



Overview of the Status of U.S. University Power Programs

Dennis Ray, Ph.D.

Executive Director

Power Systems Engineering Research Center

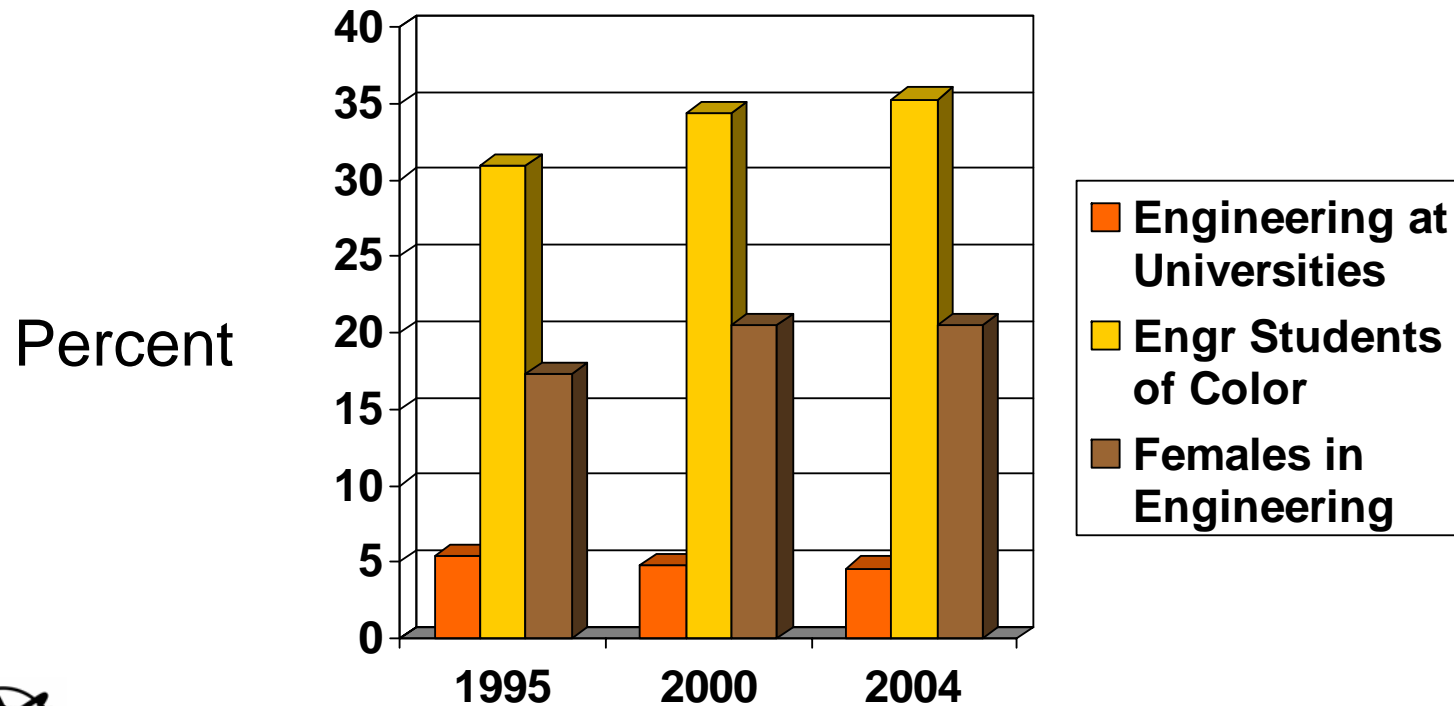
NSF Workshop on the Future Power Engineering Workforce
November 29-30, 2007

Education System Infrastructure

- Institutions
 - Universities
 - Engineering Technology Schools (community colleges, etc.)
 - Other providers (consultants, etc.)
- Outcomes
 - Degrees (associate, bachelors, etc.)
 - Professional Development (CEU's, etc.)
- Venue (in-residence, on-site, distance education, etc.)

