National Organization of Test, Research, and Training Reactors

University Programs – Update and Outlook

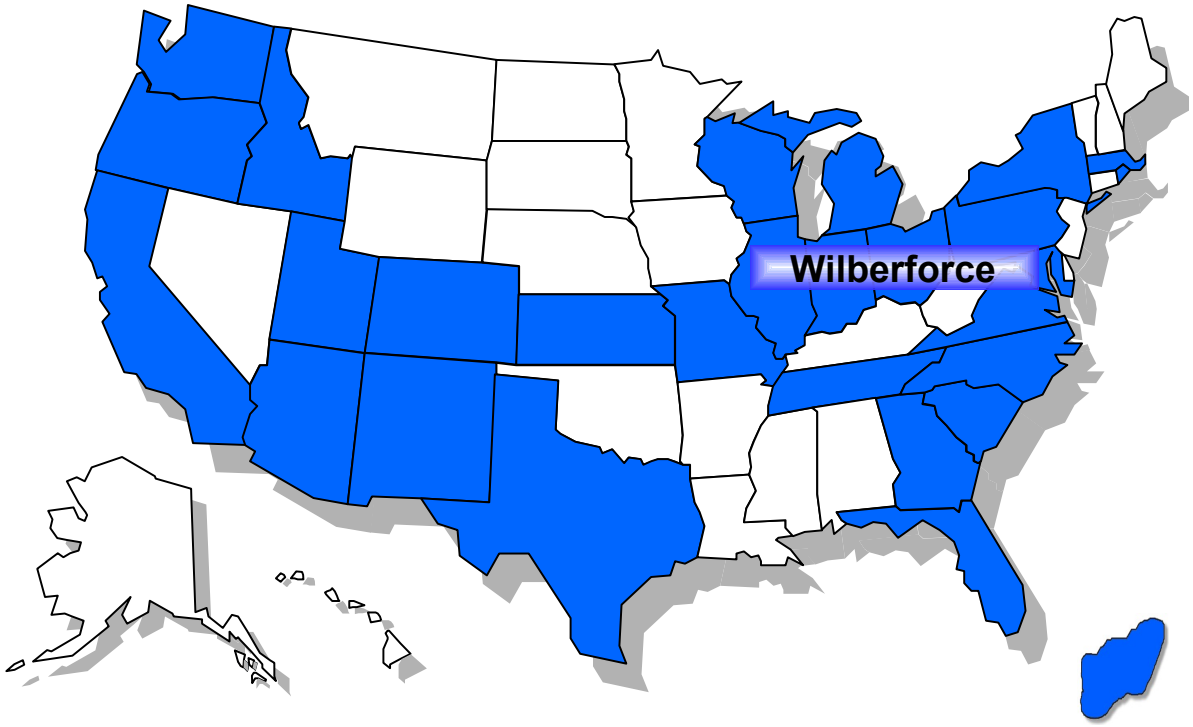
John Gutteridge
Director of University Programs
Office of Nuclear Energy, Science and Technology
U.S. Department of Energy

September 15, 2005

University Reactor Infrastructure and Education Assistance Program

	FY 2004	FY 2005	FY 2006 Request
Matching Grants	$ 0.8	$ 1.0	$ 1.0
Fellowships/Scholarships (Includes Minority Awards)	1.2	2.0	2.4
University Nuclear Infrastructure	15.2	14.7	14.1
Nuclear Engineering Education Research	5.0	4.9	5.0
Fellowships/Scholarships - HP	--	0.2	0.3
Radiochemistry	0.3	0.3	0.6
Nuclear Engineering Education Opportunities	0.4	0.4	0.6
TOTAL	**$22.9**	**$23.5**	**$24.0**

