Women in Engineering in the United States:

Overview 1990-2010

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Major Program Efforts during the 1990s resulted in increased numbers of female students and professional engineers.

WEPAN — Women in Engineering Program & Advocated Network

- Annual Conferences
- WEPAN Workshops Training Program Directors
- Regional Training Centers
- MentorNet
- Global Alliance

NSF — National Science Foundation

Funded innovation STEM education projects in increasing numbers

SWE — Society of Women Engineers

Founded in 1950. Focus on engineering as a great career for women

Scholarships

National conferences drawing thousands

Chapters on every College of Engineering Campus, monthly magazines

Framing the Problem

- Low percentages of male and female students are interested in pursuing engineering majors.
  - 13.7% of the males
  - 2.6% of the females

"American Freshman: National Norms for Fall 2007"
CPST, Comments, March/April 2008, p.25.

Statistical Trends
Women in Engineering Enrollments

Year	Total Number of Engineering Students	Number of Women	Percent Women
1990	346,169	54,772	16.5 %
1994	328,463	60,931	18.6
1998	329,657	66,276	20.1
2000	353,118	69,506	19.7
2002	383,109	71,586	18.7
2004	384,792	69,490	17.8
2006	371,720	64,544	17.4

Commission on Professionals in Science and Technology (CPST), Professional Women and Minorities, November, 2008. Prepared by Nicole Di Fabio, Carolyn Brandi, Lisa Frehill. Engineering Workforce Commission, p. 4-34. http://www.cpst.org

Number and Percentage of Engineering Degrees Awarded to Women 2005-2006

Degree	Number	Percentage
Bachelor's	68,121	19.4%
Master's	32,771	22.6
Doctorates	7,191	23.3

CPST – derived from National Science Foundation, Annual Student Survey, "Engineering Degrees by Level, Broad Field, Sex, Race/ Ethnicity7, 2005-2006." and National Center for Engineering Statistics, Digest of Educational Statistics, 2007.

Statistical Trends
Engineering Degrees Awarded to Women

Bachelor's Degrees

Year	Percentage
2000	20.8 %
2002	20.9
2004	20.3
2006	19.3
2007	18.1
2008	18.0
2009	17.8

Master's Degrees in 2009 23%

Doctoral Degrees in 2009 21%

Michael T. Gibbons, "Engineering by the Numbers," American Society for Engineering Education, December 31, 2009.
downloaded from ASEE Web site, April 4, 2011

Women in the U.S. Engineering Workforce

2005 12.7%

Type of Engineering	Total # of Engineers In thousands	Percent Female
Aerospace	90	13.3
Chemical	55	14.3
Civil	319	13.2
Comp hardware	81	10.8
Comp software	832	21.9
Electrical & Electronic	352	7.1
Industrial	189	14.9
Mechanical	318	5.8

2007 12.1%

Type of Engineering	Total # of Engineers In thousands	Percent Female
Aerospace	123	0.5
Chemical	75	21.2
Civil	382	11.5
Comp hardware	79	9.6
Comp software	907	20.8
Electrical & Electronic	347	8.6
Industrial	161	17.5
Mechanical	296	7.3

Source – National Science Foundation, *Science and Engineering Indicators 2010*
Integrated Science and Engineering Resources Data System http://webcaspar.nsf.gov

Retention of Women in the Engineering Workforce

Women are about twice as likely as their male colleagues to leave the engineering workforce after a few years

(25% compared with 12%).

Report of the Congressional Commission on the Advancement of Women and Minorities in Science Engineering and Technology Development, September 2000.

Female engineers report relatively high levels of job satisfaction yet some leave engineering careers for reasons association with:

- **Difficulty balancing career and family responsibilities,**
- **Scarcity of female mentors,**
- **Narrowly focused job requirements,**
- **Perceived inequality in management's evaluation of women's job performance**
- **Being excluded from the male-dominated upwardly mobility colleague loop**

Retention of Women in the Engineering Workforce

Dr. Lisa Frehill

Executive Director of Commission on Professionals in Science and Technology (CPST)

"The numbers are very clear…At a time when baby boomers are aging out of the workforce, the engineering profession is facing a major retention problem with regards to women. We are losing some of our best and brightest at a time of critical need."

