deputy director for science and technology at Lawrence Livermore National Laboratory. She was formerly the senior vice president at Bell Labs, Lucent Technologies.

PETER O'DONNELL JR. is president of the O'Donnell Foundation of Dallas, a private foundation that develops and funds model programs designed to strengthen engineering and science education and research.

LEE R. RAYMOND [NAE] is the chairman of the Board and CEO of Exxon Mobil Corporation.

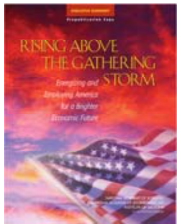
ROBERT C. RICHARDSON [NAS] is the F. R. Newman Professor of Physics and the vice provost for research at Cornell University. He was a cowinner of the Nobel prize in physics in 1996.

P. ROY VAGELOS [NAS/IOM] is the retired chairman and CEO of Merck & Co., Inc.

CHARLES M. VEST [NAE] is president emeritus of MIT and a professor of mechanical engineering. He serves on the President's Council of Advisors on Science and Technology and is the immediate past chair of the Association of American Universities.

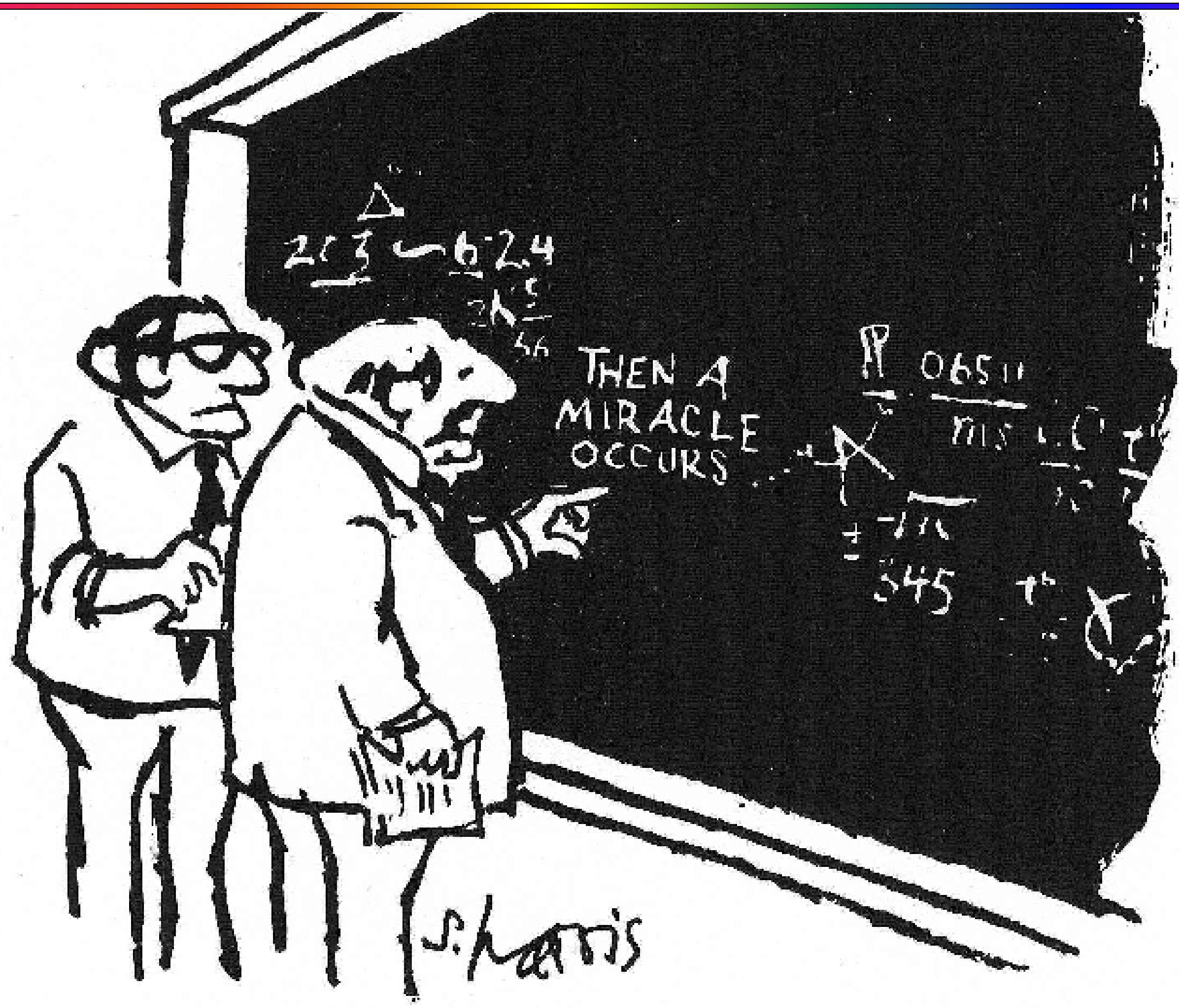
GEORGE M. WHITESIDES [NAS/NAE] is the Woodford L. & Ann A. Flowers University Professor at Harvard University. He has served as an adviser for the National Science Foundation and the Defense Advanced Research Projects Agency.

