

SOME REFLECTIONS ON THE STATUS AND TRENDS IN POWER ENGINEERING EDUCATION

G. Gross, G. Heydt, P. Sauer and V. Vittal
UIUC ASU ■ UIUC and ISU

presented at the

*IERE Workshop: The Next Generation of Power
Engineers and Researchers*

Friday, October 10, 2003

Montréal, Québec, Canada

OUTLINE

- ❑ **Power engineering education: the present status**
- ❑ **What do statistics indicate**
- ❑ **Undergraduate and graduate program trends**
- ❑ **Faculty shifts**
- ❑ **Curriculum developments**
- ❑ **Recommendations**

THE POWER ENGINEERING DISCIPLINE

- ❑ Power engineering is among the oldest branches of electrical engineering and the field is deemed to be *mature*
- ❑ The wide interest in the newer fields, such as microelectronics, nanotechnology, computers, bioengineering and communications, has steadily eroded interest in power engineering
- ❑ The power industry has not had the type of *razzle dazzle* that, say, the computer and the other high-tech industries have enjoyed for many years

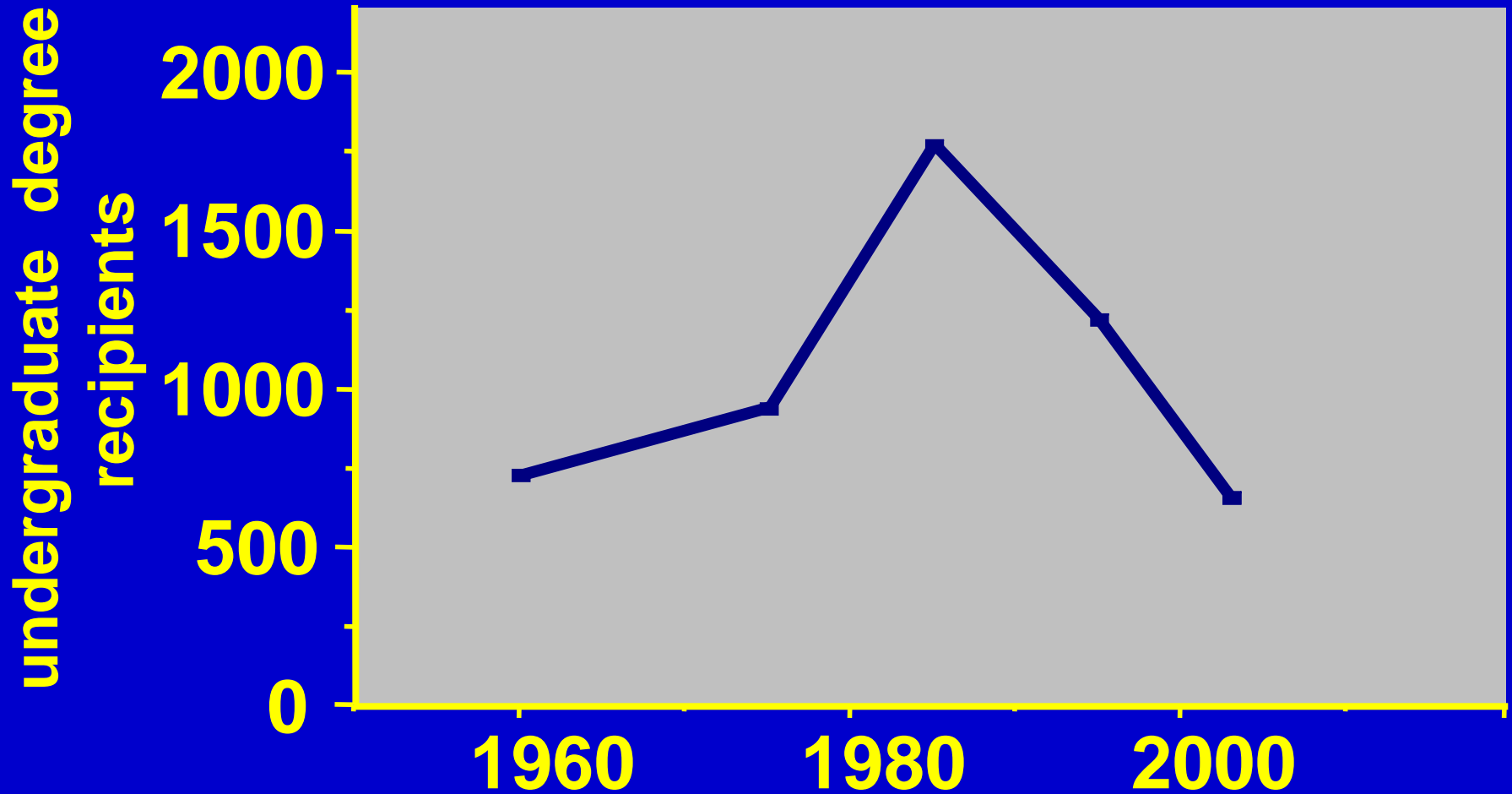
THE POWER ENGINEERING DISCIPLINE

- ❑ The restructuring of the electric power industry has dwindled support for power engineering programs and research; this support becomes further diminished by the extensive merger and acquisition trend in the industry
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- ❑ The intensive reduction in engineering personnel at utilities has given the field a certain *black eye*
- ❑ The salary range of power industry offers is typically below that of other *hot* industries

