



U.S. DEPARTMENT OF
ENERGY

OFFICE OF
SCIENCE

News from the Office of Science

*High Energy Physics Advisory Panel
24 February 2009*

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Office of Science, U.S. Department of Energy*

What's New?

- President Obama's plans for science, energy, and the environment
- Secretary Chu's plans for DOE
- Budgets – Hardly a tidy, linear process this year
 - H.R. 1, The American Recovery and Reinvestment Act (ARRA) of 2009
 - FY 2010 Congressional Budget Request + Outyear Estimates
 - FY 2009 Budget Appropriation
- **All of the above were informed by:**
 - Worldwide economic recession
 - Volatile energy prices
 - Increased sense of urgency about climate change as a global issue

Administration's Energy Plan

- Within 10 years save more oil than we currently import from the Middle East and Venezuela combined.
- Put 1 million plug-in hybrid cars – cars that can get up to 150 miles per gallon – on the road by 2015.
- Generate 10 percent of our electricity from renewable sources by 2012, and 25 percent by 2025.
- Implement an economy-wide, cap-and-trade program to reduce greenhouse gas emissions 80% by 2050.

DOE's Priorities and Goals

Priority: Science and Discovery: Invest in science to achieve transformational discoveries

- Organize and focus on breakthrough science
- Develop and nurture science and engineering talent
- Coordinate DOE work across the department, across the government, and globally

Priority: Change the landscape of energy demand and supply

- Drive energy efficiency to decrease energy use in homes, industry and transportation
- Develop and deploy clean, safe, low carbon energy supplies
- Enhance DOE's application areas through collaboration with its strengths in Science

Priority: Economic Prosperity: Create millions of green jobs and increase competitiveness

- Reduce energy demand
- Deploy cost-effective low-carbon clean energy technologies at scale
- Promote the development of an efficient, "smart" electricity transmission and distribution network
- Enable responsible domestic production of oil and natural gas
- Create a green workforce

Priority: National Security and Legacy: Maintain nuclear deterrent and prevent proliferation

- Strengthen non-proliferation and arms control activities
- Ensure that the U.S. weapons stockpile remains safe, secure, and reliable without nuclear testing
- Complete legacy environmental clean-up

Priority: Climate Change: Position U.S. to lead on climate change policy, technology, and science

- Provide science and technology inputs needed for global climate negotiations
- Develop and deploy technology solutions domestically and globally
- Advance climate science to better understand the human impact on the global environment

Priority: Science and Discovery

Invest in science to achieve transformational discoveries

- **Focus on transformational science**
 - Connect basic and applied sciences
 - Re-energize the national labs as centers of great science and innovation
 - Double the Office of Science budget
 - Embrace a degree of risk-taking in research
 - Create an effective mechanism to integrate national laboratory, university, and industry activities

- **Develop science and engineering talent**
 - Train the next generation of scientists and engineers
 - Attract and retain the most talented researchers

- **Collaborate universally**
 - Partner globally
 - Support the developing world
 - Build research networks across departments, government, nation and the globe

Office of Science FY 2009 Conference

	FY 2008 Enacted Approp.	FY 2008 Current Approp	FY 2009 Base Appropriation			
			Request to Congress	House Mark	Senate Mark	Confer- ence
SCIENCE						
Basic Energy Sciences.....	1,283,402	1,252,756	1,568,160	1,599,660	1,415,378	1,571,972
Advanced Scientific Computing Research.....	351,173	341,774	368,820	378,820	368,820	368,820
Biological & Environmental Research.....	544,397	531,063	568,540	578,540	598,540	601,540
High Energy Physics.....	720,317	702,845	804,960	804,960	804,960	795,726
Nuclear Physics.....	434,226	423,671	510,080	517,080	510,080	512,080
Fusion Energy Sciences.....	302,048	294,933	493,050	499,050	493,050	402,550
Science Laboratories Infrastructure.....	64,861	66,861	110,260	145,760	110,260	145,380
Science Program Direction.....	177,779	177,779	203,913	203,913	186,695	186,695
Workforce Development for Teachers & Scientists.....	8,044	8,044	13,583	13,583	13,583	13,583
Safeguards & Security.....	75,946	75,946	80,603	80,603	80,603	80,603
Small Business Innovation Research/Tech. Transfer.....	—	92,997	—	—	—	—
Subtotal, Science.....	3,962,193	3,968,669	4,721,969	4,821,969	4,581,969	4,678,949
Advanced Research Projects Agency-Energy.....	—	—	—	15,000	—	15,000
Congressionally-directed projects.....	123,623	120,161	—	39,700	58,500	93,687
SBIR/STTR (transfer from other DOE offices).....	—	47,241	—	—	—	—
Subtotal, Science.....	4,085,816	4,136,071	4,721,969	4,876,669	4,640,469	4,787,636
S&S (reimb. chg.).....	-5,605	-5,605	—	—	—	—
Rescission of prior year Congressionally-directed proj.....	-44,569	-44,569	—	—	—	—
Use of prior year balances.....	—	-3,014	—	-15,000	—	-15,000
Total, Science.....	4,035,642	4,082,883	4,721,969	4,861,669	4,640,469	4,772,636

