U.S. DEPARTMENT OF ENERGY | Office of Science

HEP Budget for Physicists

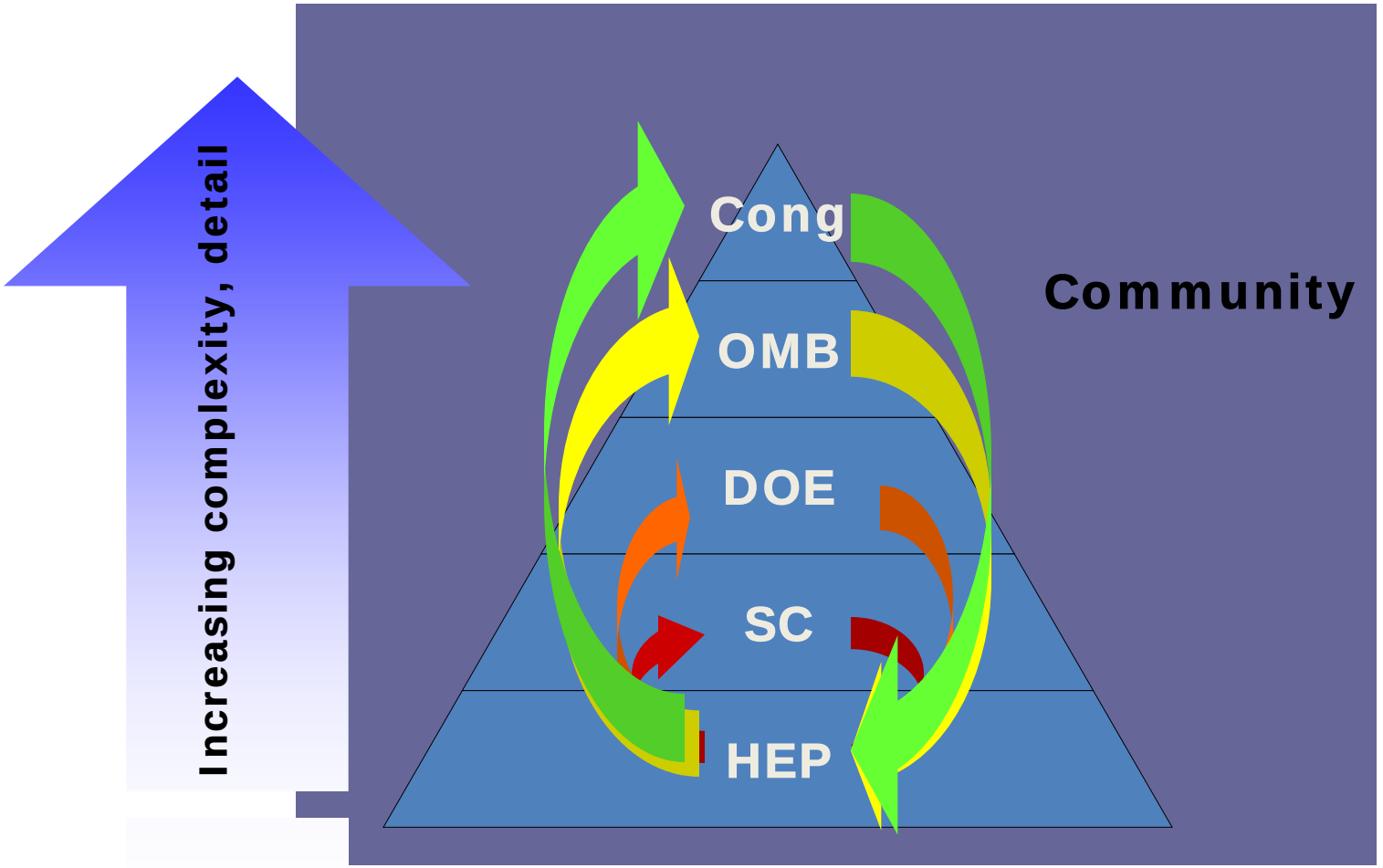
Glen Crawford

DOE Budget Process (Historical)

"This meeting was called in order to discuss the meat. It has been pointed out that there is no more meat. A motion has been made to fight over the bones."