THE POWER STUDENT ENROLMENTS

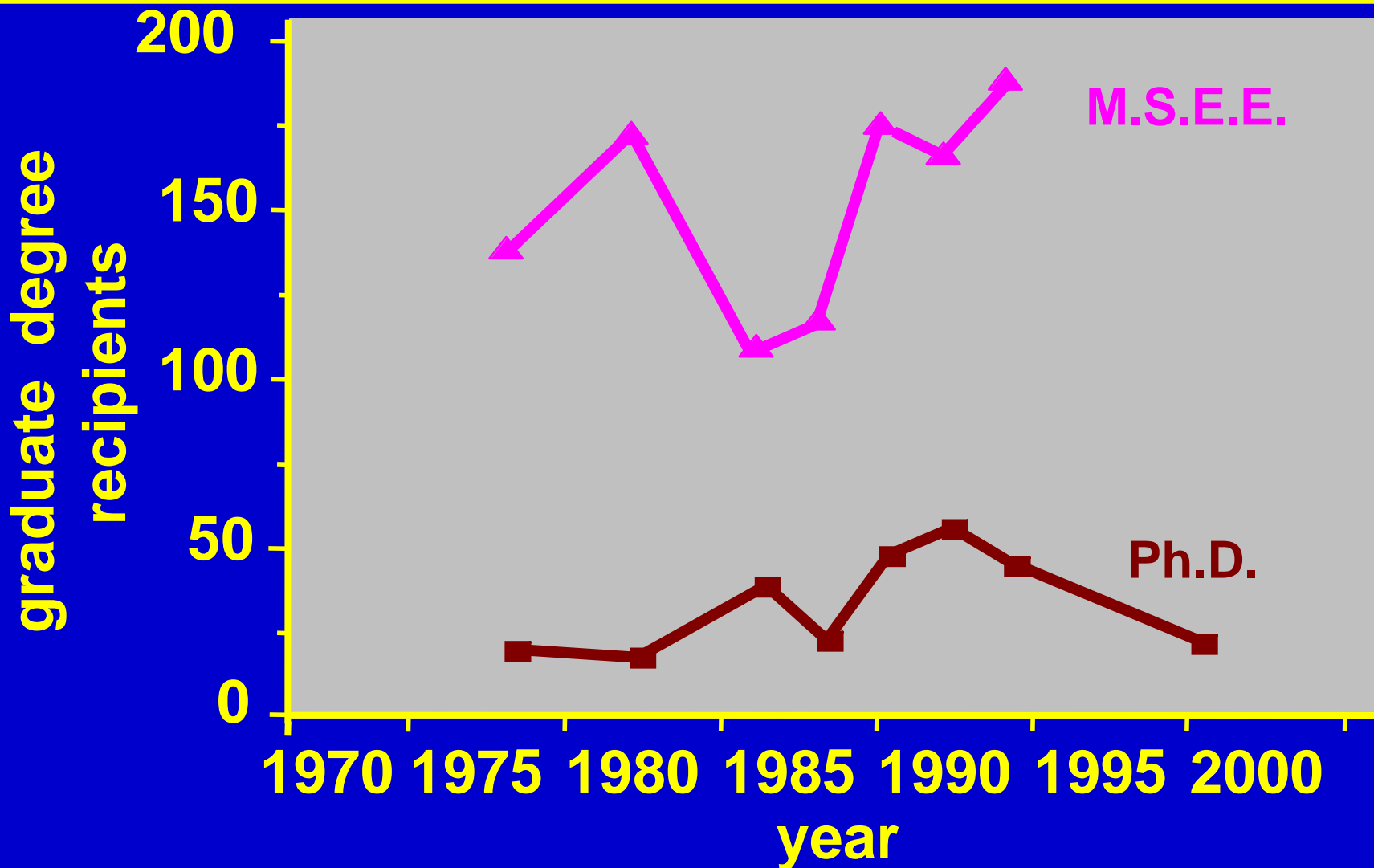
- ❑ The undergraduate student enrolment in the U.S. has been on a downward slope for many years
- ❑ The graduate student enrolment has been at a more steady level
- ❑ The level of the graduate enrolments has been due to a great extent to the large percentage of foreign students in the M.S. and Ph.D. programs

U. S. POWER ENGINEERING UNDERGRADUATE ENROLMENTS



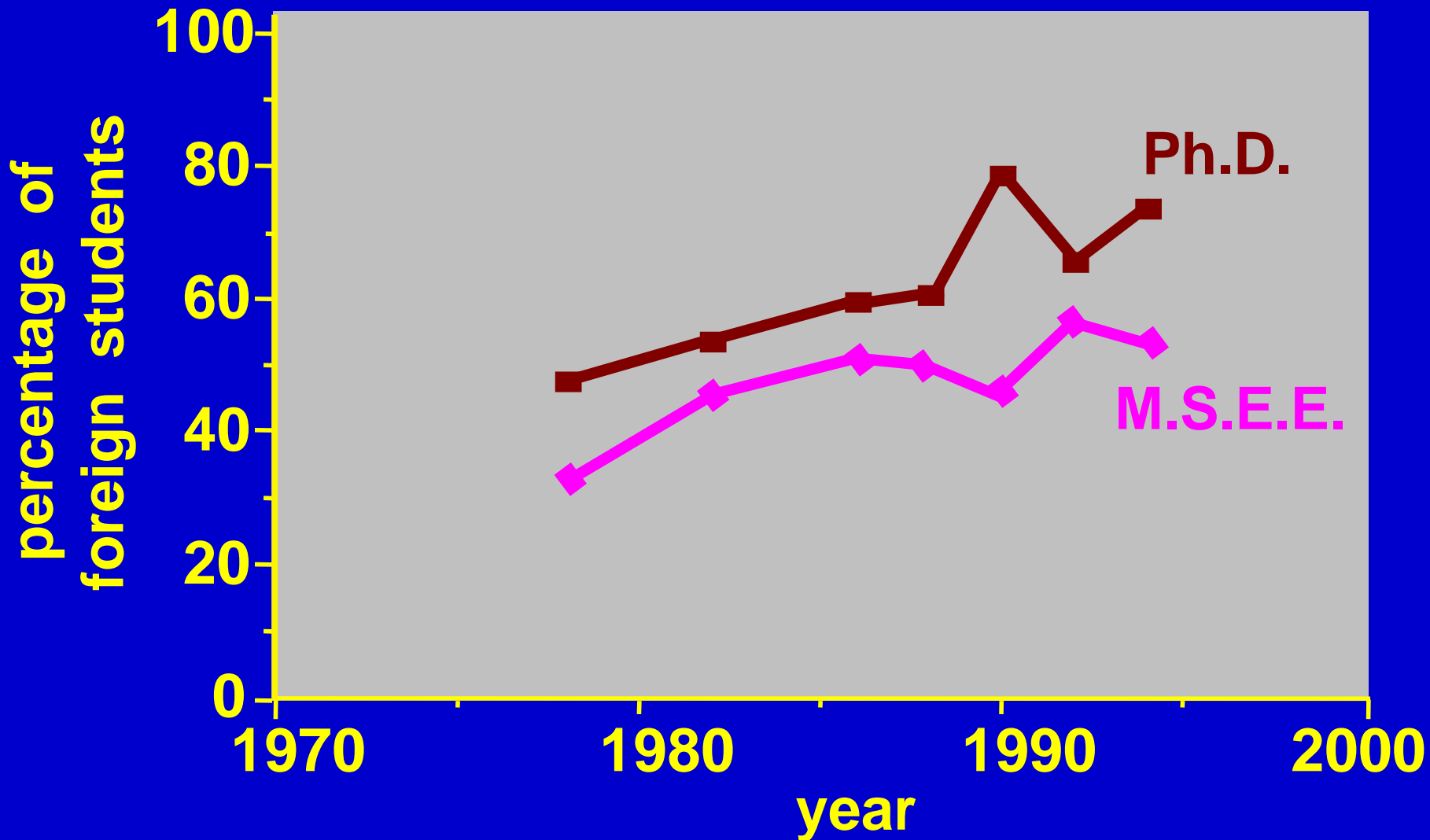
Source: G.T. Heydt and V. Vittal, "Feeding Our Profession," *IEEE Power & Energy Magazine*, vol.1, issue 1, Jan/Feb 2003, pp 38-45

