

BASIC ENERGY SCIENCES –  
Serving the Present, Shaping the Future  
<http://www.science.doe.gov/bes>

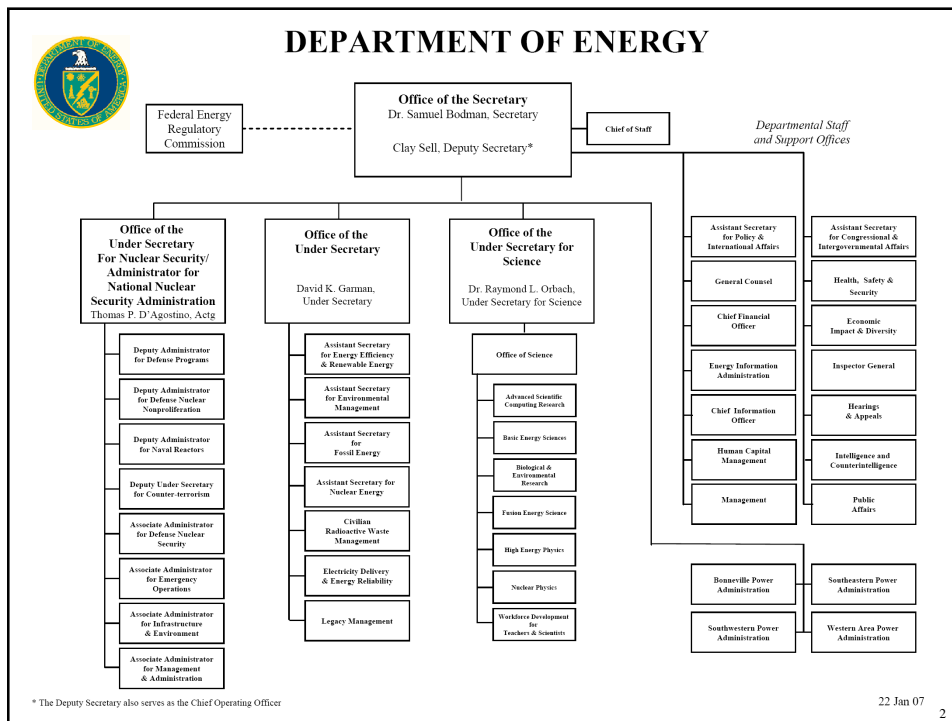


## BES Update

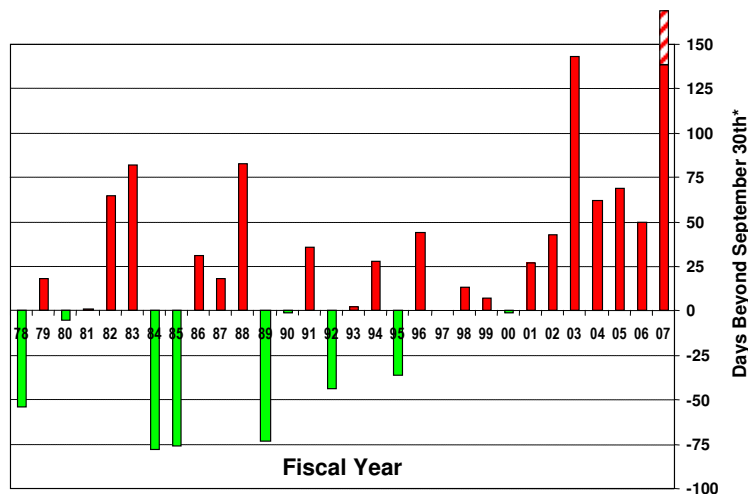
Patricia M. Dehmer  
Director, Office of Basic Energy Sciences  
Office of Science, U.S. Department of Energy  
19 April 2007



<http://www.sc.doe.gov/bes/>



### 30-Year History of Energy and Water Development Appropriations



\* Prior to FY 1977, Fiscal Years ended on June 30th

Source information from the Library of Congress: <http://thomas.loc.gov/home/search.html>