Students

- Undergraduate student interest in engineering not growing as fast as total number of undergraduates
- Diversity in engineering remains an issue (reference U.S. population figures in 2004: 38.3% people of color, 48.5% female)



Source: *Women, Minorities and Persons with Disabilities in Science and Engineering*, National Science Foundation, 2007

Power Engineering Student Trends 2005/6 vs. 2001/2 Academic Year

- Undergraduate enrollments in elective power classes declined from about 3,500 to 3,300.
- Masters: down from 1,600 to 1,400
- Doctorate: rose from 800 to 900.
- International students are now about 59% of all graduate students.
- Growing interest in “energy systems”



Source: IEEE Power Engineering Education Committee Survey
Results for 2005-06 Academic Year.

Undergraduate Estimates*

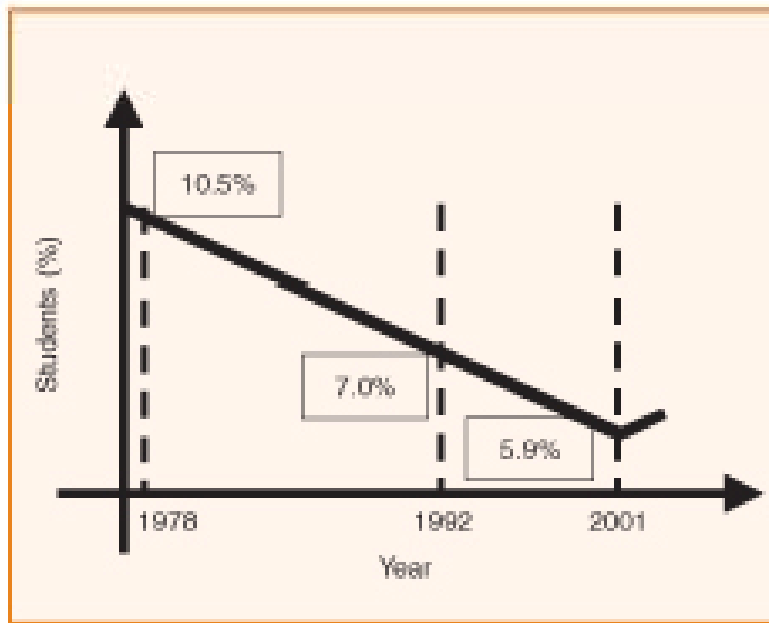


figure 1. approximate percentage of undergraduate electrical engineering students committed to electric power in the United States.