CPST Comments, November-December 2007

Society of Women Engineers commissioned a 2007 survey of 4,500 men and 1,800 women with BS and MS degrees in engineering

Findings-

- Women and men have similar levels of education and job satisfaction.
- Both women and men cite better opportunities for advancement and increased salary as the top reasons for leaving the engineering field,
- Women are more likely to cite a more family-friendly work environment (12%) and more interesting work (48%).
  Men place more emphasis on salary (17%) and advancement (23%).
- Both male and female engineering alumni report work/family balance as their biggest career obstacles, however women are twice as likely (28%) as men (14%) to cite this factor.
- Women aged 45 and older are only half and likely (29%) to hold senior engineering manager and director/president as their male counterparts (55%).

The Athena Factor:

Reversing the Brain Drain in Science, Engineering and Technology."
Harvard Business Review, May 2008.
Sylvia Ann Hewlet, Carolyn Buck Lane, and Lisa J. Servon
http://braindrain.hbr.org

Women leaving private sector SET workforce in large numbers

41% of lower ranking scientists, engineers and technologists are women, 52% leave these jobs usually in their mid-late 30s

Machismo and sexual harassment still present .
- 63% report having to deal with sexual harassment

Many report feeling isolation in the workplace.
- Snowball effect in the SET work culture

Different work strategies in these fields.
- Men rewarded for "the diving catch" and "firefighting" behavior. Women would rather manage their time.

SET jobs are "extreme," long work weeks and travel.
- "Women are still seen as the primary care-giver in a two-income household, difficult to manage career advancement and child care responsibilities.

More women have career path as "Helper" than in higher rank jobs.

Women leaving Information Technology Workforce

2008 report from the National Center for Women and Information Technology MCWIT)

percentage of women holding professional

IT related jobs decreased from 36% in 1991 to 25% in 2008.

Salaries of men and women are not equal.

Women earned an average salary of $70,370 in 2008 ,

while men earned an average salary of $80,357

After 15 years in the field females are paid 11% less than men with comparable experience.

Northeastern University IT Workforce Study

Paula G. Leventman, Principal Investigator

National Science Foundation (award # 0119839)

IT organizations are good places for women to work. These are places where technical skills and communication skills are equally important for men and women.

Requisite conditions for attaining gender equity in any company:

(1) the same proportion of women and men hold high positions in the organizational structure, and

(2) the same proportion of women and men receive the highest financial rewards.

(3) For the most part, these conditions were met within the large non-profit healthcare organization that participated fully in this research.

An atypical set of circumstances combined to help this organization approach gender equity.

Half of the IT professionals are female. Equity in terms of numbers influences corporate culture.

Both men and women talked about the importance of family friendly policies, good benefits and flex-time.

There are high percentages of women in project management and corporate management positions.

The Chief Information Officer (CIO) is female and with a stay-at-home husband. She explained how she uses the annual merit and salary review to make sure that salary scales are in fact comparable for women and men.

These conditions are not easily met in higher pressure for-profit organizations. However, we might look to information technology to model gender equity in the post-modern workplace of the 21st Century.

Cultural Change in Colleges and Companies

Hidden Brain Drain Task Force

Formed in August 2008- 14 corporations including Johnson & Johnson, CISCO, Microsoft, Alcoa.

Goal is to cut female attrition by 25%,

to add 220,000 females to SET workforce.

New efforts in coming years

must include strong leadership by deans, professors and managers.

Essential is a growing culture of diversity that emphasizes welcoming attitudes as well as mentoring and support.

Generational cultural change

is evident among engineering students and younger engineers in companies.