### The FY 2008 Congressional Budget Request for SC Prior to FY 2007 Approp.

	(B/A in thousands)					
	FY 2005 Approp.	FY 2006 Approp.	FY 2007 Request to Congress	FY 2007 vs. FY 2006	FY 2008 Request to Congress	FY 2008 vs. FY 2007
Basic Energy Sciences.....	1,083,616	1,110,148	1,250,250	+310,832 +28.0%	1,498,497	+77,517 +5.5%
Advanced Scientific Computing Research.....	226,180	228,382	318,654	+90,272 +39.5%	340,198	+21,544 +6.8%
Biological & Environmental Research						
BER Base Program.....	487,474	435,476	510,263	+74,787 +17.2%	531,897	+21,634 +4.2%
Congressionally-directed projects.....	79,123	128,601	—	-128,601 -100.0%	—	—
Total, Biological & Environmental Research.....	566,597	564,077	510,263	-53,814 -9.5%	531,897	+21,634 +4.2%
High Energy Physics.....	722,906	698,238	775,099	+76,861 +11.0%††	782,238	+7,139 +0.9%††
Nuclear Physics.....	394,549	357,756	454,060	+96,304 +26.9%	471,319	+17,259 +3.8%
Fusion Energy Sciences.....	266,947	280,683	318,950	+38,267 +13.6%	427,850	+108,900 +34.1%
Science Laboratories Infrastructure.....	37,498	41,684	50,888	+9,204 +22.1%	78,956	+28,068 +55.2%
Science Program Direction.....	154,031	159,118	170,877	+11,759 +7.4%	184,934	+14,057 +8.2%
Workforce Development for Teachers & Scientists.....	7,599	7,120	10,952	+3,832 +53.8%	11,000	+48 +0.4%
S&S.....	67,168	68,025	70,987	+2,962 +4.4%	70,987	—
Use of prior year balances.....	-5,062	—	—	—	—	—
SBIR/STTR (from SC programs).....	77,842	81,160	—	-81,160 -100.0%	—	—
Subtotal, Science.....	3,599,871	3,596,391	4,101,710	+505,319 +14.1%	4,397,876	+296,166 +7.2%
SBIR/STTR (transferred from other DOE programs).....	35,779	35,653	—	-35,653 -100.0%	—	—
Total, Science.....	3,635,650	3,632,044	4,101,710	+469,666 +12.9%	4,397,876	+296,166 +7.2%

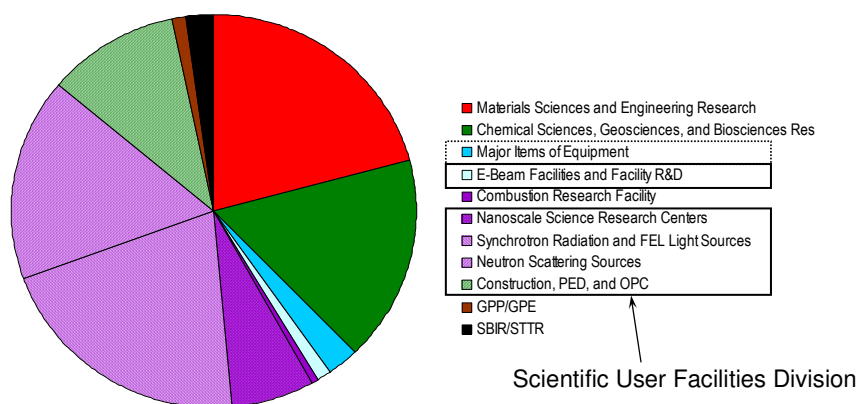
† The FY 2008 President's Budget Request and the material presented here assume the requested level for FY 2007, as the timing of FY 2007 appropriations did not allow their inclusion.