Office of Science FY 2008 Budget

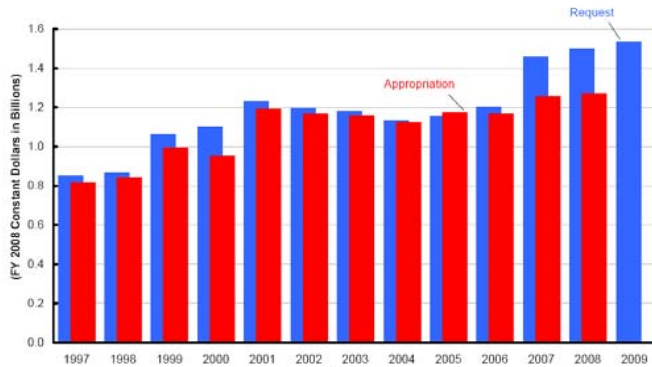
Appropriation and supplemental

	FY 2008		
	Prior Approp.	Supple- mental	Current Approp.
Basic Energy Sciences	1,269,902	+13,500	1,283,402
Advanced Scientific Computing	351,173	—	351,173
Biological and Environmental Research	544,397	—	544,397
High Energy Physics	689,331	+32,000	721,331
Nuclear Physics	432,726	+1,500	434,226
Fusion Energy Sciences	286,548	+15,500	302,048
Science Lab Infrastructure	66,861	—	66,861
Science Program Direction	177,779	—	177,779
Workforce Development	8,044	—	8,044
Safeguards and Security	75,946	—	75,946
Subtotal, Science	3,902,707	+62,500	3,965,207
ARPA-E	—	—	—
Safeguards and Security (reimbursable charge)	-5,605	—	-5,605
Congressionally-directed projects	123,623	—	123,623
Rainforest Rescission	-44,569	—	-44,569
Use of prior year balances	-3,014	—	-3,014
Undistributed	—	—	—
Total, Science	3,973,142	+62,500	4,035,642

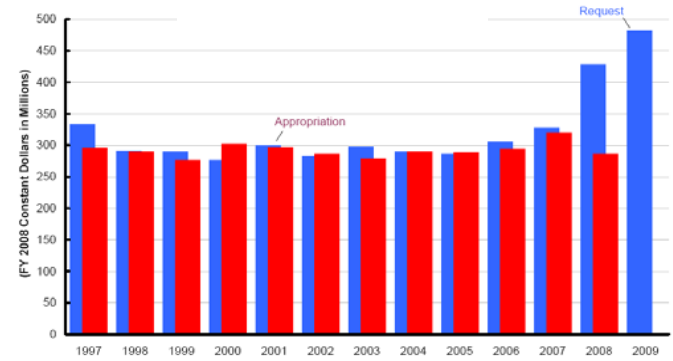
12-Year History of Request vs. Appropriation for SC Programs (FY08 Constant Dollars)*