RICHARD N. ZARE [NAS] is the Marguerite Blake Wilbur Professor of Natural Science at Stanford University. He was chair of the National Science Board from 1996 to 1998.



Between October 2005 and January 2006

A miracle occurs



"I think you should be more explicit here in step two."

The American Competitiveness Initiative

"Tonight I announce the **American Competitiveness Initiative** to encourage innovation throughout our economy and to give our nation's children a firm grounding in math and science. First, I propose to double the federal commitment to the most critical basic research programs in the physical sciences over the next 10 years. This funding will support the work of America's most creative minds as they explore promising areas such as nanotechnology, supercomputing and alternative energy sources."

White House photo by Eric Draper

State of the Union Address
Tuesday, January 31, 2006

How the Competitiveness Initiative Came About

To many physical scientists, the American Competitiveness Initiative (ACI) announced this month by President George W. Bush may seem like manna from heaven: It would double over 10 years the combined $9.5 billion budgets of the National Science Foundation (NSF), core programs at the National Institute of Standards and Technology (NIST), and the Office of Science at the Department of Energy (DOE), starting with a $910 million boost in 2007 (*Science*, 10 February, p. 762). But it has more earthly political roots. In addition to signaling the Bush Administration's support for basic research in the physical sciences, the initiative provides a window on how this Administration makes science policy.

ACI is a $136 billion package of proposals whose most costly component—an estimated $4.6 billion in 2007 and $86 billion over 10 years—would make permanent a tax credit for companies that increase their research budgets. Its doubling provision would cost $50 billion over a decade. ACI also contains a 1-year infusion of $380 million for the Department of Education to improve math and science in the nation's elementary and secondary schools.

These ideas—and many others—have been blowing around Washington, D.C., for years. Bush has repeatedly sought to make the tax credit permanent, for example, and in 2002, Congress passed a bill that would double NSF's budget over 5 years, although that hasn't happened. The winds picked up in 2005, as a bevy of reports, speeches, and legislation urged a greater federal investment in research and science and math education to sustain U.S. economic might.

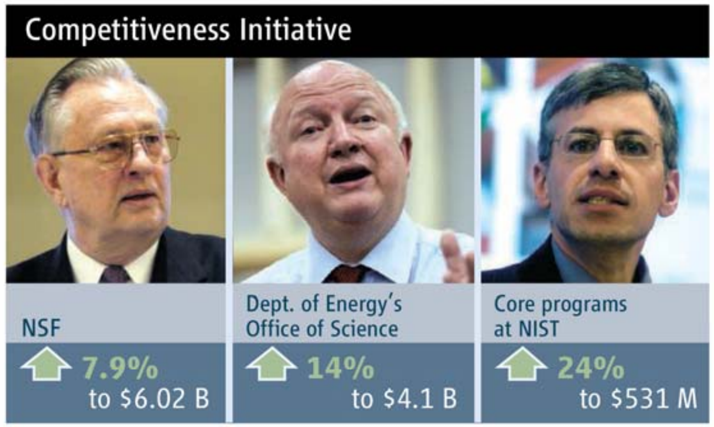
In searching for a tipping point that led to the unveiling of the initiative in the president's 31 January State of the Union speech, the media quickly settled on a couple of December meetings at the White House. There, high-tech industry CEOs and scientific leaders discussed a prescription for change laid out in an October report from the National Academies entitled *Rising Above the Gathering Storm* (*Science*, 21 October 2005, p. 423). But the history is more complicated—and more interesting.