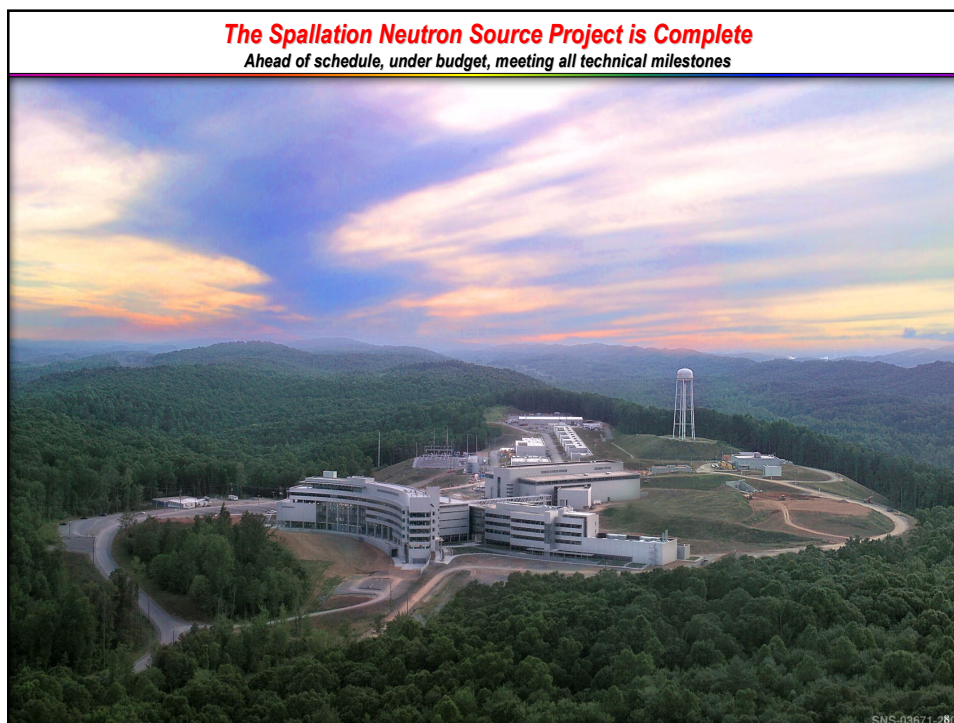
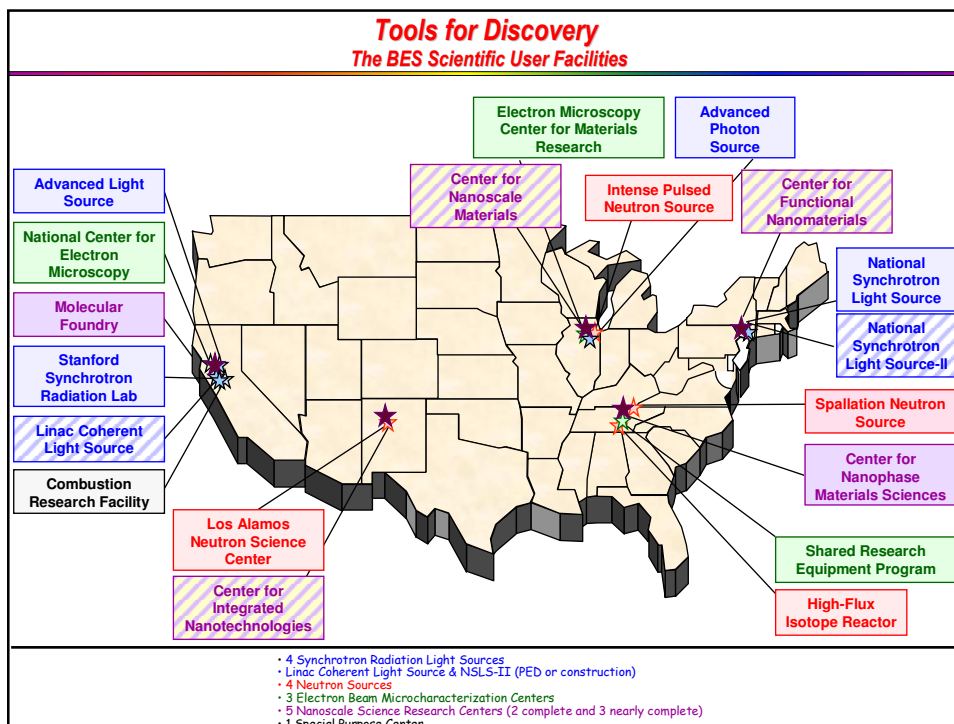
†† A portion of Stanford Linear Acceleration Center linac operations transfers from High Energy Physics to Basic Energy Sciences in FY 2007 and FY 2008. Excluding the linac operations funding, the remainder of the High Energy Physics budget increases by 12.6% in the FY 2007 request and a further 3.7% in FY 2008.