* Prior to FY 2008 Supplemental

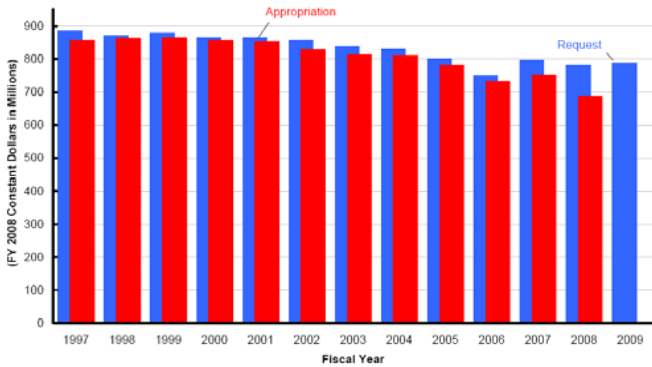
BES



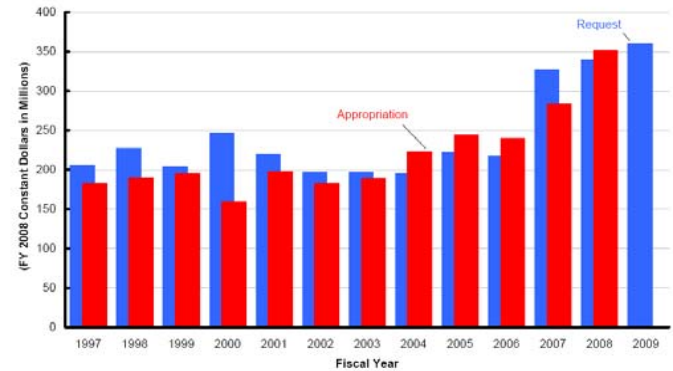
FES



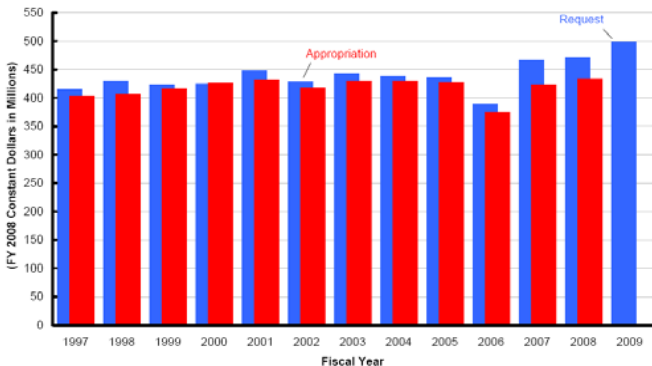
HEP



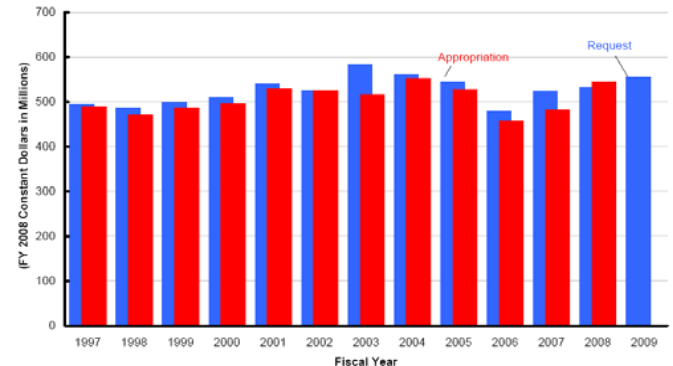
ASCR



NP



BER



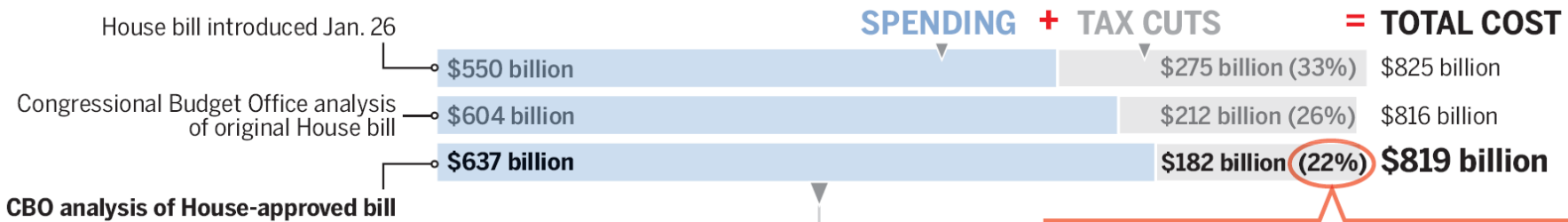
Office of Science FY 2009 ARRA

FY 2008 Enacted Approp.	FY 2008 Current Approp	FY 2009 Base Appropriation				FY 2009 Recovery Act Approp.
		Request to Congress	House Mark	Senate Mark	Confer- ence	

SCIENCE

Basic Energy Sciences.....	1,283,402	1,252,756	1,568,160	1,599,660	1,415,378	1,571,972	
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H.R. 1, The American Recovery and Reinvestment Act of 2009



Democrats say tax cuts represent one-third of the overall stimulus package, not a huge difference from President Obama's original goal of **40 percent**.

But congressional budget analysts count nearly \$100 billion of these measures as spending, because they are credits going to people who don't pay taxes.

The CBO adjustment reduces the tax-cut portion of the package to **22 percent**.

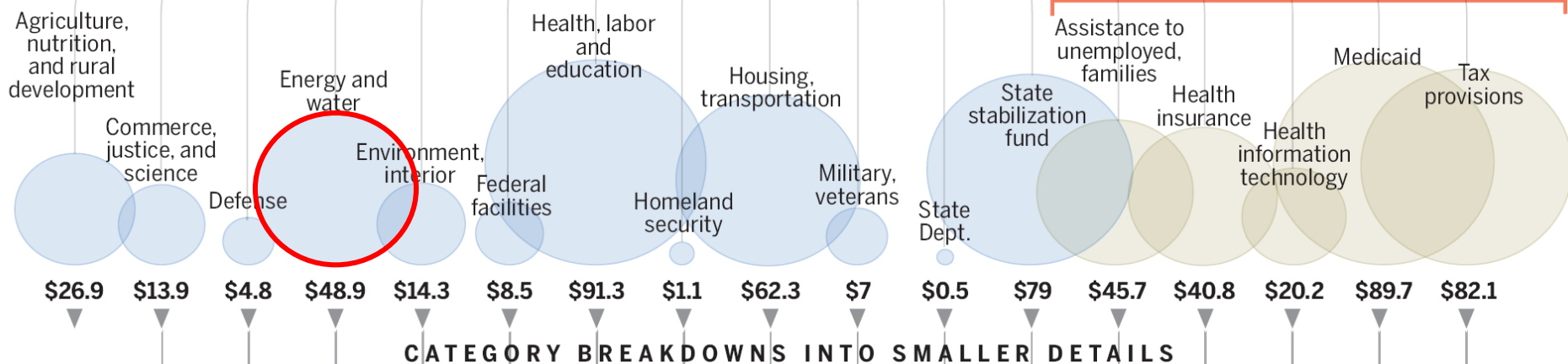
TOTAL SPENDING

The CBO divides the bill's spending into direct payments to individuals (i.e., unemployment compensation or tax credits) and purchases of goods and services, either directly by the federal government or indirectly in the form of grants to states and local governments.

Direct payments to individuals:

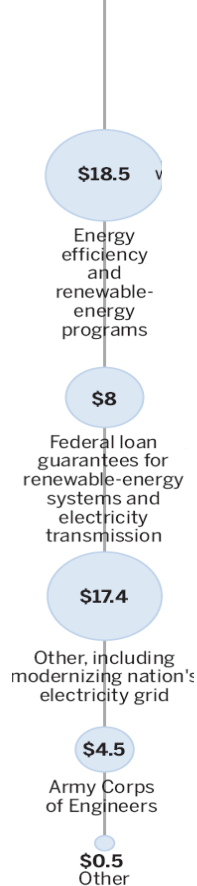
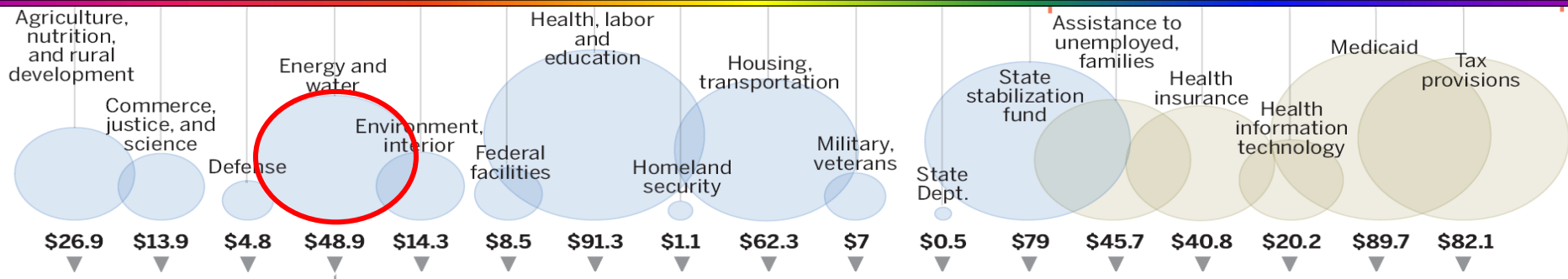
Democrats define some of this as tax cuts.