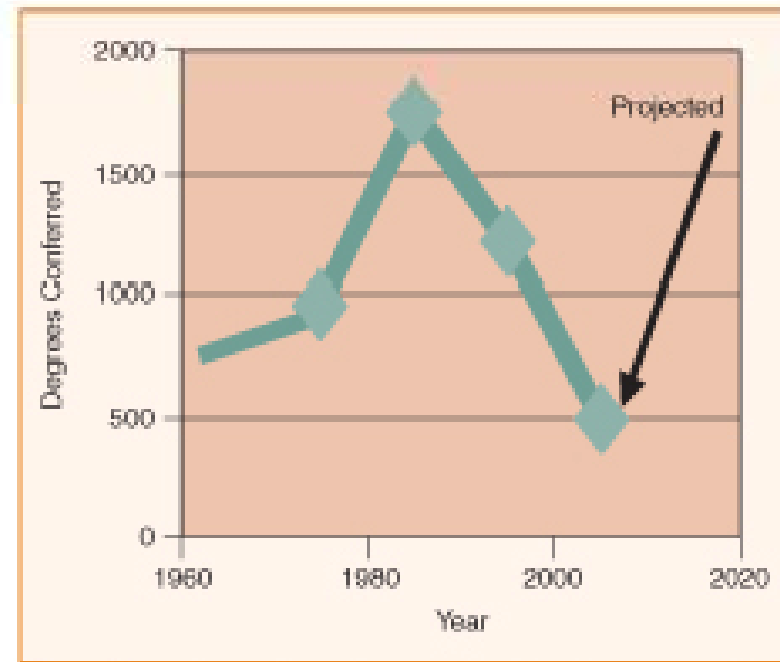


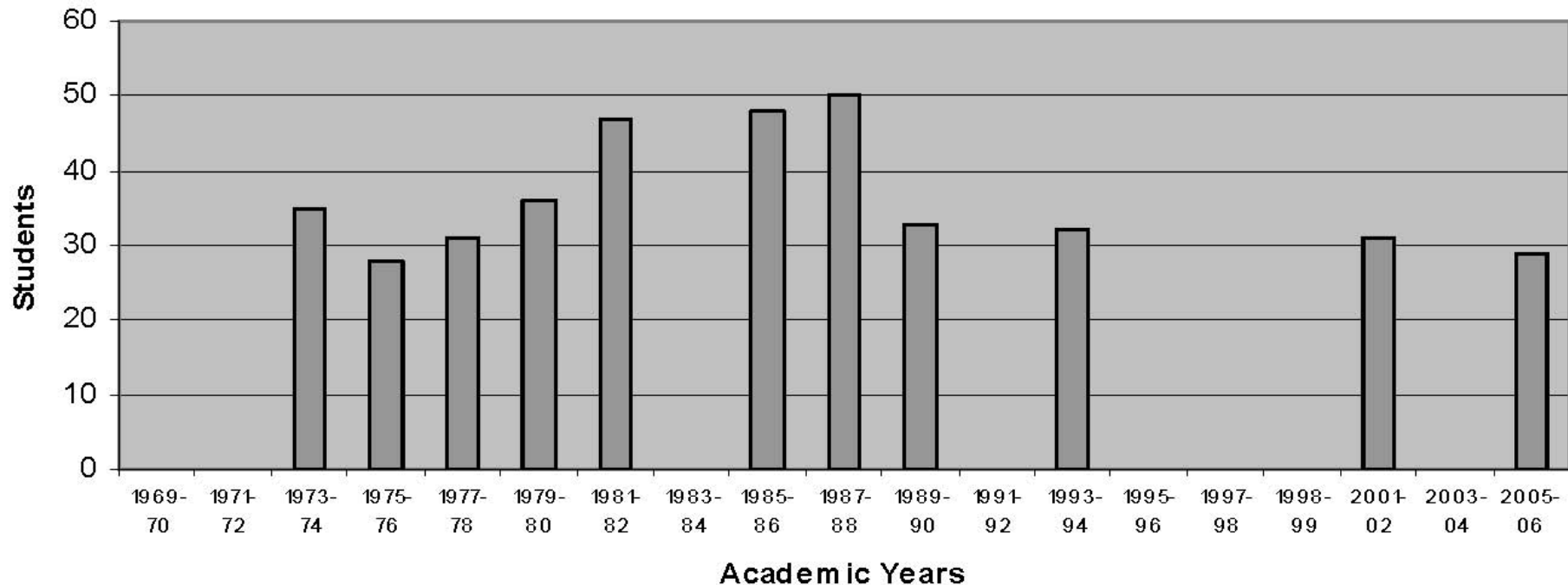
figure 2. undergraduate degrees in electric power engineering conferred annually in the United States.

* Undergraduate EE students do not declare themselves as “power engineering majors” so estimation is necessary.