### Timelines for BES Solicitations Based on BRN Workshops

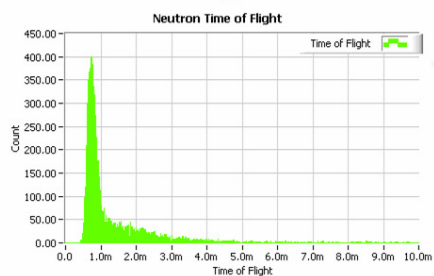
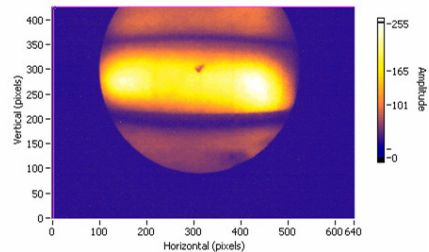
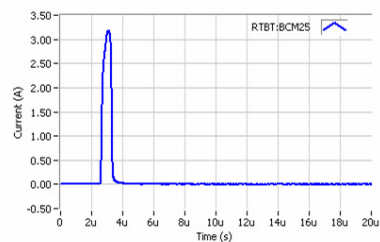
Solicitation:	Instrumentation	Basic research for solar energy utilization	Basic research for the hydrogen fuel initiative	Basic research for advanced nuclear energy systems
Funding in FY 2007 Request	~ \$20 million	\$34.1 million	+ \$17.5 million	\$12.4 million
Additional funding in FY 2008 Request		+ \$5.9 million	+ \$9.5 million	
FY 2007 Congressional Budget released	February 6, 2006			
Announcement of intent to issue solicitations	February 16, 2006			
Posting solicitation on SC website	March 7, 2006	March 21, 2006	April 20, 2006	October 12, 2006
Preproposal deadlines	May 17, 2006 106 preproposals	June 5, 2006 656 preproposals	July 6, 2006 502 preproposals	Nov. 22, 2006 209 preproposals