George Booth, The New Yorker April 28, 1980

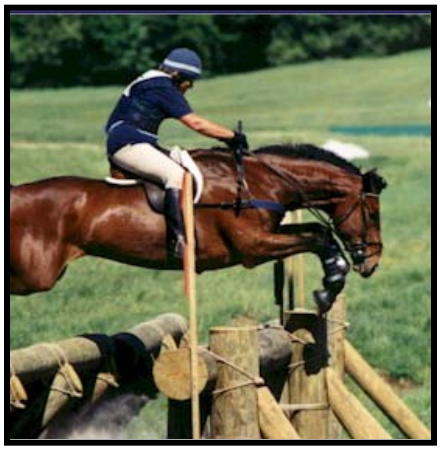
Budget Planning Cycle



There are Four Big Hurdles in SC Budget Formulation

#1 – Inside SC
(Feb. – April FY 200N)

- Each AD-ship determines program priorities within constraints of the funding guidance provided by the Director of SC.
- Each AD presents program priorities to Director of SC.
- The Director of SC determines program priorities within constraints of the funding guidance provided by DOE.



#2 – Inside DOE
(April – July FY 200N)

- The Director of SC and the DOE Assistant Secretaries present their program priorities to DOE.
- DOE determines overall agency priorities.
- SC prepares President's Budget. Each SC AD responsible for preparation of AD-ship budget.

#3 – OMB
(Aug. – Dec. FY 200N)

- DOE budget submitted to OMB.
- Each AD defends program budget at OMB hearing in early September.
- OMB provides "Passback" guidance to DOE in late November.
- Discussions between DOE and OMB refine final budget numbers.
- SC prepares President's Budget. Each SC AD responsible for preparation of AD-ship budget.

#4 – Congress
[February FY 200(N+1)]

- President's Budget presented to Congress.

[Mar. – Sept. FY 200(N+1)]

- Agencies present their budgets to Congress in formal hearings.
- Congress appropriates funding for 13 appropriations bills for FY 200(N+2), using the "President's Budget as a starting point for the Congressional Budget and appropriations."

From the comments of Ellen Burns, Office of Congressman Vern Ehlers, May 2004

Budget Formulation – General Guidelines

- Budget formulation is not simple
  - Multi-dimensional
    - **(Operations/Construction/R&D; labs/universities;…)**
  - Dynamic
  - Strongly coupled
  - With significant boundary conditions

- We try to proceed using a few basic guidelines
  - Project-like activities on planned profiles
  - Facility operations based on operations plan
  - Core research (lab/university) at level-of-effort
  - If funds remain, they can be used for new initiatives

DOE Budget Process

- In recent years, more emphasis on budget integration, planning and transparency
  - Motivated in part by focus on good project management practice throughout DOE
  - Baselined construction projects are “protected” in budget planning
    - ➢ Emphasis on getting new projects ready for baseline
- However, this is a long-lead process
  - All significant (>$2M) projects must be identified and approved internally **at least 1 year** before $$ flows
    - ➢ Projects involving civil construction have even longer lead times
  - Not well-matched to basic research R&D style where one can implement new ideas quickly
    - ➢ Source of frustration for the community

Example: FY2010 HEP Budget

(Dollars in Thousands)	FY 2009 Actual	FY 2009 Recovery Act	FY 2010 Approp
High Energy Physics			
Proton Accelerator-Based Physics	401,368	107.990	434,153
Electron Accelerator-Based Physics	32,030	1,400	27,427
Non-Accelerator Physics	101,138	4,445	99,625
Theoretical Physics	66,148	5,975	66,962
Advanced Technology R&D	195,042	116,690	182,316
Total, High Energy Physics	**795,726**	**236,500**	**810,483**

This budget is embedded in the larger Office of Science budget (see next slide). Congress usually allows redistribution between HEP subprograms.