U. S. POWER ENGINEERING GRADUATE ENROLMENTS



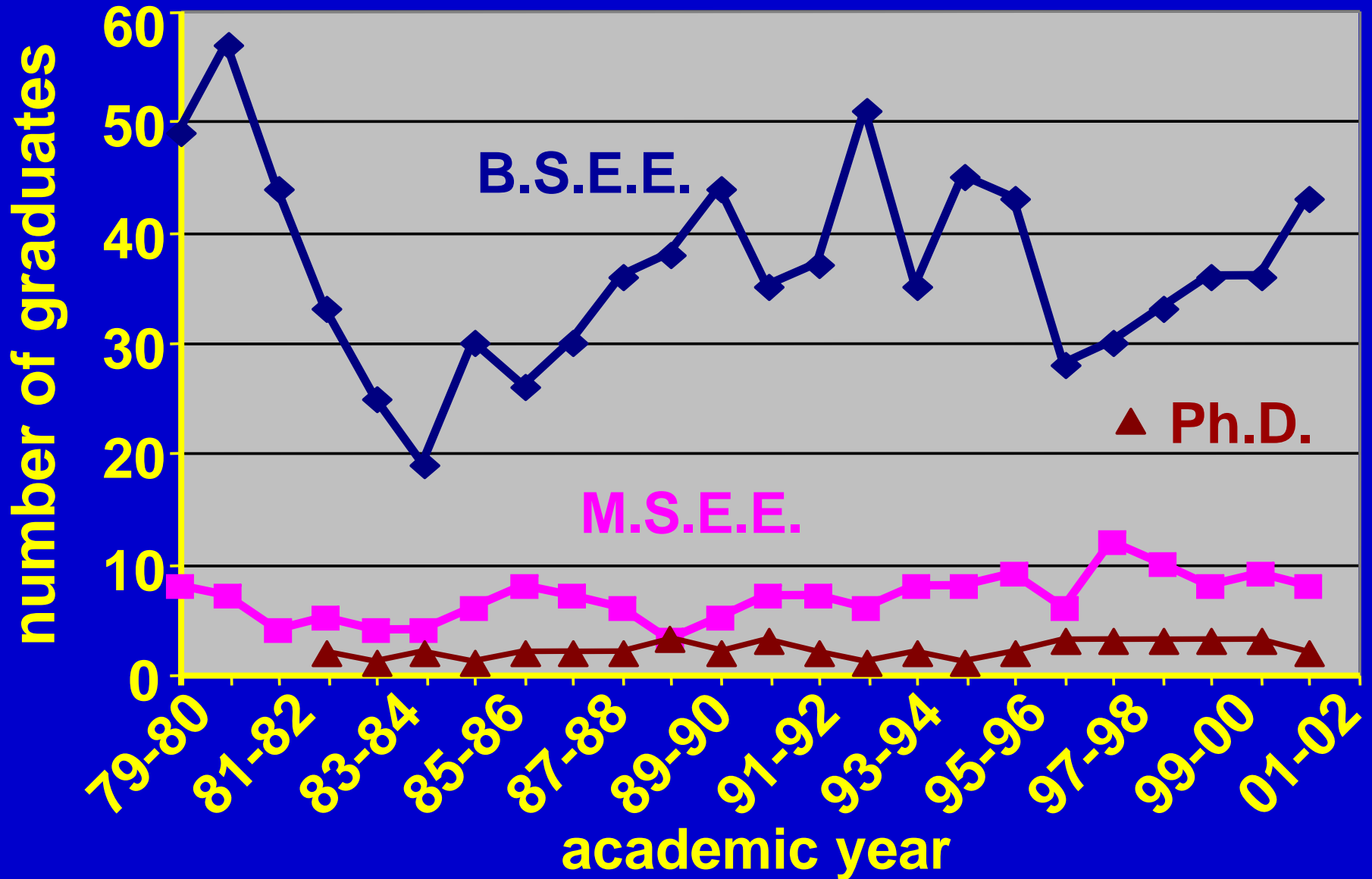
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FOREIGN GRADUATE STUDENT ENROLMENT