PIs notified of preproposal decisions	June 30, 2006 59 encouraged	August 11, 2006 346 encouraged	Sept. 12, 2006 249 encouraged	January 5, 2007 126 encouraged
Full proposal deadlines	August 30, 2006 58 received	Nov. 14, 2006 309 received	Dec. 12, 2006 229 received	March 14, 2007
Announce awards (dates are approximate)	Early April 2007	Mid April 2007	Mid May 2007	Late June 2007

### Pie Chart of the FY 2008 President's Request





## SNS First Neutrons – 28 April 2006



## Construction is Complete and Initial Operations are Underway at Four NSRCs



Center for Functional Nanomaterials  
(Brookhaven National Laboratory)



Molecular Foundry  
(Lawrence Berkeley National Laboratory)



Center for Nanoscale Materials  
(Argonne National Laboratory)



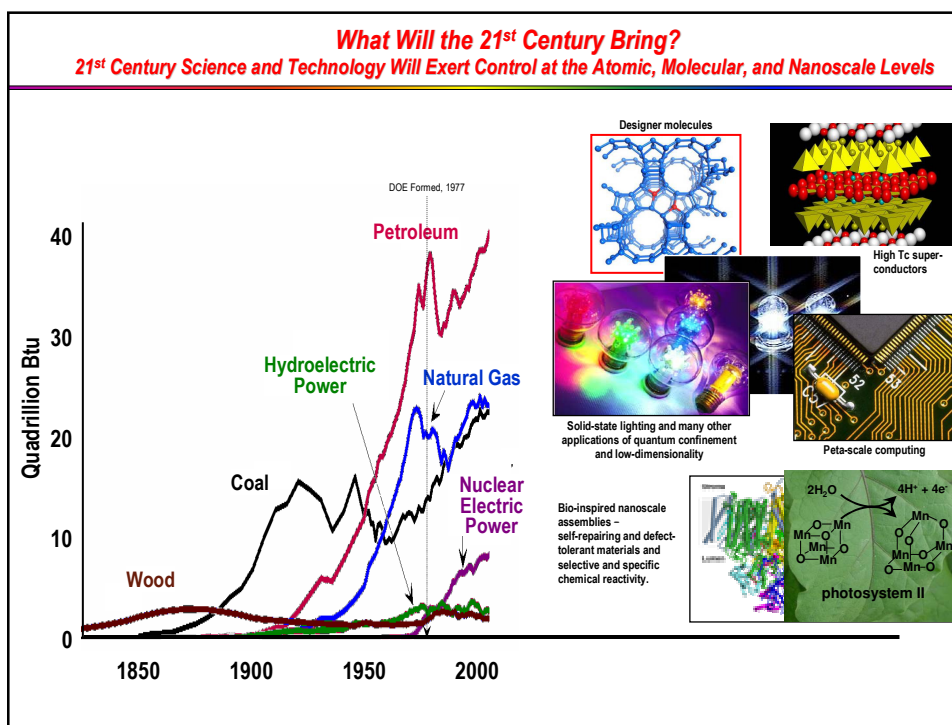
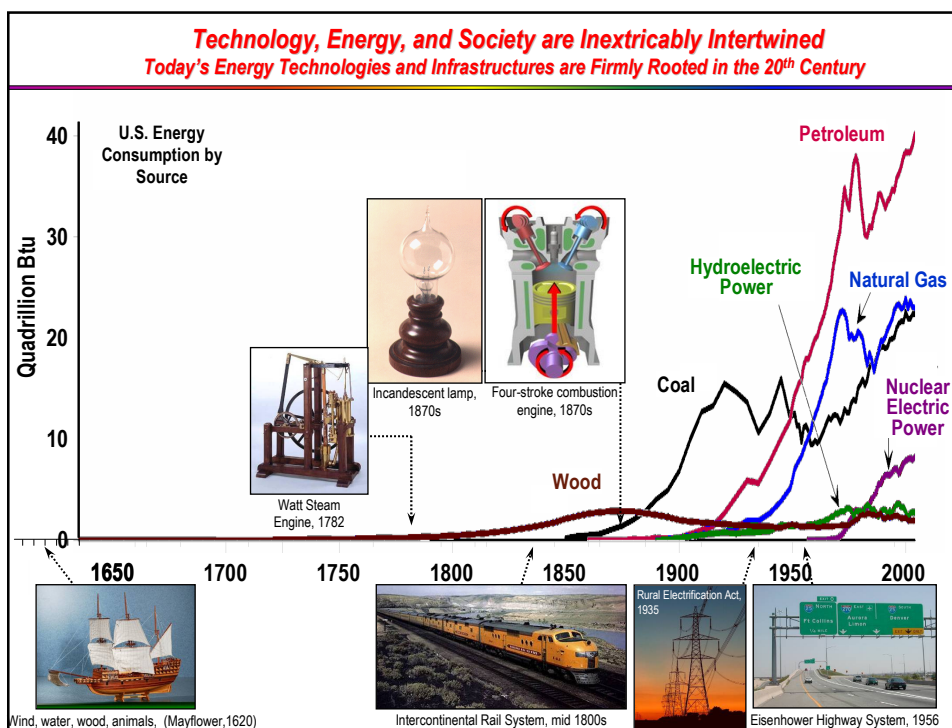
Center for Nanophase Materials Sciences  
(Oak Ridge National Laboratory)