FY 2010 Office of Science Budget

FY 2010 Funding Status

(budget authority in thousands of dollars)

	FY 2009			FY 2010				
	Base Approp.	Recovery	Enacted Approp.[a/]	Request	Req. vs. 09 Base Approp.	Conf.	Conf. vs. Request	
Basic Energy Sciences	1,571,972	+555,406	2,127,378	1,685,500	+113,528	1,636,500	-49,000	4.1%
Advanced Scientific Computing	368,820	+161,795	530,615	409,000	+40,180	394,000	-15,000	6.8%
Biological and Environmental Research	601,540	+165,653	767,193	604,182	+2,642	604,182	—	0.4%
High Energy Physics	795,726	+232,390	1,028,116	819,000	+23,274	810,483	-8,517	1.9%
Nuclear Physics	512,080	+154,800	666,880	552,000	+39,920	535,000	-17,000	4.5%
Fusion Energy Sciences	402,550	+91,023	493,573	421,000	+18,450	426,000	+5,000	5.8%
Science Lab Infrastructure	145,380	+198,114	343,494	133,600	-11,780	127,600	-6,000	-12.2%
Science Program Direction	186,695	+5,600	192,295	213,722	+27,027	189,377	-24,345	1.4%
Workforce Development	13,583	+12,500	26,083	20,678	+7,095	20,678	—	52.2%
Safeguards and Security	80,603	—	80,603	83,000	+2,397	83,000	—	3.0%
Subtotal, Science	4,678,949	+1,577,281	6,256,230	4,941,682	+262,733	4,826,820	-114,862	3.2%
ARPA-E	15,000	—	15,000	—	-15,000	—	—	
Safeguards and Security (reimbursable	—	—	—	—	—	—	—	
Congressionally-directed projects	93,687	—	93,687	—	-93,687	76,890	+76,890	
SBIR/STTR	—	+18,719	18,719	—	—	—	—	
Use of prior year balances	-15,000	—	-15,000	—	+15,000	—	—	
Unallocated	—	+4,000	4,000	—	—	—	—	
Total, Science	4,772,636	+1,600,000	6,372,636	4,941,682	+169,046	4,903,710	-37,972	2.7%

[a/] FY 2009 Enacted Appropriation is prior to the Small Business Innovation Research/Technology Transfer reprogramming and appropriations

b/ $15,000,000 appropriated under for Science prior appropriation Acts for the Advanced Research Projects Agency--Energy is to be transferred to

Publicly Visible HEP Budget Product

High Energy Physics

Funding Profile by Subprogram

(dollars in thousands)

	FY 2006 Current Appropriation	FY 2007 Request	FY 2008 Request
High Energy Physics			
Proton Accelerator-Based Physics	362,157	376,536	389,672
Electron Accelerator-Based Physics	112,291	117,460	79,763
Non-Accelerator Physics	54,205	59,271	72,430
Theoretical Physics	47,984	52,056	56,909
Advanced Technology R&D	121,601	159,476	183,464
Subtotal, High Energy Physics	698,238	764,799	782,238
Construction	—	10,300	—
Total, High Energy Physics	698,238[a]	775,099	782,238
Stanford Linear Accelerator Center (SLAC) Linac Operations (non-add)[b]	(56,100)	(52,100)	(32,500)
High Energy Physics, excluding SLAC Linac Operations (non-add)[b]	(642,138)	(722,999)	(749,738)

Public Law Authorizations:
Public Law 95-91, "Department of Energy Organization Act", 1977
Public Law 103-62, "Government Performance and Results Act of 1993"
Public Law 109-58, "Energy Policy Act of 2005"