Charted here, total outlays from 2009 through 2019, figures in billions of dollars, and represented by circles of proportional size



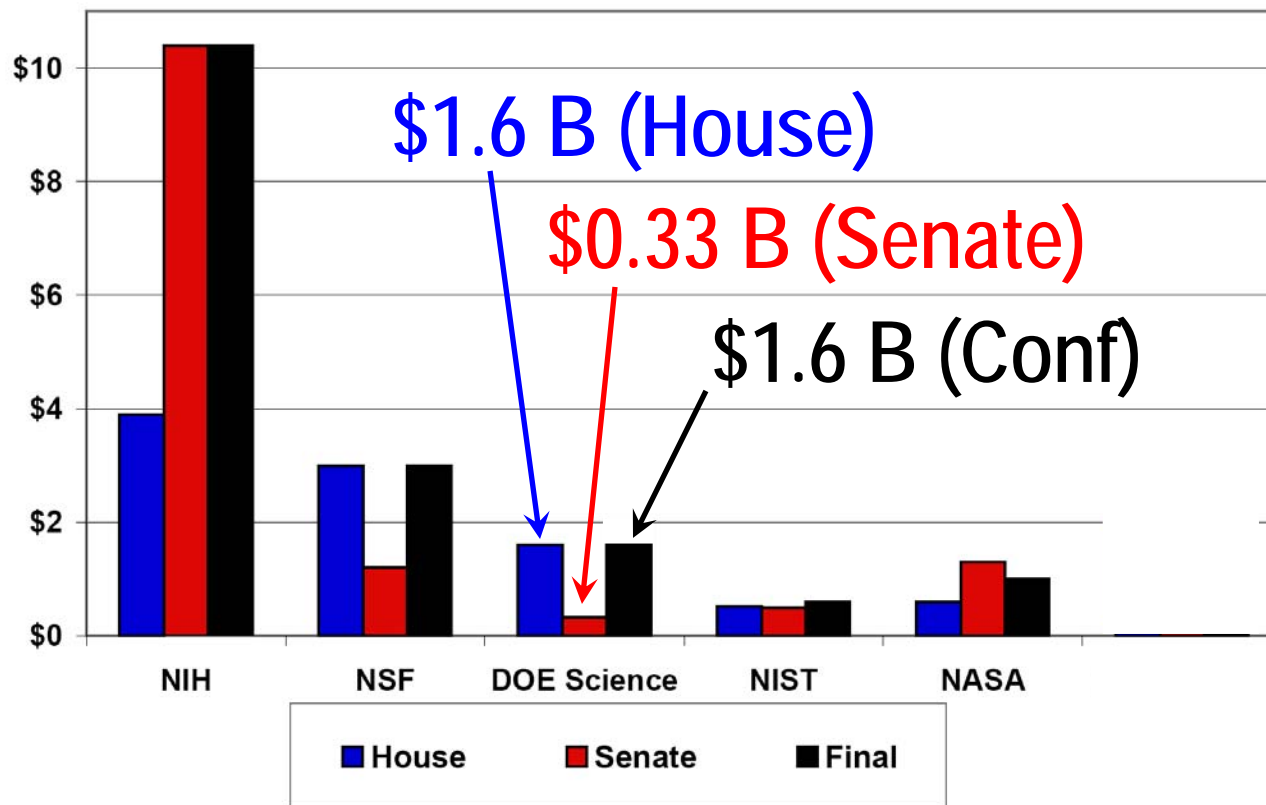
CATEGORY BREAKDOWNS INTO SMALLER DETAILS

H.R. 1, The American Recovery and Reinvestment Act of 2009



H.R. 1, The American Recovery and Reinvestment Act of 2009

2009 Supplemental Recovery Funding for R&D
(House, Senate, and Final bills)
(budget authority in billions of dollars)



Source: AAAS analysis of R&D in House, Senate, and Final stimulus appropriations bills (HR 1).
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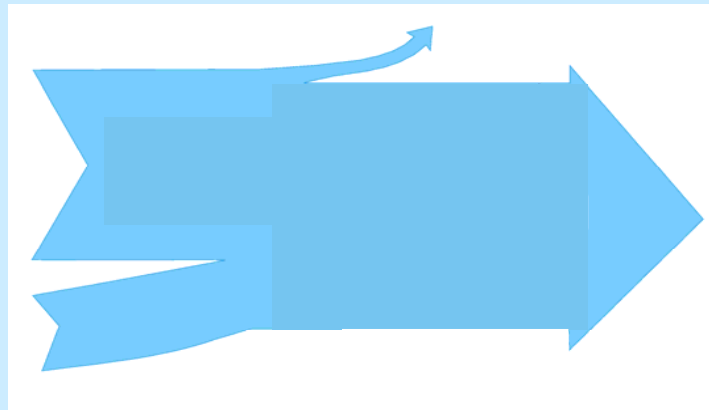


ARRA – Categories of Support in SC

- **Facility Construction** – Funds accelerate completion of a number of ongoing construction projects for major scientific user facilities, major items of equipment for those facilities, and laboratory infrastructure. General Plant Projects (GPP) update laboratory infrastructure and establish new laboratory research space, renovate existing laboratory space, demolish inadequate facilities, and improve utility systems across SC labs.
- **Facility Operations/Infrastructure** – Funds increase operations, experimental support, and infrastructure improvements at scientific user facilities across SC.
- **Research** – Funds support selected research programs across SC and are chosen to minimize out-year mortgages. Energy Frontier Research Centers are included.
- **Computing** – Funds support advanced networking; mid-range distributed computing; and computation partnerships in areas important to DOE energy missions.
- **Fellowships** – A program to support graduate students and early career scientists was proposed by SC and is under discussion within DOE.