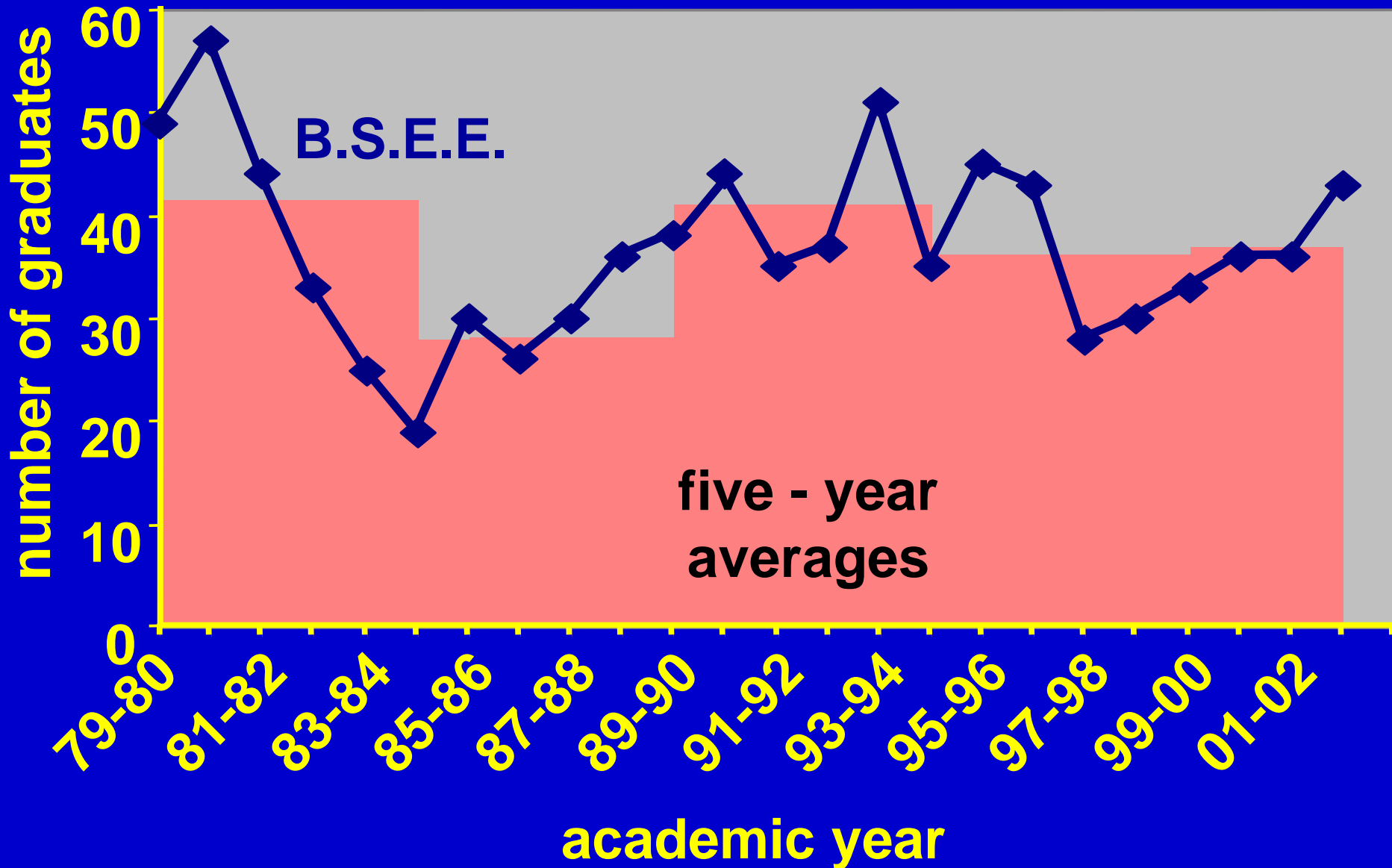


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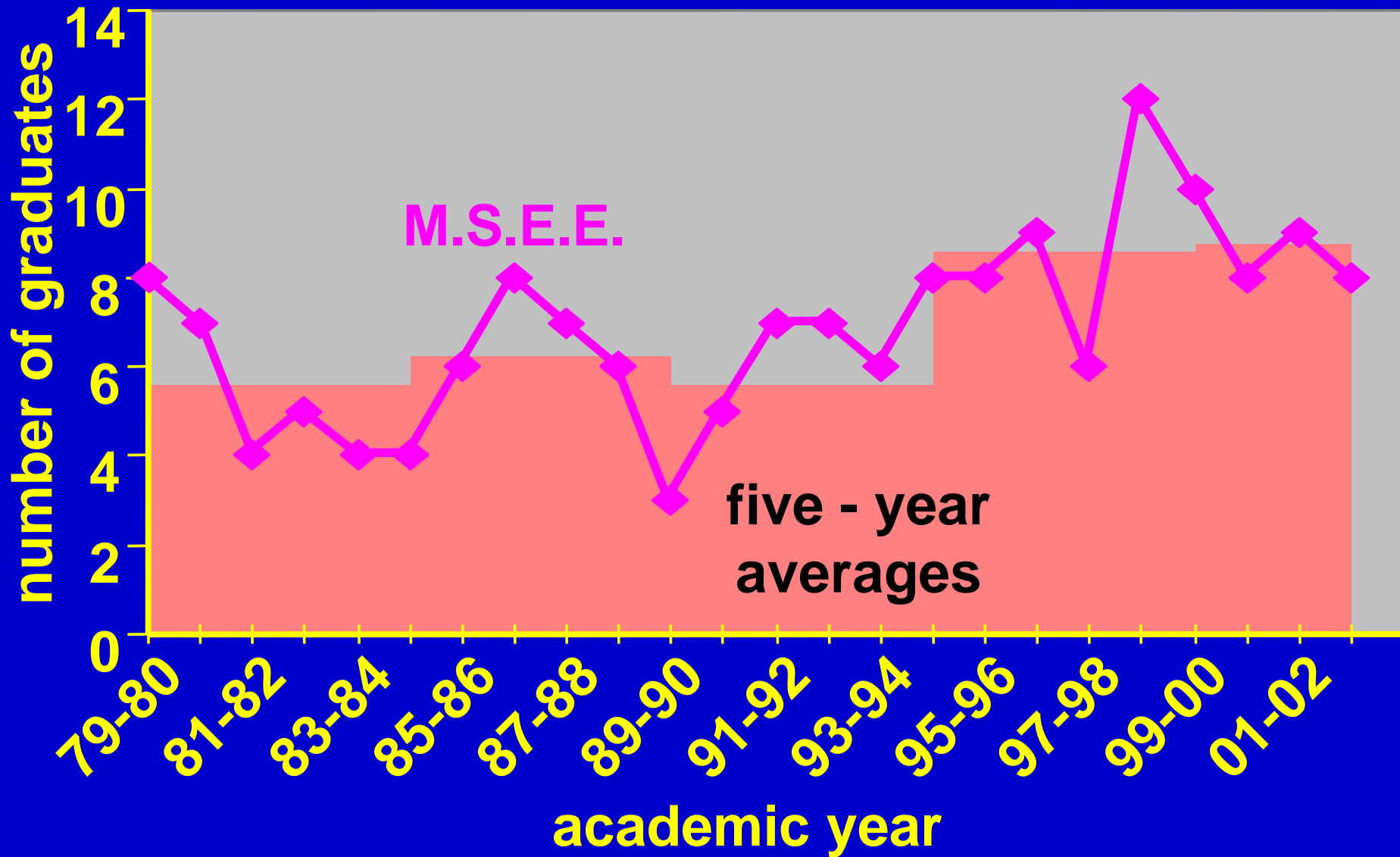
THE UIUC STATISTICS