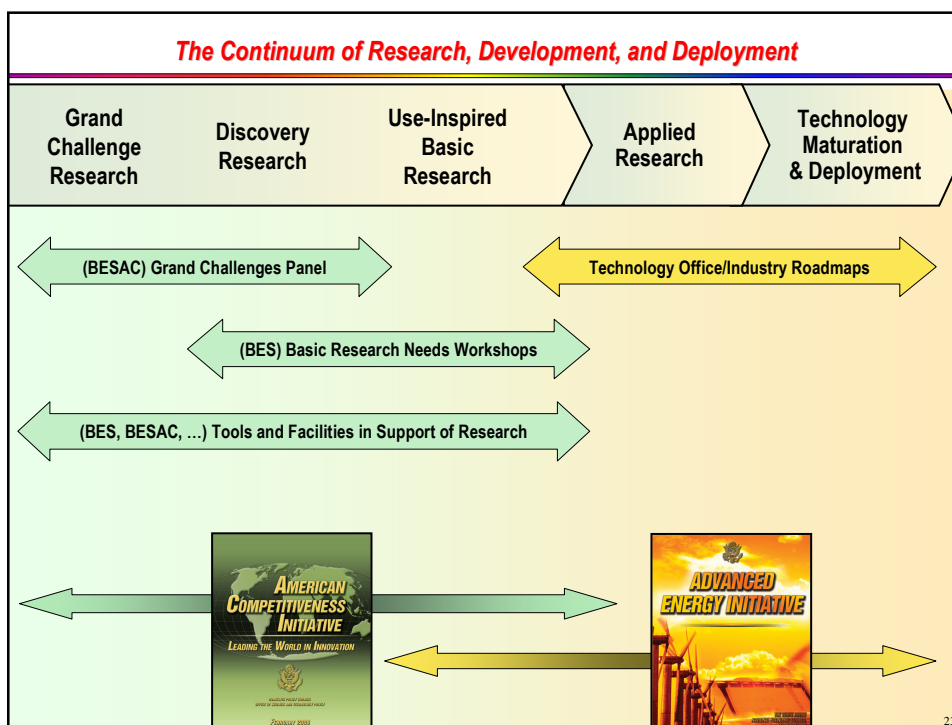
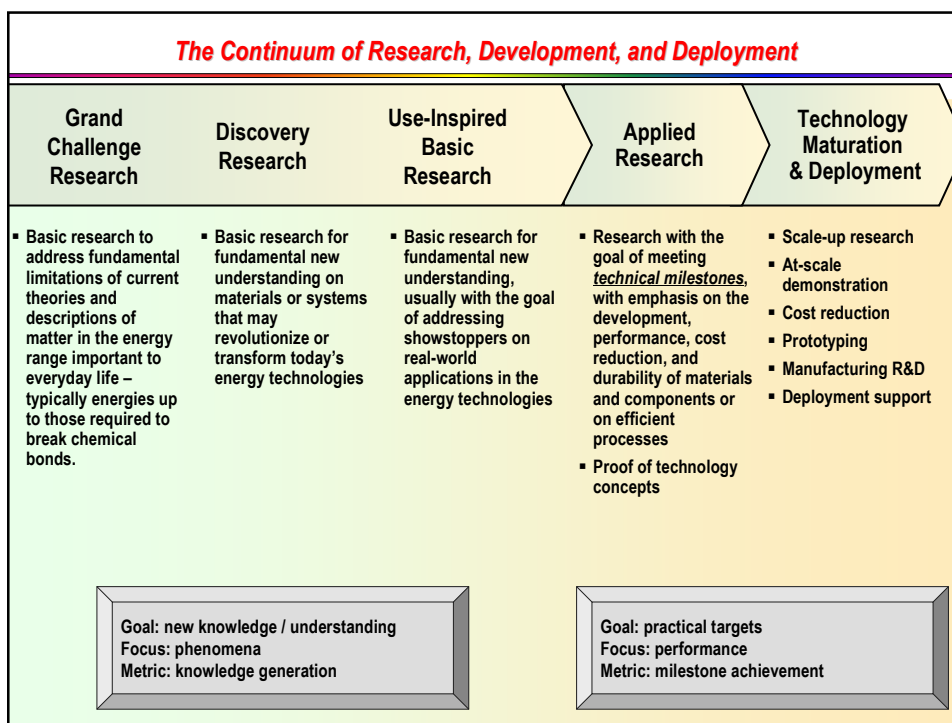