States With Participating Universities



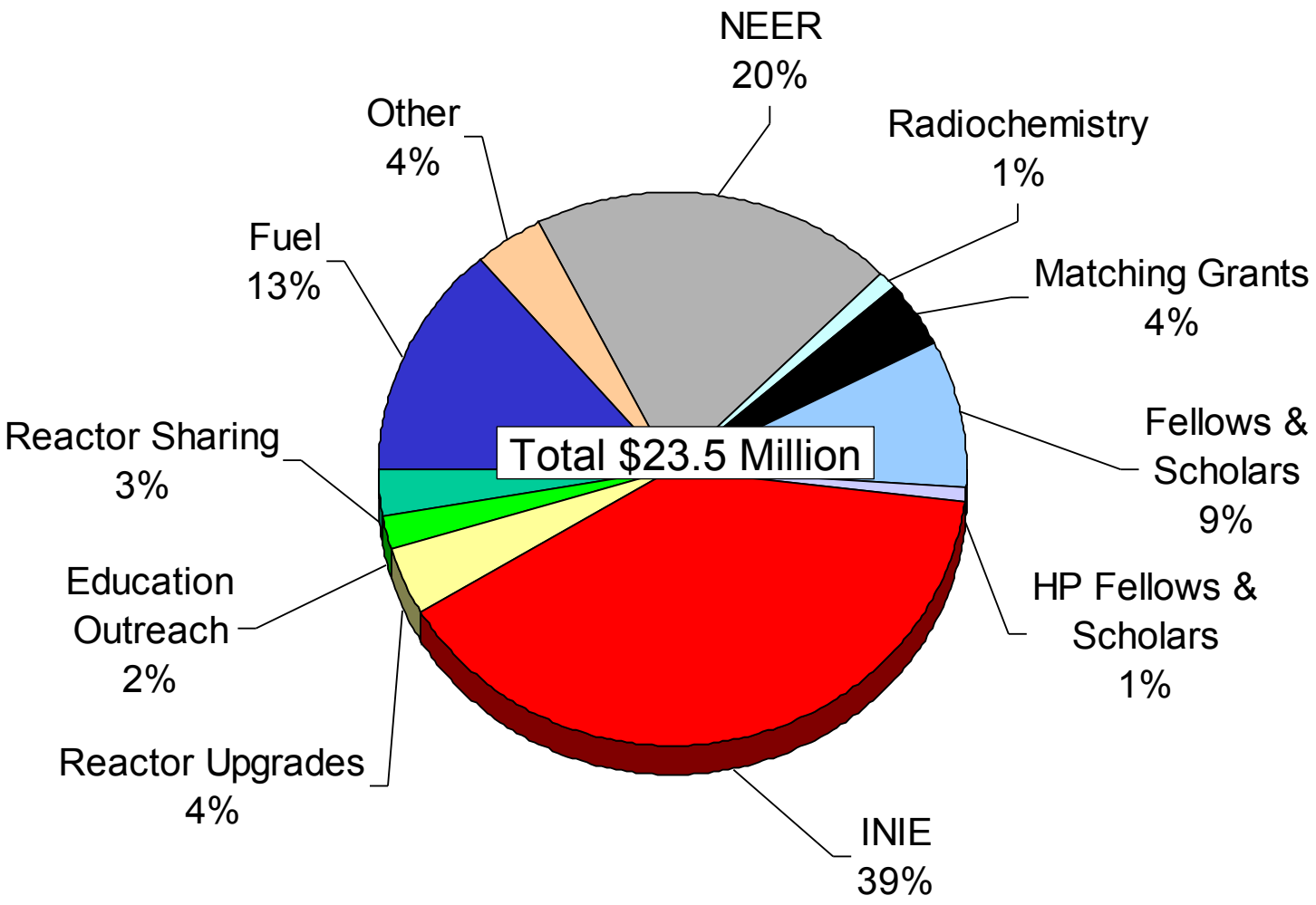
Program Participants

Clemson University
Colorado State University
Georgia Institute of Technology
Howard University*
Idaho State University
Kansas State University
Livingstone College*
Massachusetts Institute of Technology
Morgan State University*
New Mexico State University**
North Carolina State University
Ohio State University
Oregon State University
Pennsylvania State University
Polytechnic University of Puerto Rico**
Prairie View A&M University*
Purdue University
Reed College
Rensselaer Polytechnic Institute
Rhode Island Nuclear Science Center
South Carolina State University*
Texas A&M University
Texas A&M Kingsville**
Tuskegee Institute*
University of Arizona
University of California-Berkeley
University of Cincinnati
University of Florida
University of Illinois
University of Maryland
University of Massachusetts-Lowell
University of Michigan
University of Missouri-Columbia
University of Missouri-Rolla
University of Nevada – Las Vegas
University of New Mexico**
University of South Carolina
University of Tennessee
University of Texas
University of Utah
University of Virginia
University of Wisconsin
Washington State University