Mission

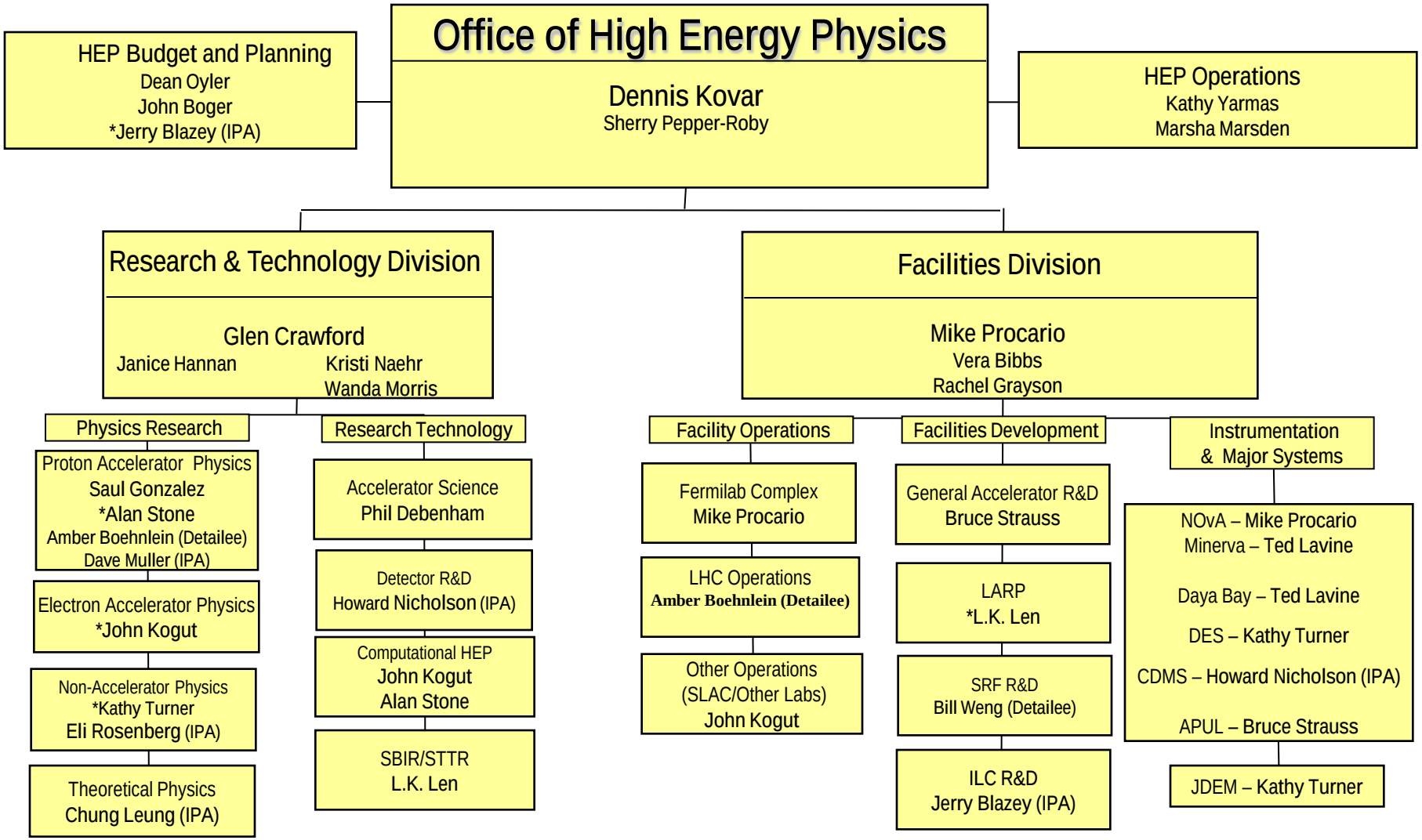
The mission of the High Energy Physics (HEP) program is to understand how our universe works at its most fundamental level. We do this by discovering the most elementary constituents of matter and energy, exploring the basic nature of space and time itself, and probing the interactions between them. These fundamental ideas are at the heart of physics and hence all of the physical sciences. To enable these discoveries, HEP supports theoretical and experimental research in both elementary particle physics and fundamental accelerator science and technology. HEP underpins and advances the DOE missions and objectives through this research, and by the development of key technologies and trained manpower needed to work at the cutting edge of science.