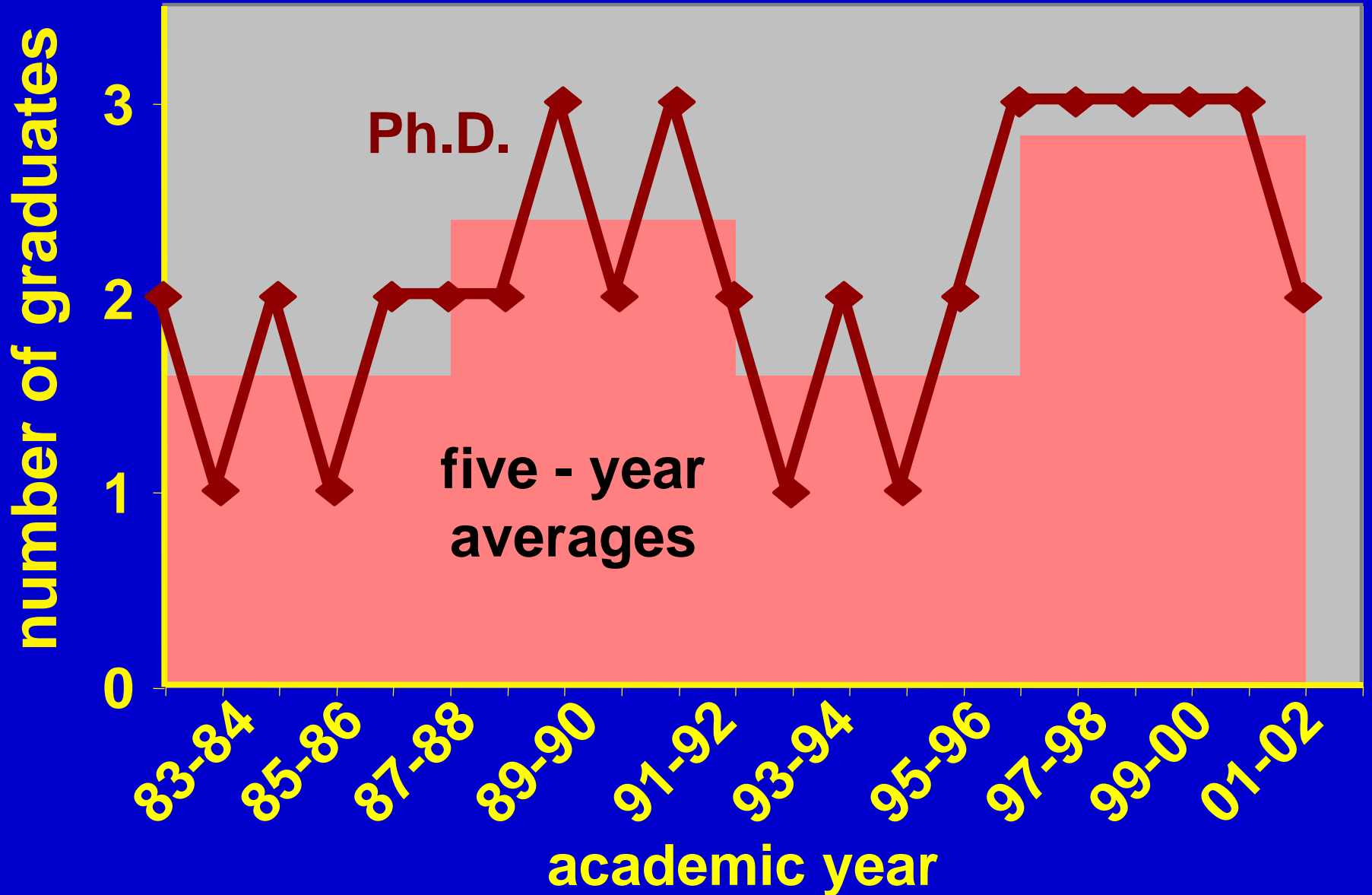
THE UIUC UNDERGRADUATE STATISTICS



THE UIUC GRADUATE STATISTICS



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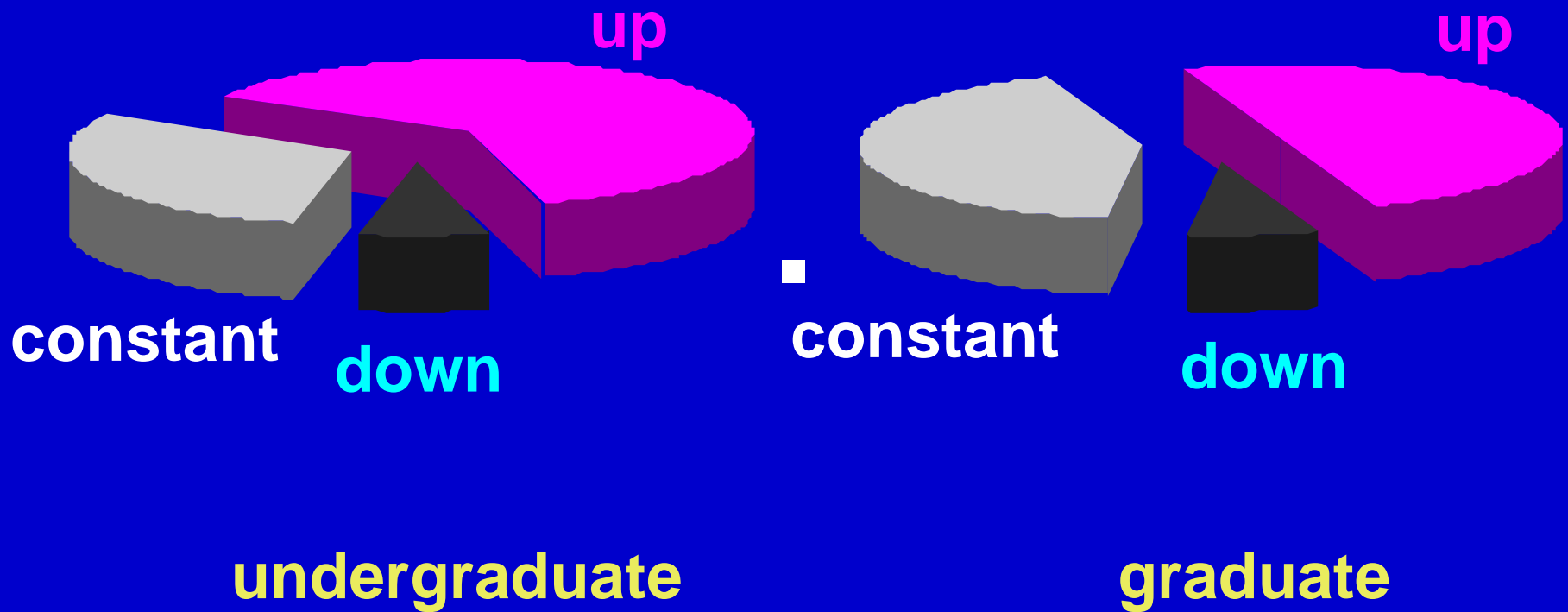
THE GENERAL ELECTRICAL ENGINEERING REALITY

- ❑ There is a certain ebb and flow to the enrolments in engineering nation-wide; since the all-time low in undergraduate engineering in 1998, there has been an uninterrupted growth in enrolments