Presidential science adviser John Marburger had actually proposed similar funding increases for the same three agencies that are the focus of the initiative—NSF, NIST, and DOE—more than a year ago, on a one-time basis. But White House budget officials were initially cool to the idea. (NSF Director Arden Bement had asked for a 15% boost in that same 2006 budget cycle but was granted only 2.5%.) "There's no question that the physical sciences weren't being funded to take advantage of the opportunities that exist," Marburger told *Science* this week. "The money needs to be very targeted, however."

This time around, Marburger had help from Samuel Bodman, a former Massachusetts Institute of Technology chemical engineering professor and corporate CEO who in January 2005 became Energy Secretary. Bodman lobbied hard for what eventually became a 14% increase for his agency's Office of Science, emphasizing the value of national user facilities such as the synchrotron and spallation sources. Marburger also benefited from the release of the academies' report just as the 2007 budget requests were under scrutiny.

Within days, the president's economic advisers tackled the issue, and by the beginning of December, White House staffers had prepared an initiative for the president. The document also provided talking points for Cabinet secretaries to use at a series of closed-door meetings with CEOs, university presidents, and other stakeholders during a 6 December Innovation Summit organized by the Commerce Department at the behest of representatives Frank Wolf (R–VA), Vernon Ehlers (R–MI), and other science advocates in the House. "Industry was the most recent sector to be brought in," Marburger notes, "although the momentum had been building for some time."

With high-tech executives on board, some in the White House were worried that any competitiveness initiative would be seen as self-interested lobbying for a permanent tax credit. So Chief of Staff Andrew Card sent word to several leaders in the scientific community asking for their views about some type of innovation initiative. Not surprisingly, he received a flood of supportive comments.



Triumphant trio. NSF Director Arden Bement, DOE Secretary Samuel Bodman, and NIST Chief William Jeffrey applaud the president's new initiative.

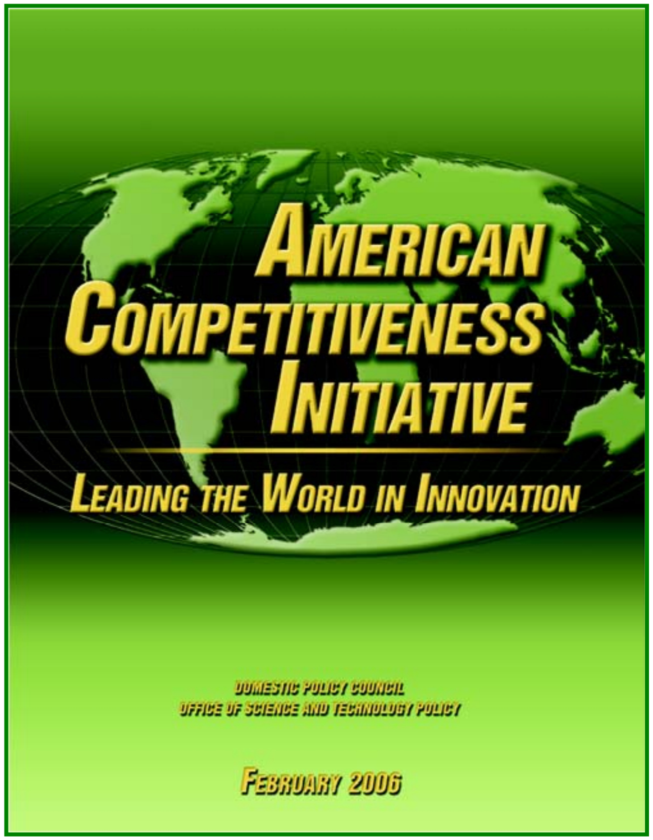
SOURCE: 2007 BUDGET; (IMAGES, LEFT AND RIGHT): CHRIS MADDALONI; (CENTER) STEVEN SENNE/AP PHOTO