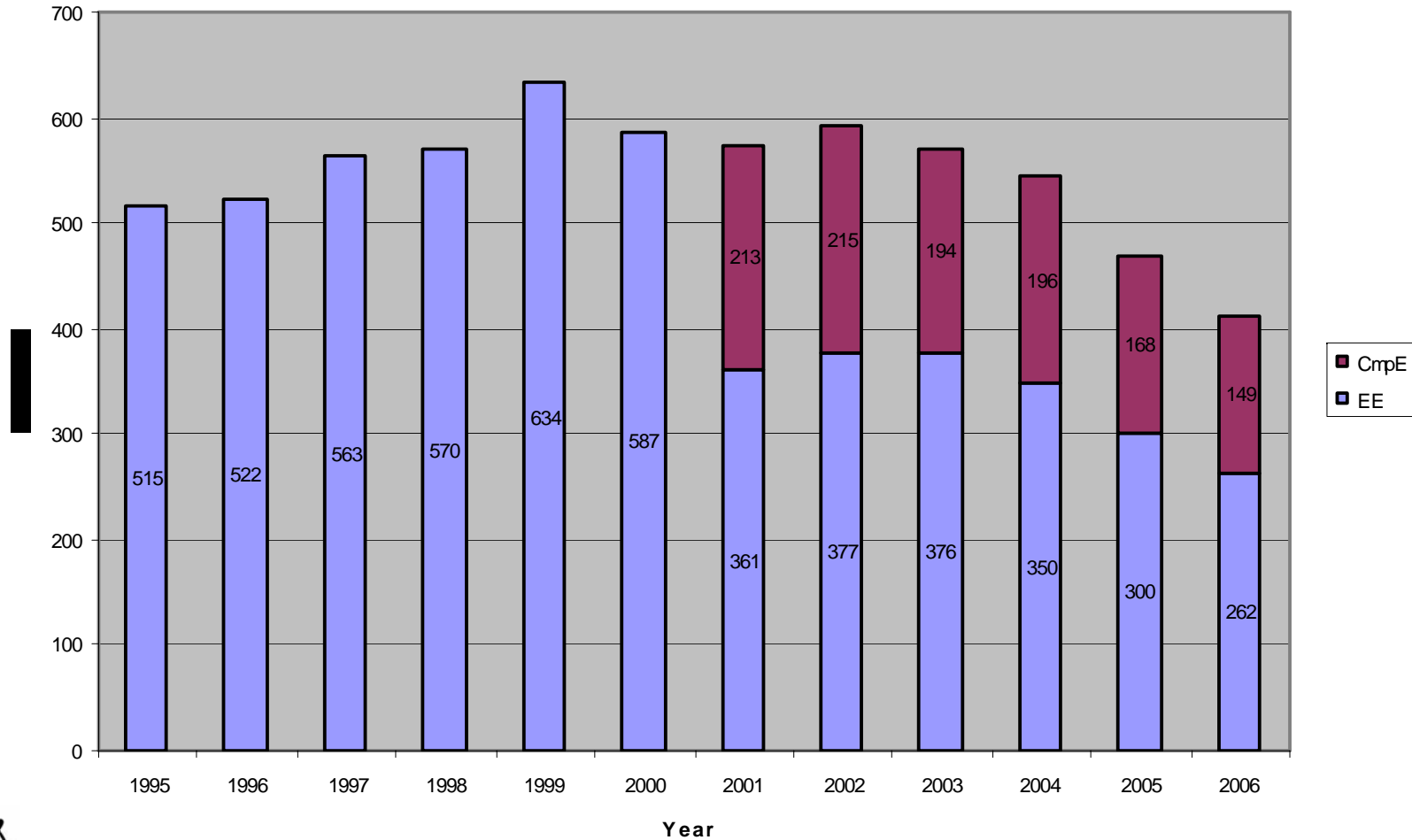
Source: G. Heydt and V. Vittal, “Feeding Our Profession”, *IEEE Power and Energy Magazine*, Feb. 2003.

Average Number of Undergraduate Students in Elective Classes



Source: IEEE Power Engineering Education Committee Survey Results for 2005-06 Academic Year.

Declining ECE Undergraduate Enrollments (Univ. of Wisc.)



Power Engineering Image

- **When you think of power engineering, what comes to mind?**
 - Exciting (58%)
 - Critical to society (55%)
 - Lots of opportunities (51%)
 - Future minded (43%)
 - Relevant (40%)
 - Boring (2%)



Source: IEEE PES International Survey
of Power Engineering Students (June 2007)

Career-Choice Decision Factors

- What made you decide on your career path?
 - Interesting career (67%)
 - Opportunity to help solve significant societal challenges (38%)
 - Make the world a better place to live (33%)
 - Good pay opportunities (30%)*
 - High likelihood of getting a job (20%)
- * Latest IEEE salary data show that power engineers paid lowest among EE careers.



Source: IEEE PES International Survey
of Power Engineering Students (June 2007)

Influential People in Career Choices

- Who influenced your career choice?
 - Guidance counselor/mentor/teacher (26%)
 - Talking with people in the industry (22%)
 - Parent's suggestions (12%)
 - Friend's suggestions (6%)
 - Media (2%)



Source: IEEE PES International Survey
of Power Engineering Students (June 2007)

U.S. University Power Programs: How Many Are There?