- ❑ In many electrical and computer engineering programs, the growing tendency to select the computer engineering option has resulted in the majority of students seeking the computer rather than the electrical engineering degree

THE GENERAL ELECTRICAL ENGINEERING REALITY

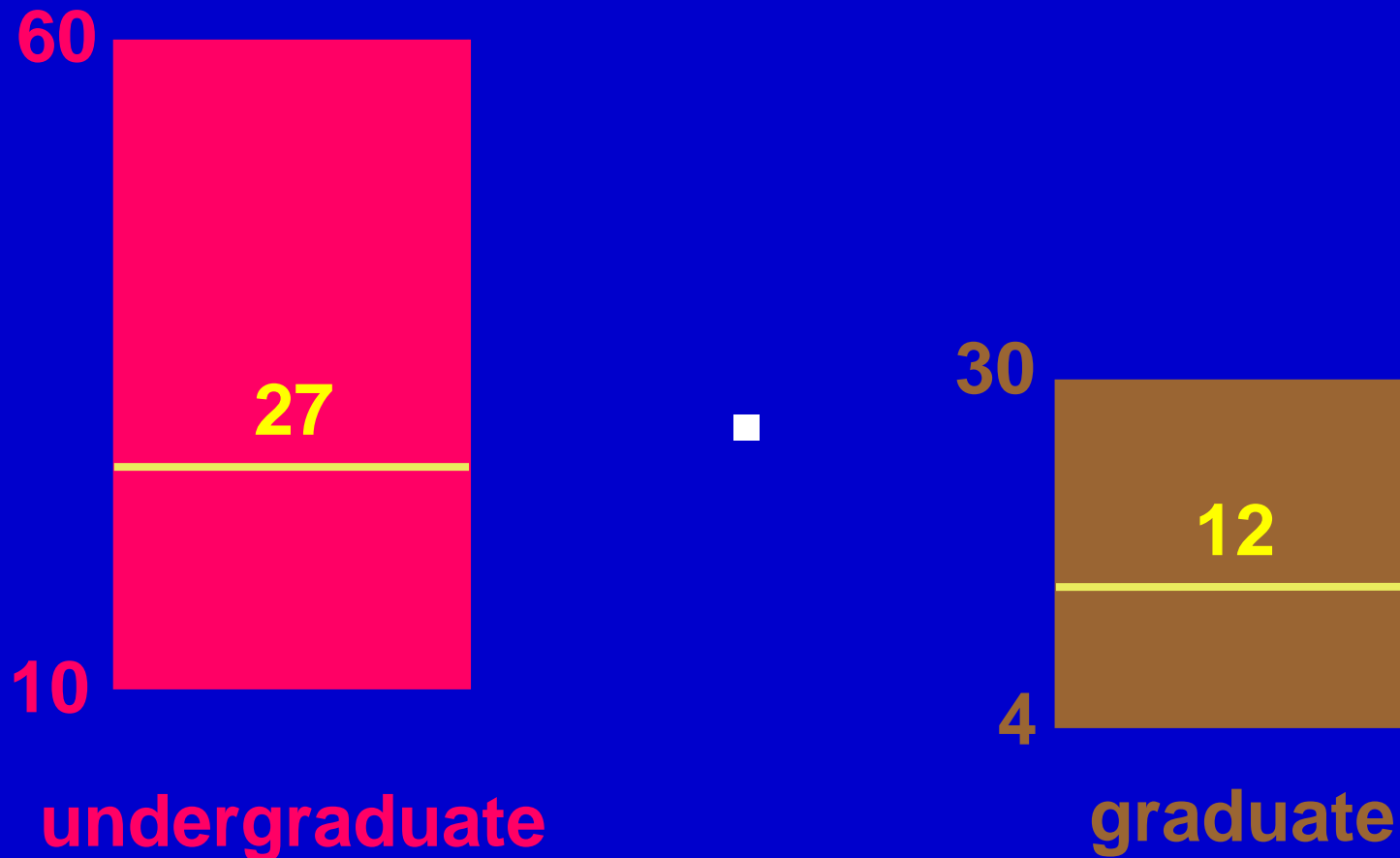
- Given the decreasing number of electrical engineering undergraduates, there is good progress in stopping the precipitous decline in the undergraduate power engineering enrolments to the point where many power programs are experiencing record levels