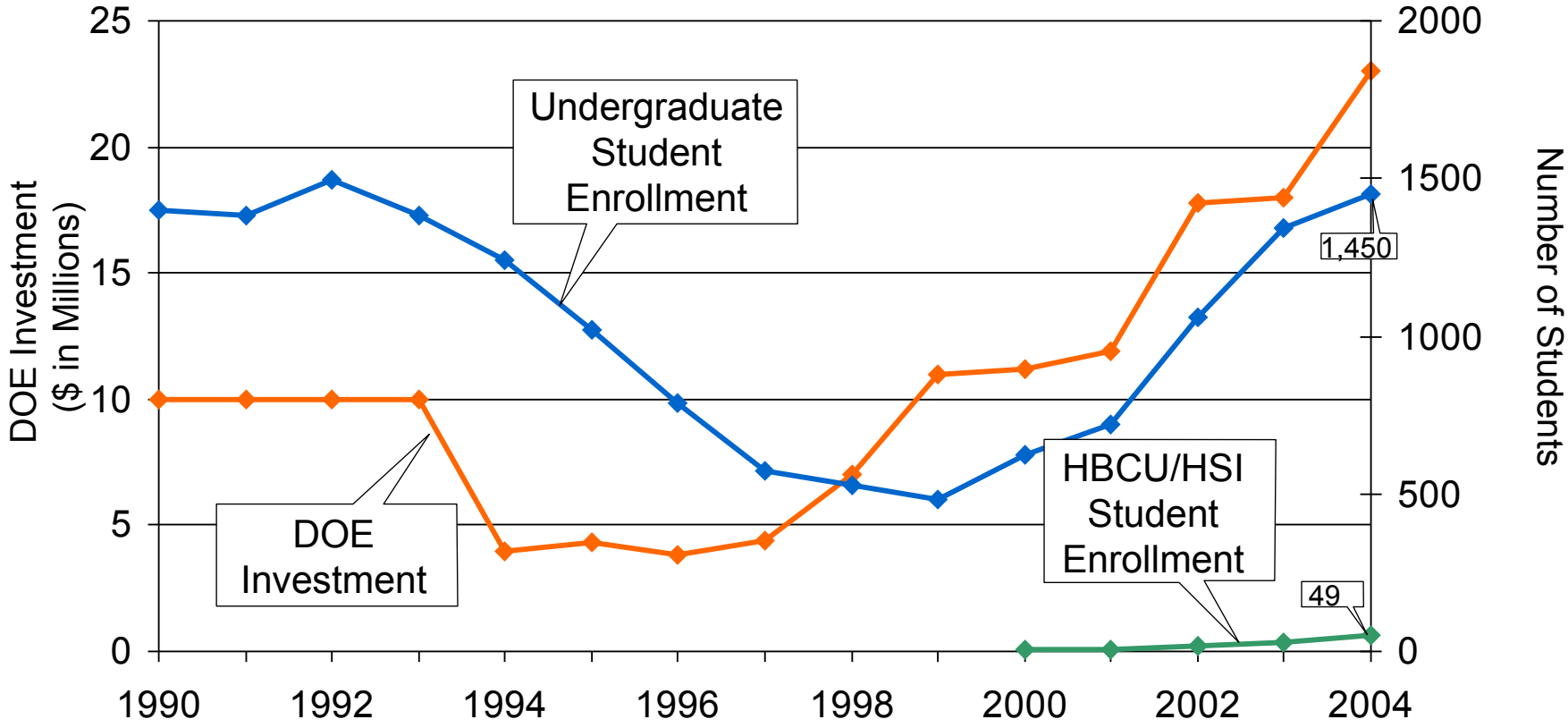
Worcester Polytechnic Institute

**U.S. Historically Black Colleges and Universities; **Hispanic Serving Institution*

University Reactor Infrastructure and Education Assistance Program – FY 2005



University Reactor Infrastructure and Education Assistance Program



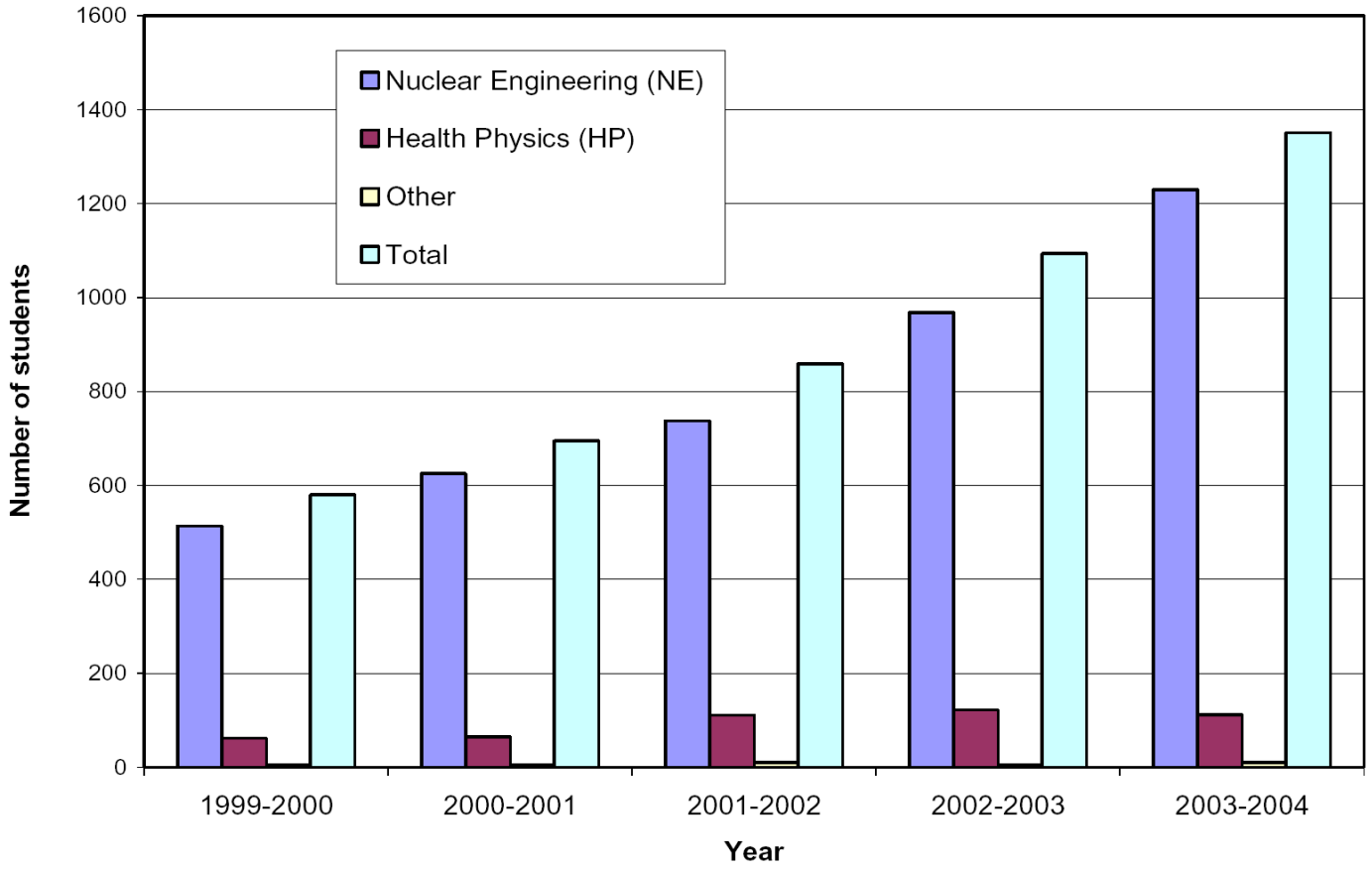
Nuclear Engineering Department Heads Organization (NEDHO)

Enrollment/Employment Data (2004)

- Covered 1999/2000 through 2003/2004 academic years
- Nineteen schools responded
- Shows that undergraduate NE enrollment is rising at an annual rate of 23 percent (NE and HP)
- Graduate enrollment rose only 4 percent
- 38 percent of BS conferred students continued their education
- 29 percent of BS grads is unknown – a point of concern