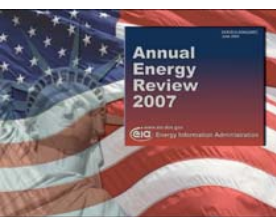
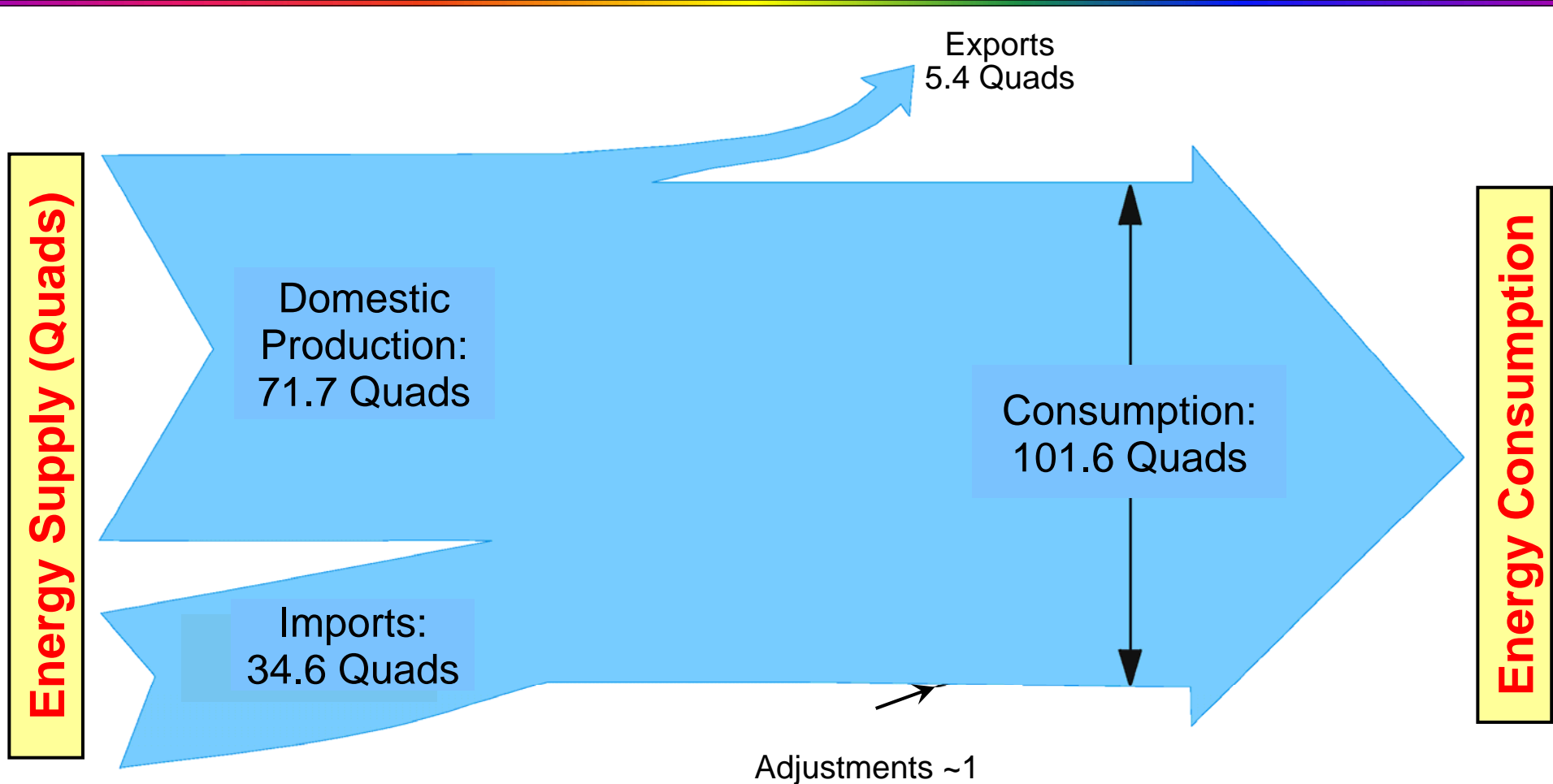
Backup

Energy sources and consumption sectors in the U.S.