- Overview of the program for interested layman, NOT intended to be
  - **Comprehensive**
  - **Prescriptive**
  - **Highly detailed**
- Main goal is to be a description of the program which is
  - **Compelling**
  - **Consistent**
  - **Reflecting research priorities**

HEP Budget Narrative

- Some examples of recent HEP budgets on our website: **http://www.science.doe.gov/hep/budget/HEPBudgetpage.shtm**
- Narrative format set by DOE CFO, OMB, Congress
- The major HEP subprogram categories are “tool-based”, that is, divided by what sort of facility/experiment is used to perform the research.
  - This does not always align with the major scientific thrusts.
- HEP management was restructured in 2008 to better align with the budget structure
  - Program managers have budget control (and responsibility) for their own programs.
  - Overall strategic vision coordinated by Associate Director for HEP and Division Directors

HEP Organization Chart

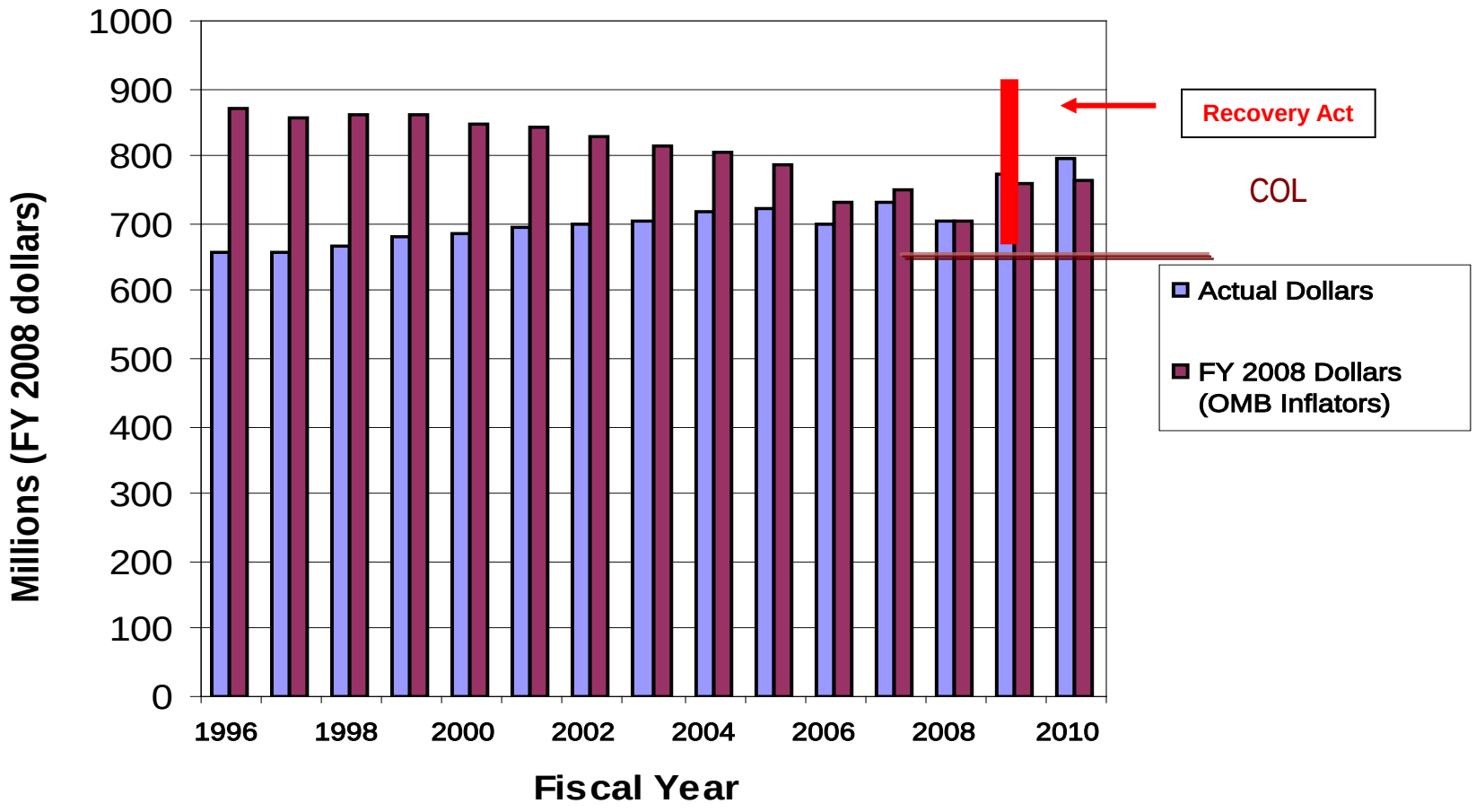


Budget Execution (Current FY)

- Write financial plans (labs) and grants (universities, others) based on appropriated (or expected) budget
- Initial plan usually based on "worst case" of House or Senate mark. DOE CFO sets overall funding level.
  - In addition, program may hold back funds for pending decisions, possible rescissions, contingency
- Subsequent plans can rearrange funding distribution or priorities
  - In case of Continuing Resolutions, can get stuck in holding pattern, making execution difficult
  - This has become the rule rather than the exception
- **Generally try to implement "big picture" priorities identified by the scientific community**
  - After the fact, review/ discuss outcomes with advisory groups

Recent Budget History

- HEP FY 2009 funding is + 10% compared to FY 2008 and above OMB Cost-of-Living (COL) from FY 2007
- HEP received $236.5 million in Recovery Act funding
- HEP FY 2010 Appropriations is about OMB COL compared to FY 2009



Projects and Budgets

- Managed according to approved baselines by designated Project Manager. Extent of oversight tailored to total project cost (TPC)