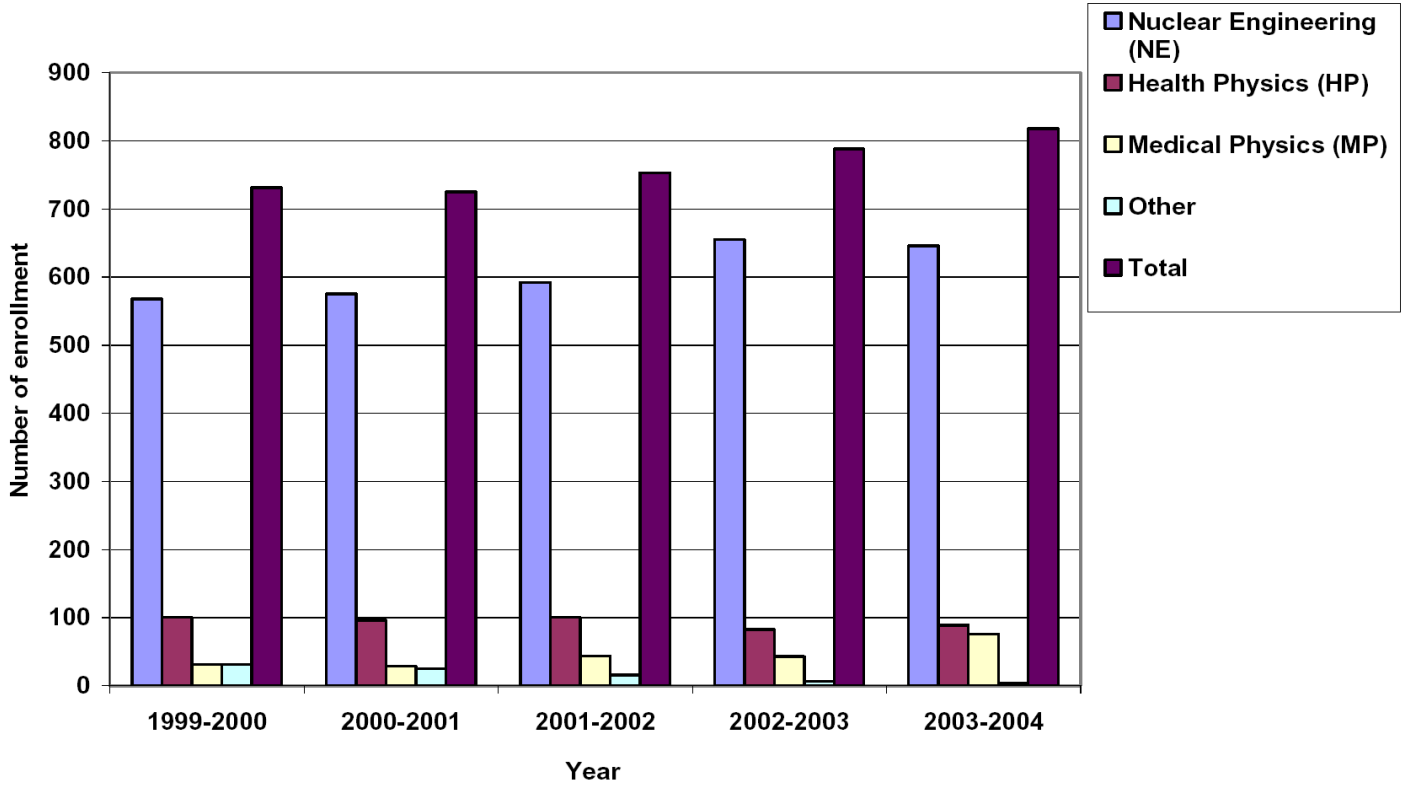
NEDHO

Undergraduate Enrollment



NEDHO

Graduate Enrollment



Survey of Nuclear Engineering Students

Factors Influencing Their Choice of Nuclear Engineering Education

Information Sources

When you were considering colleges and universities in high school, which sources of information were most important to you? (select up to three)

• College ranking guidebooks/websites	50.9%
• Campus visit	49.5%
• College websites	30.6%
• Parents	27.3%
• Direct mail from colleges	23.1%
• High school teachers	20.8%
• Students (family or friends in college)	19.9%
• High school guidance counselors	13.4%
• Family friends or community members / Other	10.6%
• Brother/Sister or other family	9.3%
• Graduates of the college of your interest	8.3%
• College fairs at high schools	3.2%
• Direct mail from science teachers' professional assoc.	5.1%
• High school alumni enrolled in college	3.2%

College Choice

When you made your choice of which college or university to attend, which of the following factors were most important in your final decision? (select up to three)

• Availability of a specific major	55.6%
• Quality of undergraduate education	50.0%
• National reputation	48.6%
• Campus size and location	39.8%
• Total cost to attend the institution	36.6%
• Job opportunities/ placement for graduates	23.6%
• Availability of scholarships	20.8%
• High quality faculty	16.2%
• Availability of financial assistance	15.7%
• Student access to faculty	8.8%
• Quality of graduate education	7.9%
• COOP/ Internship opportunities	6.9%
• Strict admissions standards	5.6%
• Other	4.6%
• Avail. of ROTC programs/Parent is an alumnus	3.7%

When Introduced to the Field

- **When did you first hear about majors or careers involving nuclear science/engineering/technology or health physics?**
  - 8th grade or before 21.8% ✦
  - 9th grade 9.3%
  - 10th grade 11.6%
  - 11th grade 21.8%
  - 12th grade 18.1%
  - Freshman in college 15.3% ✦
  - Sophomore in college 2.3% ✦

✦ M/F difference is significant

How Introduced to the Field

How did you first hear about majors in nuclear science/engineering/technology, or health physics? (select one)