After the decision was made in mid-January to have the president propose ACI, the details were held in strict confidence until the day of the speech. Agency heads were told only that they had been selected for a "science initiative," and information was dribbled out by various Administration officials in the 6 days between the president's address and his budget submission. Although her agency is slated to receive only a tiny slice of the ACI pie, Education Secretary Margaret Spellings was given a starring role. Custodian of the Administration's signature No Child Left Behind program and a fellow Texan with strong ties to the president, Spellings led off a hastily arranged press briefing by four Cabinet secretaries the morning after the initiative was announced.

Now that the president has spoken, Congress must decide whether it will give each agency what Bush has requested—and for the designated programs. Despite an overall budget for 2007 that would reduce domestic discretionary spending, Wolf, who chairs the spending panel with jurisdiction over NSF and NIST, flat-out promises that both agencies "will get their number." (NSF is pegged for a 7.9% boost, and NIST's core programs would rise by 24% once projects earmarked by individual members are removed from the budget.) "I don't plan to spend a year talking about it, like we had to do last year," Wolf adds. "We're going to get it done."

–JEFFREY MERVIS

The American Competitiveness Initiative



"The centerpiece of the American Competitiveness Initiative is President Bush's strong commitment to double investment over 10 years in key Federal agencies that support basic research programs in the physical sciences and engineering."

"America's economic strength and global leadership depend in large measure on our Nation's ability to generate and harness the latest in scientific and technological developments and to apply these developments to real world applications. These applications are fueled by: scientific research, which produces new ideas and new tools that can become the foundation for tomorrow's products, services, and ways of doing business; …