Center for Integrated  
Nanotechnologies (Sandia & Los  
Alamos National Labs)







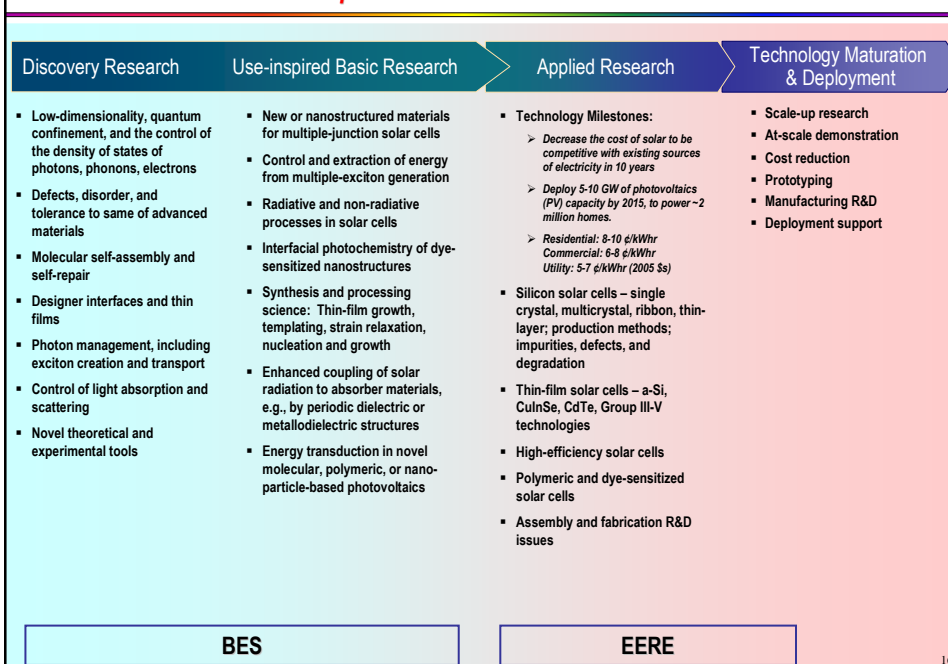


## Discovery and Use-Inspired Research The "Basic Research Needs" Workshops



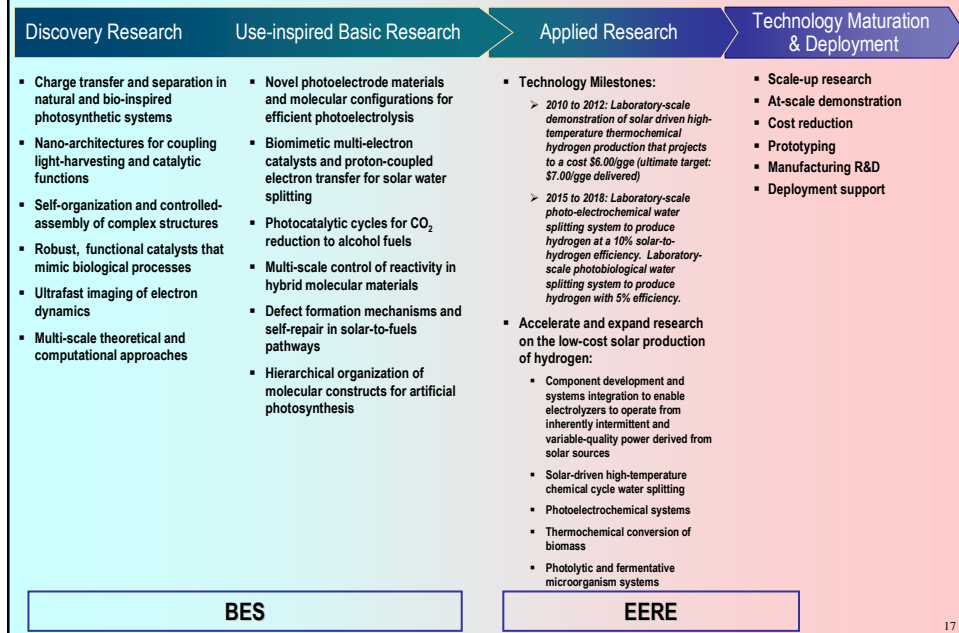
- **Basic Research Needs to Assure a Secure Energy Future**  
BESAC Workshop, October 21-25, 2002  
*The foundation workshop that set the model for the focused workshops that follow.*
- **Basic Research Needs for the Hydrogen Economy**  
BES Workshop, May 13-15, 2003
- **Nanoscience Research for Energy 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 Superconductivity**  
BES Workshop, May 8-10, 2006
- **Basic Research Needs for Solid-state Lighting**  
BES Workshop, May 22-24, 2006
- **Basic Research Needs for Advanced Nuclear Energy Systems**  
BES Workshop, July 31-August 3, 2006
- **Basic Research Needs for the Clean and Efficient Combustion of 21st Century Transportation Fuels**  
BES Workshop, October 30-November 1, 2006
- **Basic Research Needs for Geosciences: Facilitating 21st Century Energy Systems**  
BES Workshop, February 21-23, 2007
- **Basic Research Needs for Electrical Energy Storage**  
BES Workshop, April 2-5, 2007
- **Basic Research Needs for Materials under Extreme Environments**  
BES Workshop, June 10-14, 2007
- **Basic Research Needs for Catalysis for Energy**  
BES Workshop, August 5-10, 2007