• Other	18.1%
• High school teacher	14.8%
• An intro to engineering/physics class	14.4%
• Toured a nuclear facility, research center or hospital	6.5%
• A mailing or brochure	6.0%
• A college open house/information session while in H.S.	6.0%
• Friend(s) studying nuclear science or engineering	5.6%
• Family friend or community member	3.2%
• An open house/information session while in college	2.3%
• High school counselor	0.9%

Attraction to the Field

What attracted you most to the field of nuclear science? (select up to three)

• Intellectually stimulating	55.1%
• Attractive salary	47.7%
• Good job opportunities	36.6%
• Challenging career	32.9%
• Work at the forefront of technology	31.9%
• Work in a cool career	28.7%
• Providing clean energy	28.7%
• Good job security	25.5%
• Importance of national energy independence, or national security	21.8%
• Work in a problem-solving environment	19.9%
• Work in a complex career	16.7%
• Rapid job advancement	10.2%
• Other	4.2%

Expected Area of Work

In which area of nuclear science/engineering/technology or health physics do you plan to work after your degree/certificate completion?

• Commercial Power	23.1%
• Research & development	14.8%
• Nuclear medicine	14.4%
• Other	11.6%
• National lab	8.3%
• Military	6.5%
• Academic (university teaching or research)	4.2%
• Nuclear Regulatory Commission	3.2%
• Major Vendor/Architect/Eng. Organization	2.8%
• Department of Energy	2.8%
• Weapons	2.3%
• Waste management or envir. restoration	2.3%
• Consulting	1.4%

NOTE: Academic and National Lab may overlap somewhat in terms of work area, and that these students may not be far enough along in their college career to know the options in these two areas

Also note that Commercial Power and the category "utility" was added together

Area of Study

Which best describes your area of study in nuclear science?

• Power plant systems and operations	33.8%
• Engineering physics	17.6%
• Plasma, fusion, laser research	13.4%
• Core design	10.2%
• Radiation protection (medical)	7.4%
• Medical research	7.4%
• Radiation protection (power)	5.1%

So Now We Know More From All These Surveys And Data Collection, What Are We Doing To Implement Programs To Keep The Pipeline Going?