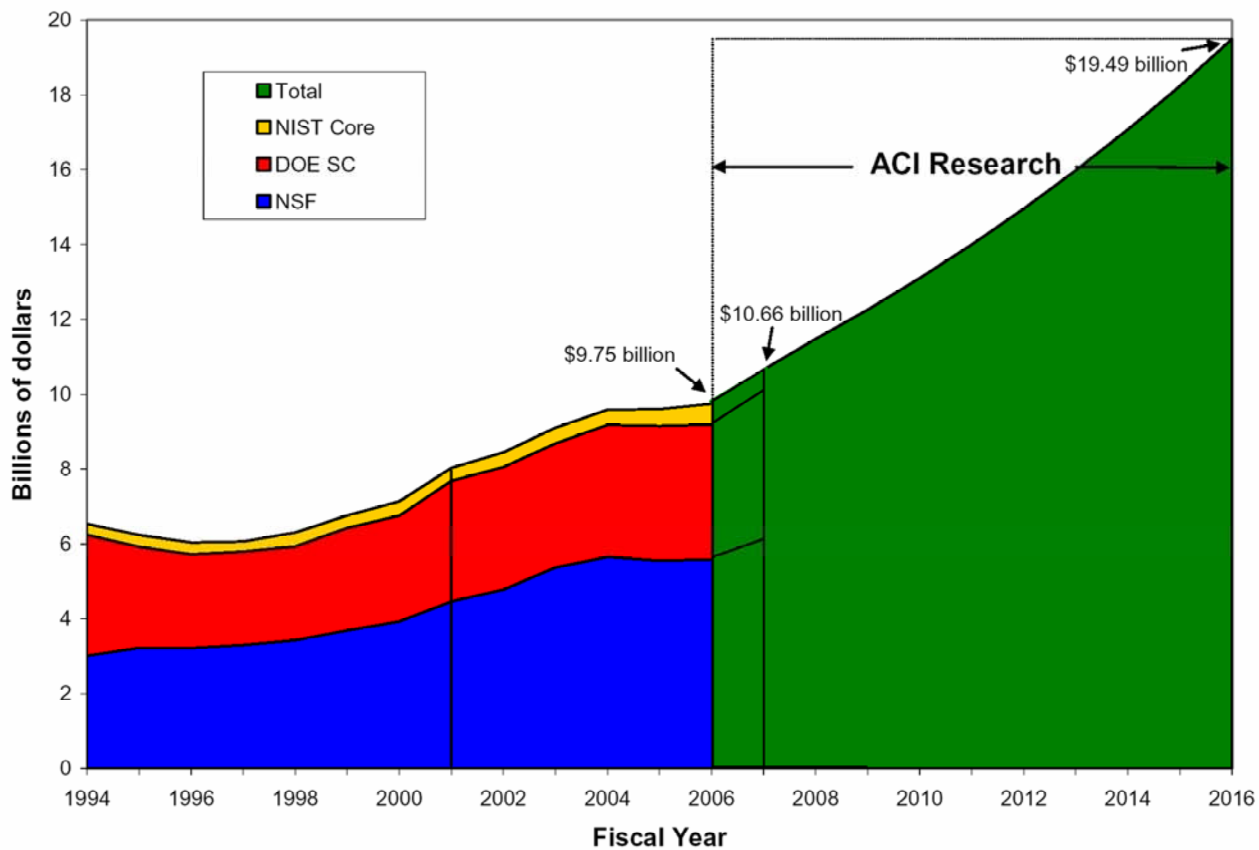
The American Competitiveness Initiative doubles, over 10 years, funding for innovation-enabling research at key Federal agencies that support high-leverage fields of physical science and engineering: the National Science Foundation, the Department of Energy's Office of Science, and the National Institute for Standards and Technology within the Department of Commerce.

Agency-specific ACI Goals Relevant to BES & DOE

- World-class capability and capacity in nanofabrication and nanomanufacturing that will help transform current laboratory science into a broad range of new industrial applications for virtually every sector of commerce, including telecommunications, computing, electronics, health care, and national security (NSF, DoE, NIST)
- Chemical, biological, optical, and electronic materials breakthroughs critical to cutting-edge research in nanotechnology, biotechnology, alternative energy, and the hydrogen economy through essential infrastructure such as the National Synchrotron Light Source II and the NIST Center for Neutron Research (DoE, NIST)
- Overcoming technological barriers to the practical use of quantum information processing to revolutionize fields of secure communications, as well as quantum mechanics simulations used in physics, chemistry, biology, and materials science (DoE, NIST, NSF)
- Overcoming technological barriers to efficient and economic use of hydrogen, nuclear, and solar energy through new basic research approaches in materials science (DoE, NSF, NIST)
- Improving capacity, maintenance, and operations of DoE and NIST labs

ACI Research Funding FY 2007-2016

In 2007, the ACI proposes overall funding increases for NSF, DoE SC and NIST core of $910 million, or 9.3%. To achieve ten-year doubling, overall annual increases for these agencies will average roughly 7%.



http://www.ostp.gov/html/budget/2007/1pger_ACI.pdf

	FY06 Funding	ACI Research FY 2007		ACI Research FY 2016	
	$ (billions)	$ (billions)	% increase	$ (billions)	% inc. over FY06
NSF	$5.58	$6.02	7.8	$11.16[1]	100.0
DoE SC	$3.60	$4.10	14.0	$7.19[1]	100.0
NIST Core[2]	$0.57[3]	$0.54	-5.8[4]	$1.14[1]	100.0
TOTAL	$9.75	$10.66	9.3	$19.49	100.0

[1] ACI doubles total research fund; individual agency allocations remain to be determined.

[2] NIST core consists of NIST lab research and construction accounts.

[3] The 2006 enacted level for NIST core includes $137 million in earmarks.

[4] Represents a 24 percent increase after accounting for earmarks.

End