U.S. POWER ENGINEERING PROGRAM 2003 ENROLMENTS



Source: 40 responses of the survey reported by P. W. Sauer, G. T. Heydt and V. Vittal, "The State of Electric Power Engineering Education," *IEEE Transactions on Power Systems*, Special Section on Education, to appear in 2004

U.S. POWER ENGINEERING PROGRAM ENROLMENTS

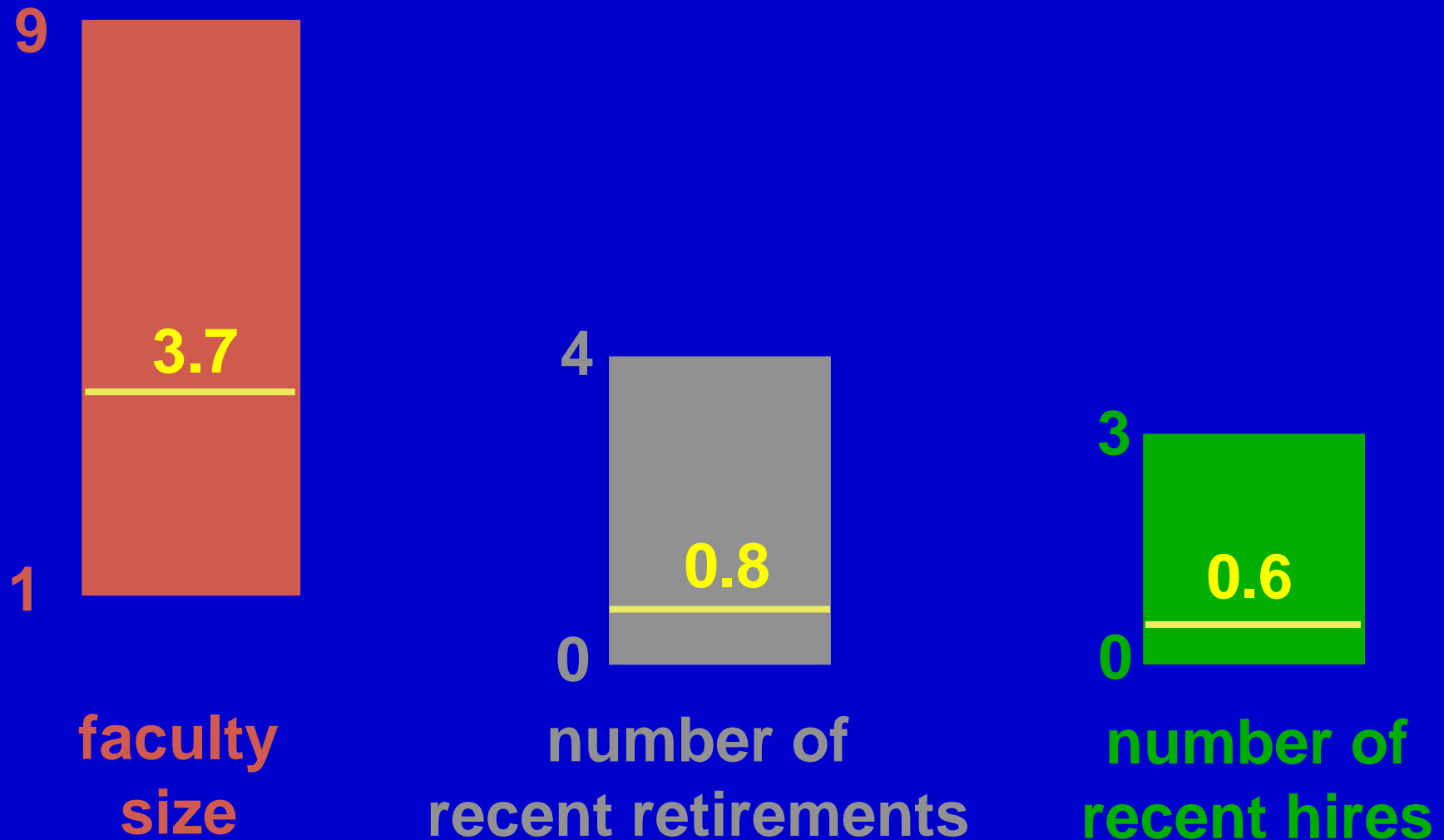


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U.S. POWER FACULTY: THE 2003 SURVEY RESULTS

- ❑ The power faculty at most universities has only a small fraction of practicing professors
- ❑ There is a graying of the power faculty with the average age of professors creeping upward and the number of useful years remaining in their professional lives rapidly decreasing
- ❑ The number of retirements in faculty typically outpaces the number of additions of new faculty