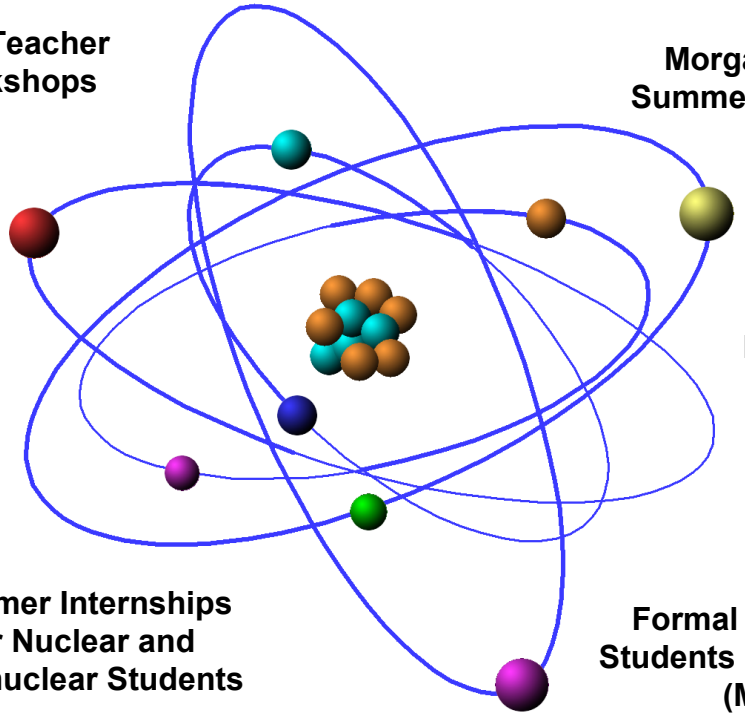
Examples of Outreach Efforts

University Partnerships

ANS Teacher Workshops

Morgan State Summer Program

Harnessed Atom – Pittsburgh Public Schools



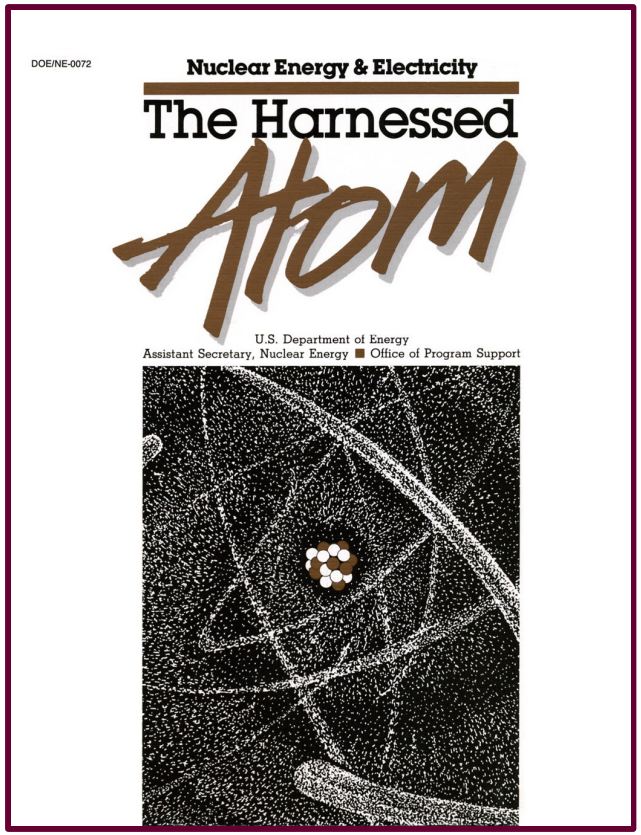
Fellowships and Scholarships

Summer Internships for Nuclear and Non-nuclear Students

Formal Survey of NE Students past BS degree (Messer)

The Harnessed Atom

High School Honors Edition



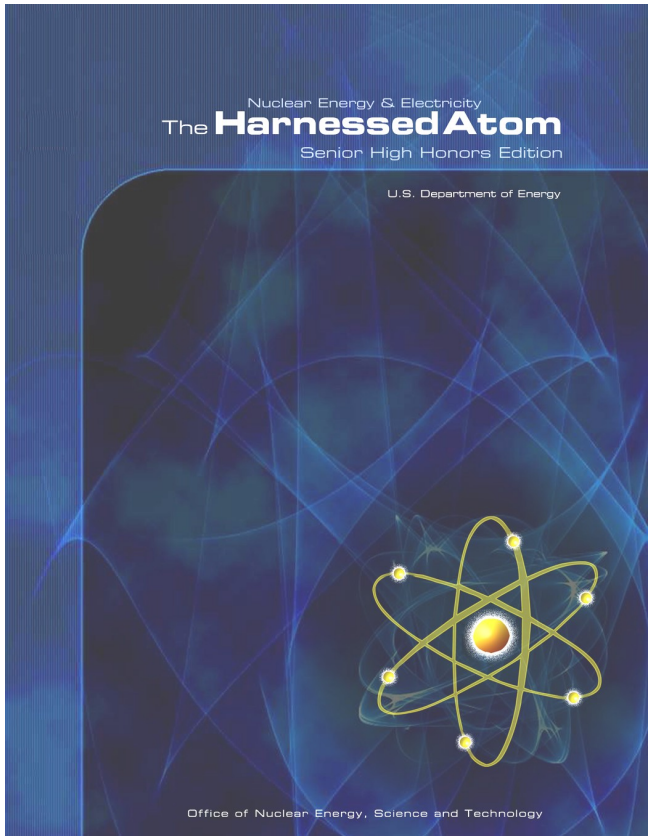
The Harnessed Atom

- **Science educational curriculum developed 20 years ago by DOE Office of Nuclear Energy for junior high classrooms**
- **Includes a Teacher's Guide, Student Reader, experiments and activities, and a video in mini-CD format (originally a filmstrip)**
- **Though designed for junior-high age students, it tested successfully on non-science major students through Junior College level**
- **10,000 classroom sets produced by DOE**