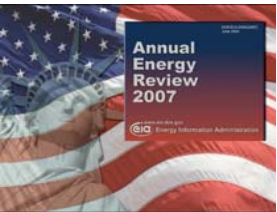
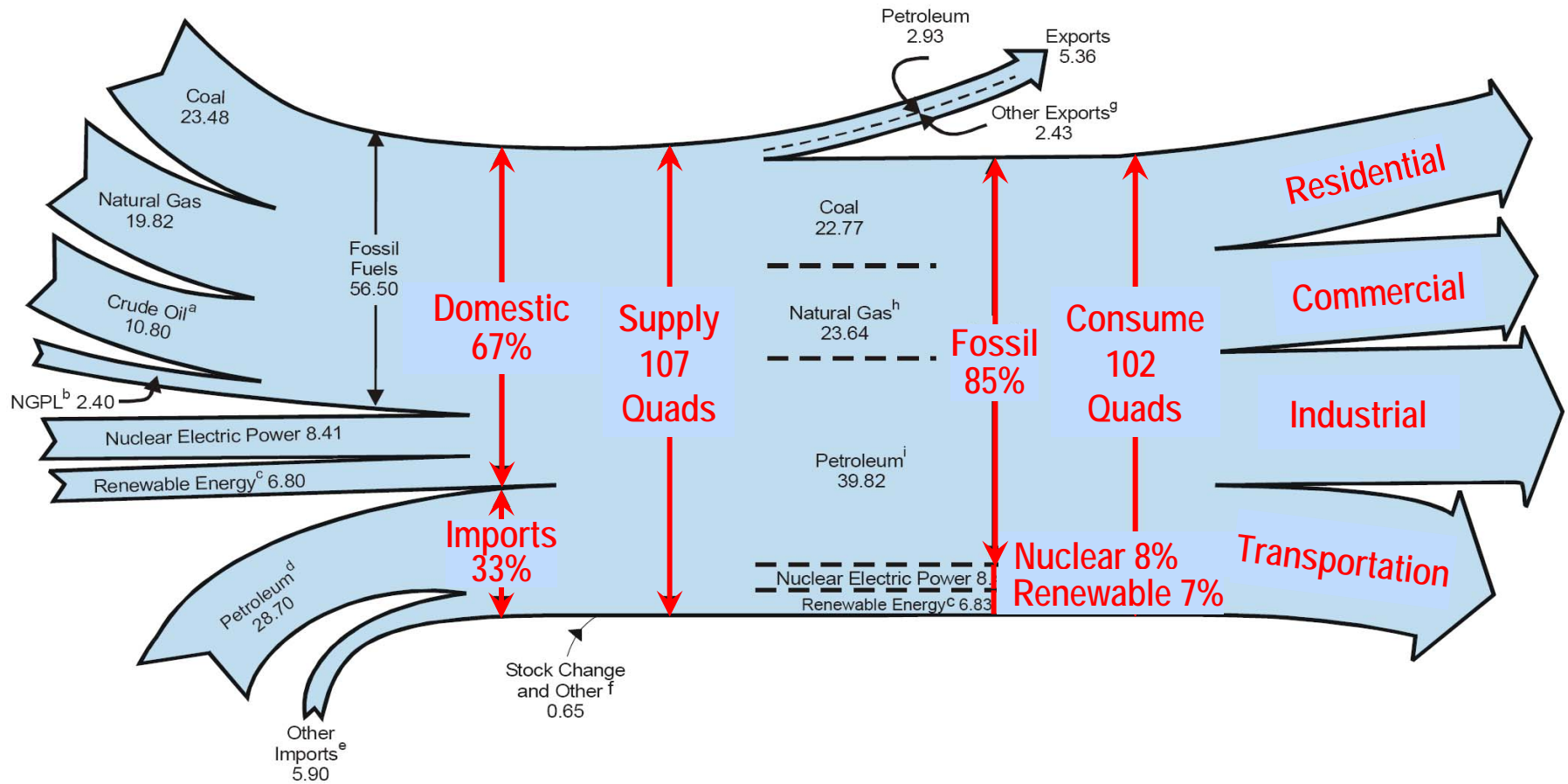
U.S. Energy Flow, 2007 (Quads = Quadrillion BTU = 10^{15} BTU)

About 1/3 of U.S. primary energy is imported



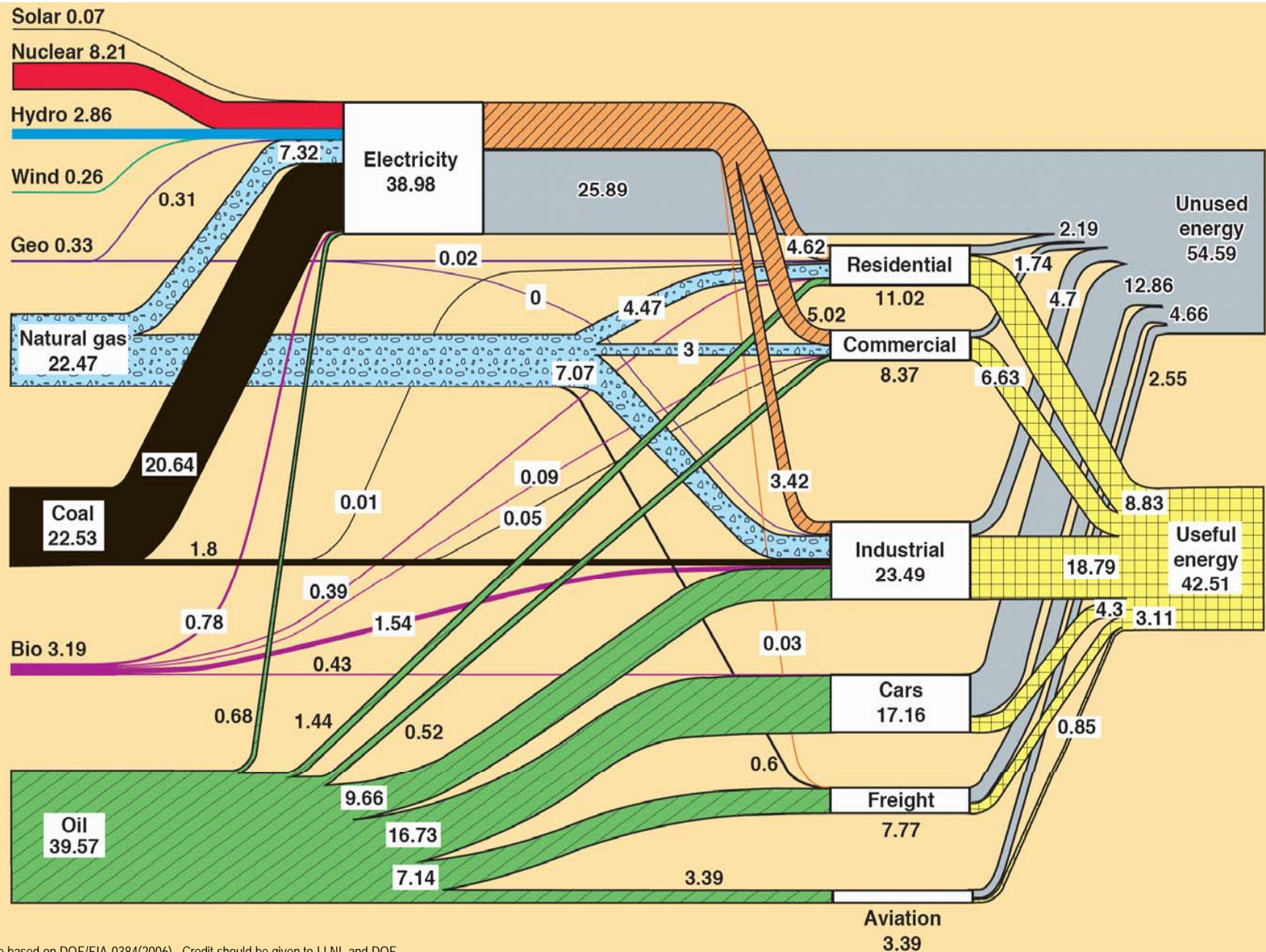
U.S. Energy Flow, 2007 (Quads)