## Example: Solar-to-Electric Conversion

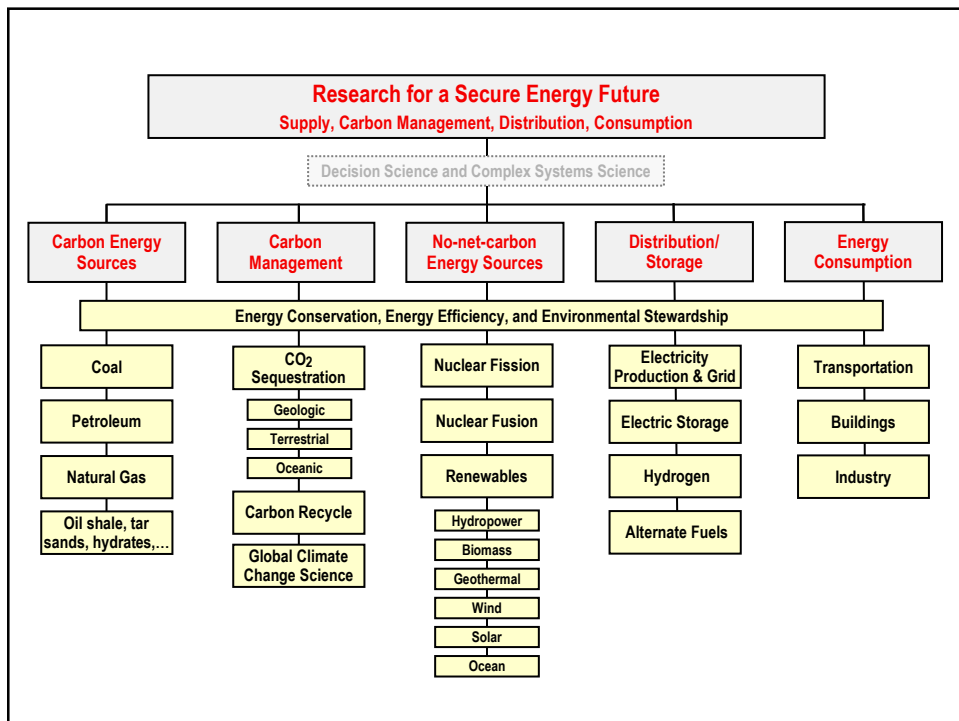


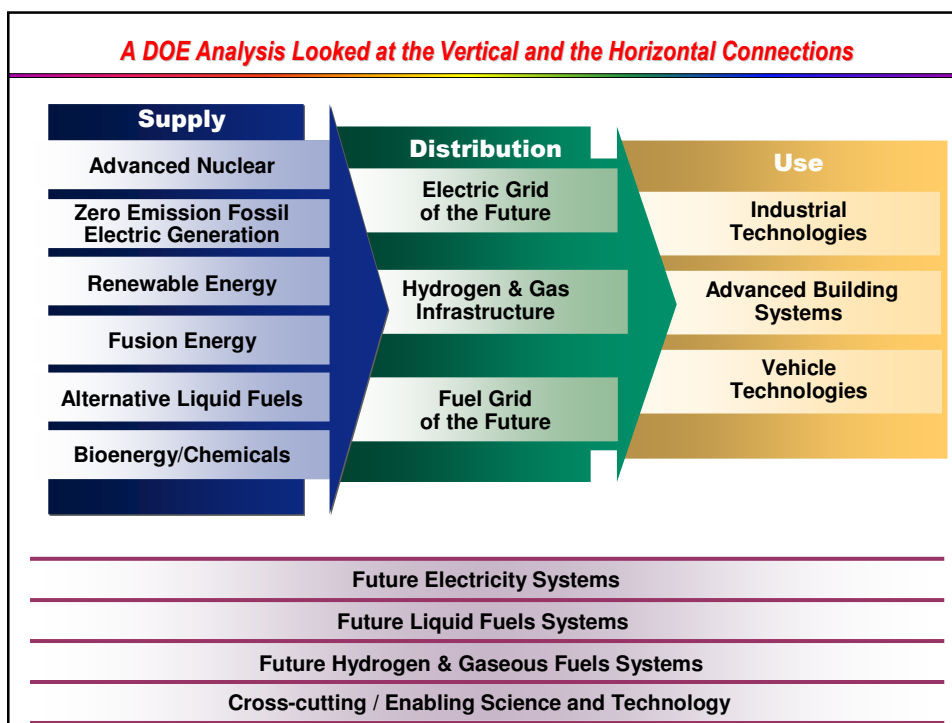


### Example: Solar-to-Fuels Conversion



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**Grand Challenges**

Our 20th century theoretical frameworks for condensed matter and materials physics, chemistry, and biology fail as we move to:

- ultrasmall or isolated systems at one extreme and
- complex or interacting systems at the other extreme.

New 21<sup>st</sup> century frameworks must be created to provide the language to interpret the discoveries of the last quarter of the 20<sup>th</sup> century: superconductivity, metamaterials, nano-x, chemistry in all its complexities including replication, and more. These frameworks will recognize that the boundaries among condensed matter and materials physics, chemistry, and biology are erased at small scales.

The BESAC Grand Challenges subcommittee has posed five questions:

- **How do electrons move in atoms, molecules and materials?**  
*Creating a new language for electron dynamics to replace the 20<sup>th</sup> century assumption that electrons move independently from atoms*
- **Can we control the essential architecture of nature?**  
*Designing the placement of atoms in materials using tools of self-assembly, self-repair, self-replication*
- **How do particles cluster?**  
*Understanding primary patterns, emergence, and strong correlations*
- **How do we learn about small things?**  
*Interrogating the nanoscale, and communicating with it*
- **How does matter behave beyond equilibrium?**  
*Formulating the basis for non-equilibrium behavior, which dominates the world around us at both very small and very large scales*