  - Decision process in R&D phase still ill-defined for smaller projects, handled case-by-case
    - How to cross the “valley of death” between proof-of-principle R&D and cutting metal?
  - New rules and guidelines for how to report costs both pre- and post-baseline
    - Available on request
  - Complex dance between project and budget requirements/timelines (see following slide)

Budget vs Project Process

Budget Process

- Externally driven by Congress and Office of Management and Budget
- Cares about
  - How much $$ do you want to spend? When? Why?
  - What color is the $$? (operating, equipment, other)
- Construction projects automatically get higher visibility due to extra reporting requirements and financial controls

DOE Project Management Process

- Internally driven by DOE Office of Engineering and Construction Management (OECM) and SC Office of Project Assessment (Lehman)
- Cares about
  - What Phase is the project in?
  - Is it ready to go to the next Phase? (Critical Decisions or CD's, e.g. CD-0)
  - Cost, schedule, technical readiness
- Larger projects automatically get higher visibility in DOE due to layered approval levels

DOE Budget Requests REQUIRE appropriate CD's are passed before requesting/spending $$

Strata of DOE Projects

Threshold	Triggers	DOE Jargon	Decision Maker	Consequences	Recent Examples
Civil Construction: ➢ $5M OR ➢ 20% of TPC	Extensive Budget Reporting	Line Item Const.	if TPC >$400M: *Dep. Sec.* if TPC >$100M: *Director, Office of Science* if TPC >$20M: *Assoc. Dir.*	Budget Reporting and Tracking; Congressional visibility; OMB apportionment	NuMI LBNE
Total Project Cost (TPC) >$20M	Extensive Project Reporting	MIE		Earned Value Management; DOE project reporting (PARS); OMB performance tracking (PART)	U.S. LHC NOvA Daya Bay DES
Total Project Cost (TPC) >$5M	DOE Project Management System	MIE	AD's delegate	DOE Project Management (CD-process, reviews)	Run II Detector Upgrades Minerva
Total Estimated Cost (TEC) >$2M	Budget Reporting	Major Item of Equip. (MIE)	HEP program manager	MIE tracking; Request in FY+2 budget	VERITAS T2K

Backup

U.S. Department of Energy

Office of Science

DOE Budget Timeline