- U.S. Universities responding to IEEE Power Engineering Education 2005/06 Survey* offering a power systems analysis course: 63
- U.S. Universities with 3 or more faculty reporting 60% or more time spent in power area (could include power electronics): 22
- Straw poll of PSERC faculty on the number of “strong” U.S. university power programs: 18 received 2 or more votes (28 w/ at least 1 vote)

* The survey is voluntary so non-responses likely.



Source: IEEE Power Engineering Education Committee Survey
Results for Various Academic Years.

Power Engineering Program Trends

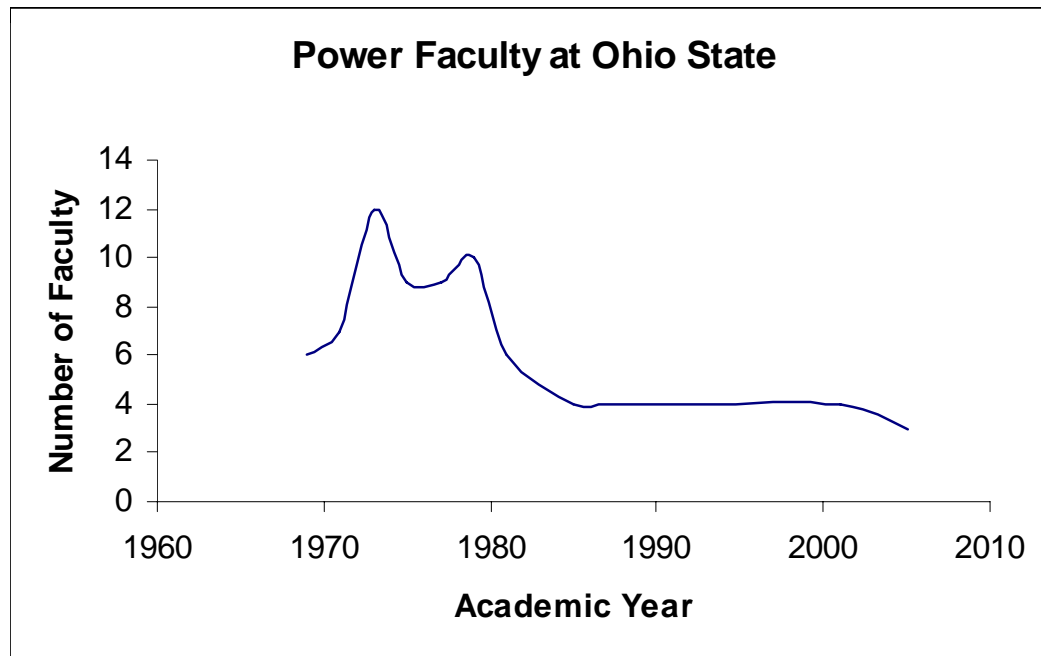
- New (untenured) faculty declined from 21% in early 90s to 14% of total faculty.
- Senior faculty rose from 50% to 63%.
- Selected poll found that 3 faculty members were hired for every 4 that leave.
- Reported total research funding per institution declined about 18% between 2001/02 – 05/06.
- Industry-funded research rose compared to 2001-02, but did not off-set declines in government-funded research.



Source: IEEE Power Engineering Education Committee Survey
Results for Various Academic Years.

University Power Systems Programs

- Of 48 programs reporting in both 1987/8 and 2005/6, 50% declined and 15% grew in number of major faculty members.



Power Engineering Faculty

Carnegie Mellon University:

1975: 8 faculty; 2007: 1

Cornell University:

1975: 7 faculty; 2007: 1

University of Michigan:

1971: 5 faculty; 2007: 0

UC Berkeley:

1971: 4 faculty; 2007: 1

Univ. of Missouri-Columbia:

1975: 8 faculty; 2007: 0



Source: IEEE Power Engineering Education Committee Survey
Results for Various Academic Years.

Poll of University Workshop Invitees

- Poll taken to quickly give all attendees an overview of the U.S. university power programs present in this Workshop and some insights into those programs.
- Workshop invitees are not a representative sample of all U.S. power programs.
- 15 universities here were able to respond to the poll.