The Harnessed Atom

High School Honors Edition

Objective: Redesign 20-year Old Curriculum



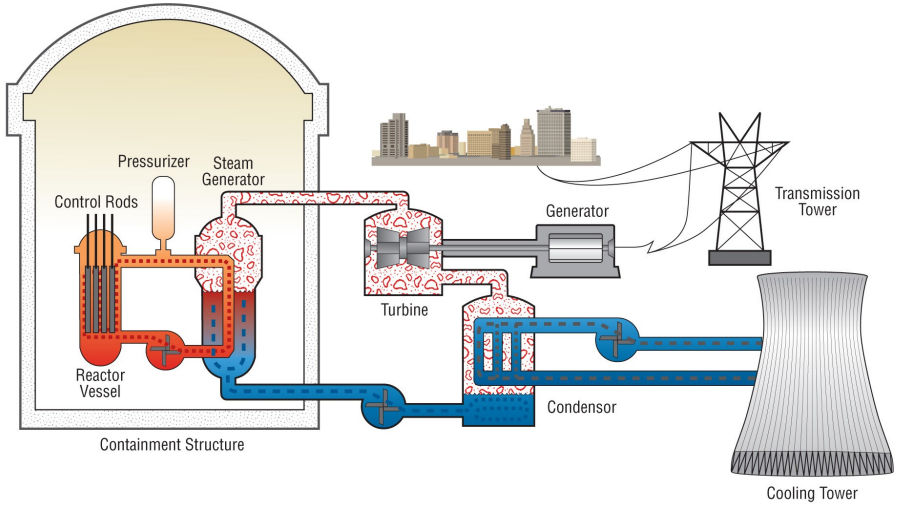
- For more advanced students grades 11-12
- Update content and format
- Work with a Public School system to review and validate through Pilot Test of the curriculum
- Field Test a revised edition in regions across the U.S.
- Distribute validated curriculum nationally in partnership with Labs, academic institutions, public and private sectors

The Harnessed Atom

High School Honors Edition

Why we are updating the curriculum

- Helps ensure that United States maintains the technical skill base required to support our energy infrastructure
- Increases awareness at the pre-college level for students interested in sciences and engineering, including nuclear engineering
- Helps high school students make informed choices about college majors and career options
- Supports Department of Energy mission to foster education and understanding of energy technologies and options



The Harnessed Atom

High School Honors Edition

What revised Harnessed Atom will accomplish in classrooms

- Strengthens teaching of fundamental nuclear science concepts
- Provides critical thinking experiences for students
- Teaches basic science of energy production, thermodynamics, radiation, nuclear reactions, and nuclear energy
- Provides clear, unbiased information on nuclear topics

The Harnessed Atom

High School Honors Edition

This is a partnership where everyone wins

- **Strengthens teaching of fundamental nuclear science concepts at the high school level**
- **Industry and academic institutions benefit because students are better prepared**
- **Teachers gain valuable teaching resources**
- **Students gain knowledge of nuclear science, energy technology and of career options that will help them far beyond high school**

Electrostatic Fun for Pittsburgh High Schooler at Oak Ridge Science Museum

Harnessed Atom

Status

- **Pilot tested program in the Pittsburgh Public School System (2004-2005 academic year)**
- **Looking for an additional 3-5 areas to field test H.A. curriculum**
- **Have interest for next field tests from:**
  - North Carolina – Raleigh Area (GE)
  - Massachusetts (MIT)
  - Central Virginia (AREVA)
  - Idaho Falls, Idaho (INL)
  - Oregon (Oregon State/WNSA)
- **Funding provided by DOE/private sponsor**
- **All field tests will include facilities/reactor visit**
- **DOE will continue support of school system after initial field test is completed**

FY 2005 Efforts

- Support 6 Innovations in Nuclear Infrastructure and Education (INIE) Consortia
- Provide fresh fuel and spent fuel support for university research/training reactors
- Funded 20 University Reactor Instrumentation
- Funded 22 Reactor Sharing support
- Support 18 new and 33 continuing Nuclear Engineering Education Research (NEER) grants
- Funded 25 Matching Grants
- Grant approximately 130 Fellowships/Scholarships/Internships
- Support >35 Teacher Workshops through the American Nuclear Society
- Fund 3-4 Radiochemistry programs
- Fund 7 University Partnership Programs
- Support 4 “new” nuclear engineering schools – SCSU, USC, West Point, UNLV
- Outreach to High School Students – Pittsburgh Public School System and beyond
- Continue survey of students in an effort to determine when, why and how students make career decisions, and how best to market nuclear engineering and science to students
- Begin detailed survey of past and current students to determine numbers, employment, those that remained in nuclear field, etc.

FY 2006 Budget Changes

- Support Junior Faculty research
- Additional support for INIE Consortia
- Increase University partnerships to eight, totaling 17 universities
- Support of health physics and increased fellowship and scholarship support at NE/HP schools
- Increasing focus on reactor conversion activities for plate type and TRIGA university reactors

Summary

- University Program has come a long way, but increased funding is crucial to the future of nuclear engineering and it is by no means assured
- Enrollments have soared, but may need to rise even more if the country pursues an activist nuclear energy policy
- Current programs are working well and new initiatives will help sustain infrastructure
- DOE/NE is committed to the continued growth of nuclear education in the U.S. through outreach programs like the Harnessed Atom to all sectors of the population
- Congressional support remains strong, but growth will require significant new funding
- Federal support of nuclear education is under scrutiny

WWW.NUCLEAR.GOV