U.S. POWER FACULTY: THE 2003 SURVEY RESULTS



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ENCOURAGING DEVELOPMENTS ON THE CURRICULUM FRONT

- ❑ A determined movement away from the old straight jacket curriculum to new enriched course offerings with broadened choice
- ❑ New developments are evident in three principal thrusts
 - addition of microeconomic/finance elements
 - introduction of energy, environment and public policy aspects
 - wider array of power systems, power electronics and machines/drives courses

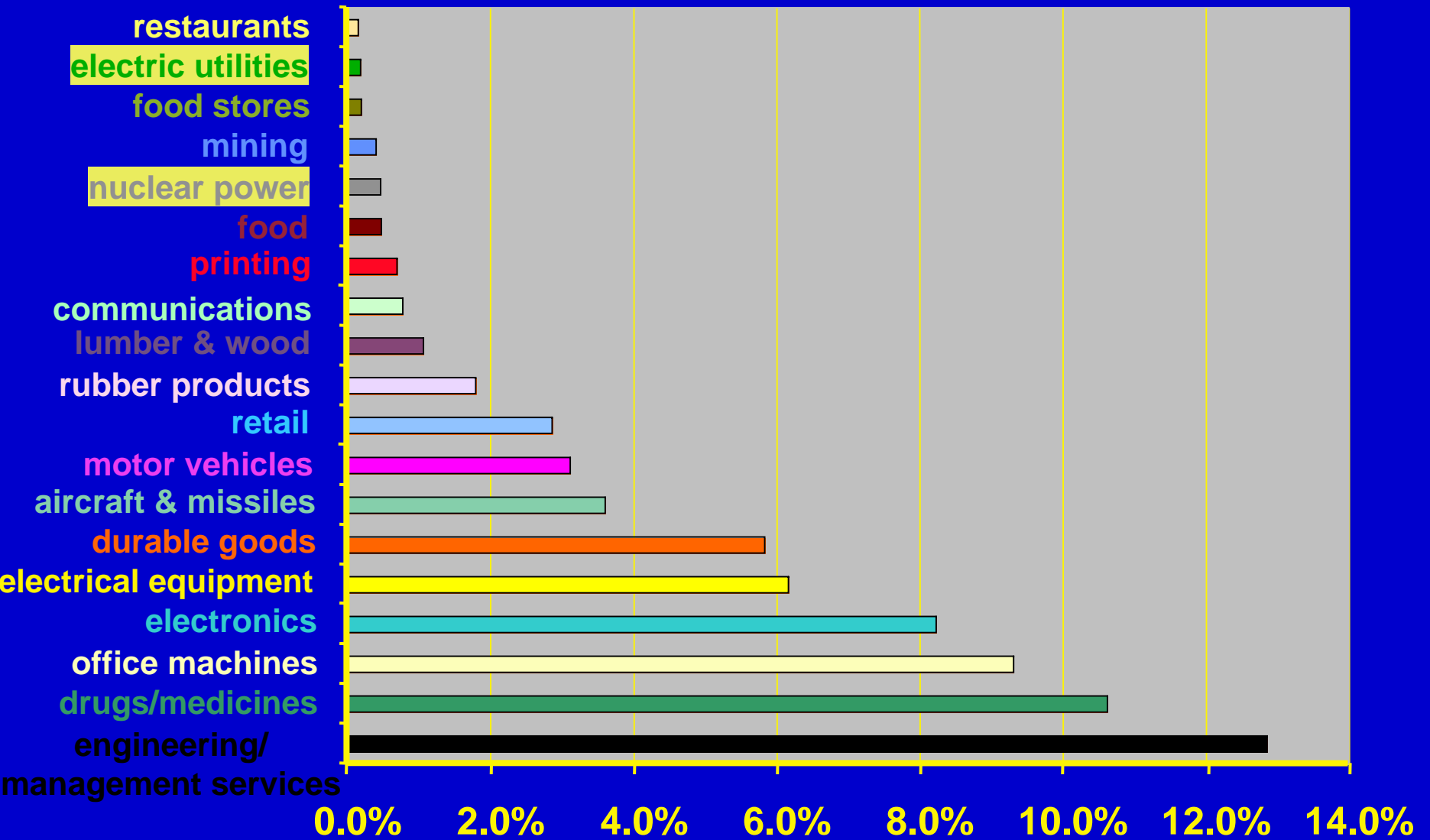
A SAMPLE OF NEW COURSE OFFERINGS

- Power quality
- Power simulation lab
- Alternative energy and dispersed resources
- Renewable energy systems
- Hybrid electric car
- Energy management

ON-LINE POWER ENGINEERING EDUCATION

- Many universities and for profit entities have engaged to a lesser or greater extent in the offering of on-line courses
- The reduced level of activities seems to be a trend among all institutions
- The long term viability of such programs is questionable

PERCENTAGE OF REVENUES FOR R & D EXPENDITURES



THE IMPACT OF RECENT EVENTS

- ❑ **Restructuring of electricity and the California crisis sharpened public interest in electricity**
- ❑ **The September 11, 2001, tragedy brought to prominence the issue of the security of the North American interconnected power system**
- ❑ **The 2003 Mega-Blackout produced keen interest in the reliability of the interconnected grid**

RECOMMENDATIONS

- ❑ **A more active role for the government – both federal and state – in the direct support of power engineering education and research, given the critical role of the continued government involvement in the regulation of the industry**
- ❑ **An increased involvement of industry in all aspects of the educational experience : strong need for students and faculty to interact with industry personnel for ensuring the correct focus in research and teaching activities**

RECOMMENDATIONS

- ❑ **Continued restructuring of the power engineering curriculum to strike an effective balance between making the discipline attractive to undergraduates and imparting solid engineering skills and basic foundations to its graduates**
- ❑ **Seizing the opportunity of the current upsurge in student interest to ensure that the upward trend in power engineering enrolments is sustained**