85% of primary energy is from fossil fuels



U.S. Energy Flow, 2006 (Quads)

>70% of primary energy for the transportation sector
and >60% of primary energy for electricity generation/use is lost



Source: LLNL 2008; data are based on DOE/EIA-0384(2006). Credit should be given to LLNL and DOE.

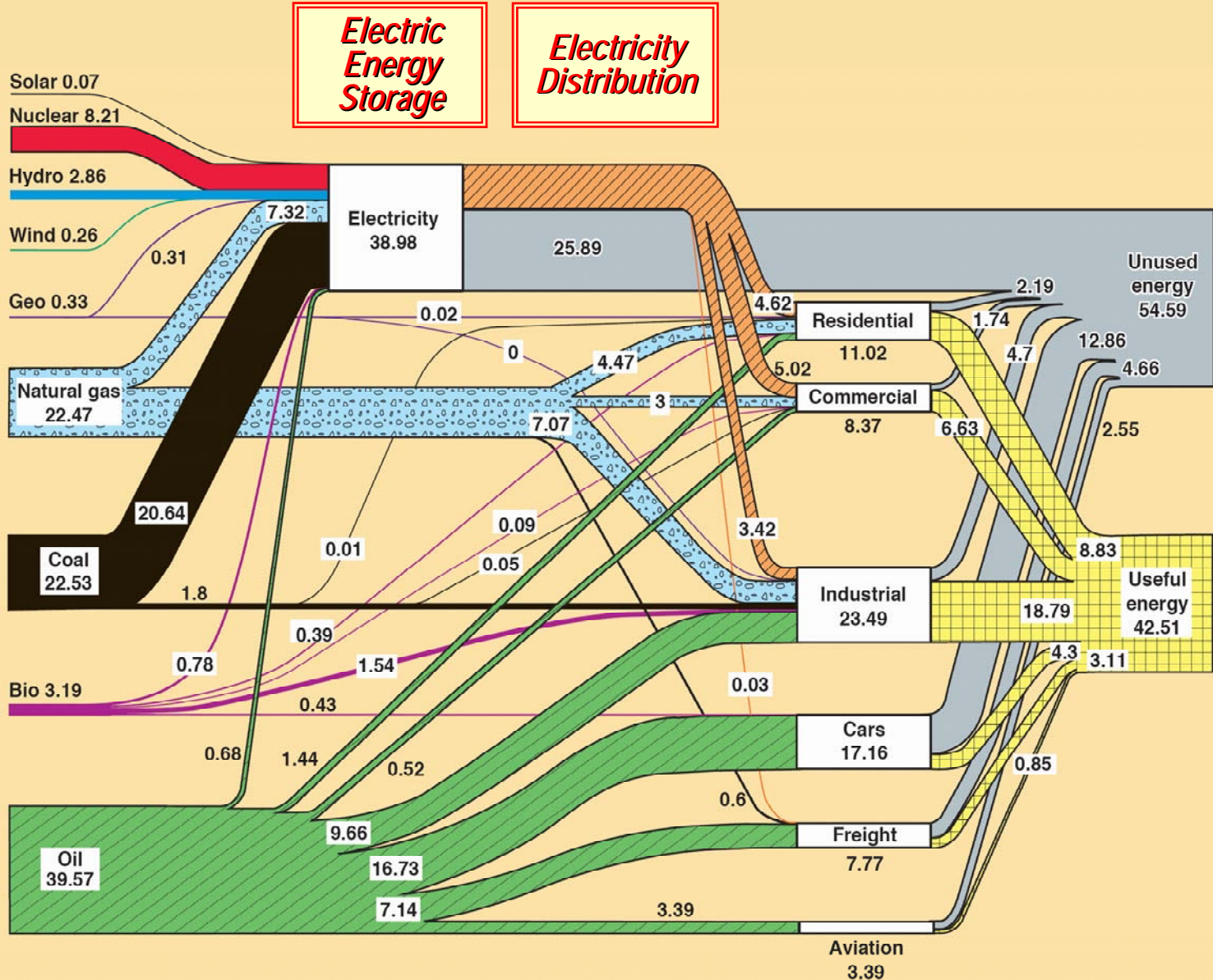
Key RD&D Strategies

Zero-net-emissions Electricity Generation

Fuel Switching

CCS

Fuel Switching



Electric Energy Storage

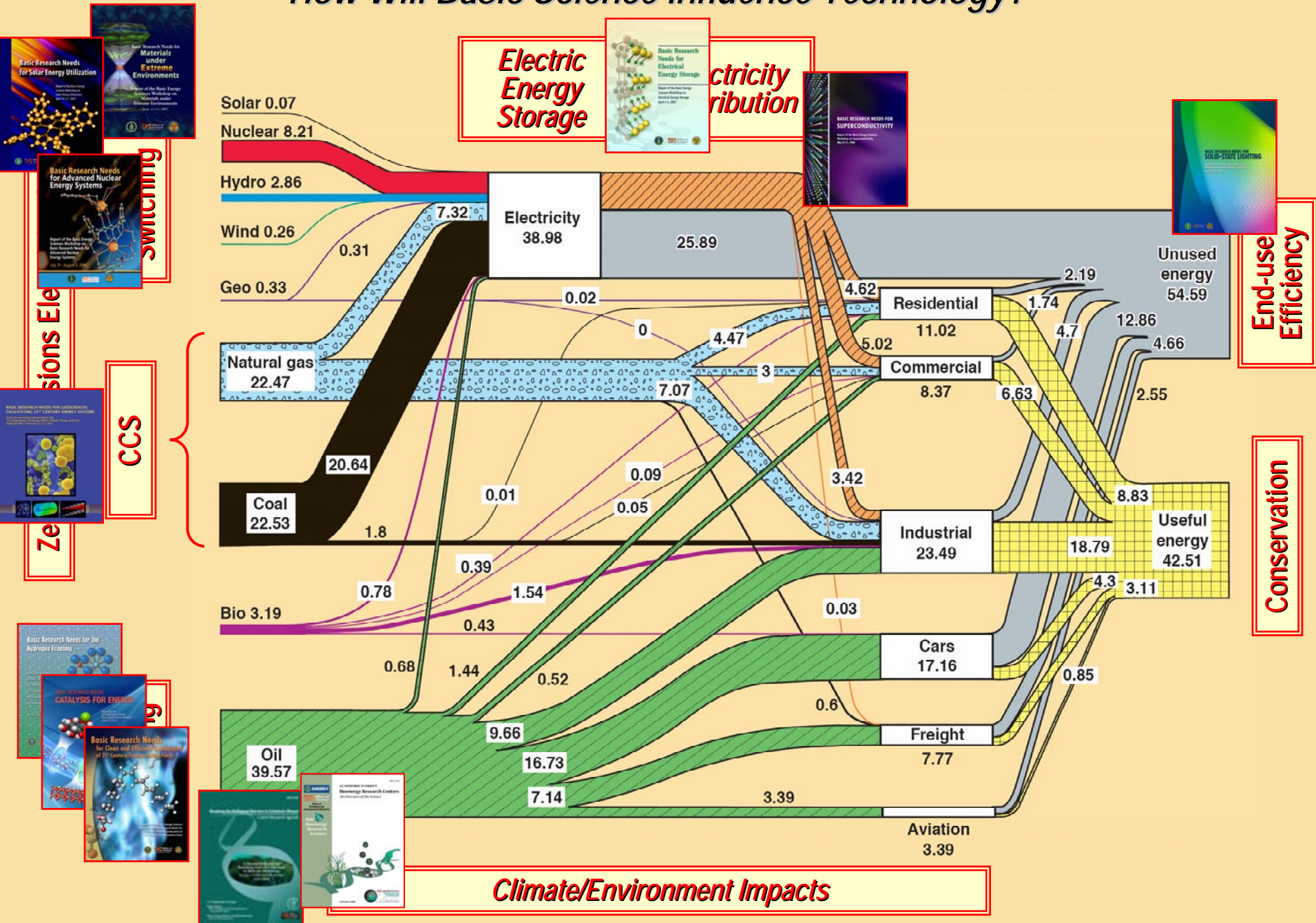
Electricity Distribution

End-use Efficiency

Conservation

Climate/Environment Impacts

How Will Basic Science Influence Technology?



Source: LLNL 2008; data are based on DOE/EIA-0384(2006). Credit should be given to LLNL and DOE.

Accelerator Support in the Office of Science Programs

Basic Energy Sciences (~\$500+M, overwhelmingly operations of facilities)

National Synchrotron Light Source
Stanford Synchrotron Radiation Laboratory
Advanced Light Source
Advanced Photon Source
Linac Coherent Light Source
SLAC Linear Accelerator
National Synchrotron Light Source-II
Spallation Neutron Source
Manuel Lujan Jr. Neutron Scattering Center

Nuclear Physics (~\$250M, overwhelmingly operations of facilities)

Continuous Electron Beam Accelerator Facility
Relativistic Heavy Ion Collider
Holifield Radioactive Ion Beam Facility
Argonne Tandem Linear Accelerator System

High Energy Physics (~\$500M, with very substantial advanced R&D)

Tevatron Collider + improvements/upgrades
Large Hadron Collider
Advanced technology R&D

Short-term, Mid-term, and Long-term Activities

	HEP	BES	NP
Maintain and upgrade flagship user facilities	✓	✓	✓
Develop concepts, techniques, and materials for future facilities	✓	✓	✓
Maintain core competencies and a trained workforce in accelerator science	✓	✓	✓
Steward accelerator science and technology development broadly	✓		