

womenChEs make progress toward

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Contributing Editor

IN 1965, MARTHA J. B. Thomas received the Society of Women Engineers' (SWE) Achievement Award "in recognition of her significant contributions to the Science of Chemistry as an engineer, educator, and administrator, while fulfilling her duties as a wife and mother." While appreciative of Thomas's accomplishments — including holding seven patents, being a national research fellow and chemistry instructor at Boston Univ., and actively participating in SWE and the American Chemical Society (ACS) — the wording dates itself to an era when a woman might be imagined to have a successful career or a fulfilling family life, but not both.

Today, hard data, as well as individual women engineers' testimonies, indicate that women have made progress in increasing their presence in industry, representation among corporate management, relative earnings, and ability to command respect for professional accomplishments while sacrificing less of their personal lives. It's also clear that women have yet to achieve total equality in the engineering workforce. But the trends are moving — albeit sometimes slowly — in the right direction.

Chemical engineering, as AIChE president Dianne Dorland points out (*AIChExtra*, *CEP*, Jan. 2003, p. 92, and www.aiche.org/about/prescorner), is one of the most woman-friendly engineering disciplines. About 11.5% of those employed as chemical engineers are women, according to the Bureau of Labor's Current Population Survey 2001; the only disciplines with higher percentages of women are industrial engineering (17%) and metal and metallurgical engineering (12%).

Women comprised 24% of all scientists and engineers and 10% of all engineers in 1999 (National Science Foundation [NSF], Science & Engineering Indicators 2002 [SEI 2002]), up slightly from 23% and 9% in 1993. Considering

Women

in the chemical
engineering

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in numbers,

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worklife

environment.

that they represent about 52% of the U.S. population and 46% of its workforce, women are clearly underrepresented in science and engineering.

WHAT A GIRL WANTS

Engineering organizations have been working for some time on increasing female representation, usually as part of larger diversity and inclusiveness efforts. One such program is the National Society of Professional Engineers' (NSPE) Diversity Task Force, which was recently created to address the broad issues of diversity and determine for the first time how much of NSPE's membership is female, according to task force member and chemical engineer Deborah Grubbe.

The numbers of women engineers grew dramatically in the 1970s and 80s, then flattened in the 1990s (figure), says environmental engineer Peggy Layne, who just finished a two-year term as director of the National Academy of Engineering's (NAE) engineering-diversity initiative and is now working for the American Association of Engineering Societies (AAES) on a project to help the societies collectively address diversity issues. Perhaps the toughest part of increasing the numbers of women engineers is figuring out why the growth trend stopped, Layne believes.

In high school and earlier, girls take math and science courses at the same rate — and higher rates, when it comes to chemistry and biology — as boys, and perform at the same or higher levels, according to SEI 2002. But after high school, something happens. "Girls are as prepared for science and engineering as boys — they're just not as interested," says Layne. To help interest and educate girls and their parents, teachers and school administrators, NAE developed its Enginergirl website (www.enginergirl.org).

equity

“Studies indicate that young girls tend to be interested in helping people, and they see things like law and medicine as directly helping others — while engineering is a little removed,” suggests Layne. “Once women get into the field, they see that the opportunities are immense,” notes chemical engineer Lisa Barnes, a facilities engineering management team leader with BP (Houston, TX). “But in university and high school, they perhaps get messages that success may be in other fields.”

THE BOTTOM LINE

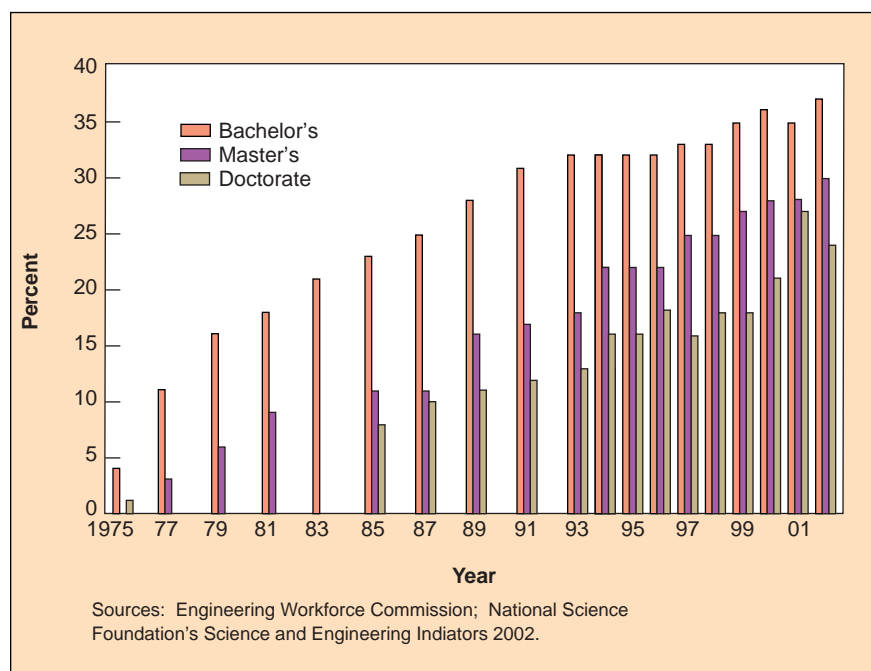
U.S. industry, which employs the lion’s share of the science and engineering workforce (75% of those with science and engineering bachelor’s degrees and more than 60% of masters, according to SEI 2002), provides many encourag-

ing examples of support for women. Nonprofit research organization Catalyst reported that 15.7% of the corporate officers of the Fortune 500 were women in 2002 (up from 12.5% in 2000 and 8.79% in 1995); top earners were 5.2% women in 2002, compared with 1.9% in 1996; and women held 9.9% of the titles wielding “corporate clout” (e.g., chair, CEO, vice chair, president, COO, senior executive VP, executive VP), up from 7.3% in 2000.

High-profile leaders like Carly Fiorina of Hewlett-Packard, Patricia Russo of Lucent Technologies, and Anne Mulcahy of Xerox Corp. provide some of the most-visible role models for women in industry. And many employers are making concerted efforts to build a critical mass of female professionals, typically as part of larger workforce-diversity and inclusiveness efforts. “I would say that more and more companies are ‘getting’ it,” says Grubbe, who is also corporate director of safety and health at DuPont.

DuPont was featured as one of *Working Mother* magazine’s 100 best employers in 2002 (www.workingmother.com/100best.shtml), a roster in which the chemical industries make a healthy showing. The list takes into account such factors as the percentage of women in the workforce, child- and elder-care resources, flexible work scheduling, parental leave, employee feedback, and the percentage of management that is female. The high-profile listing, in addition to helping women identify female-friendly workplaces, also benefits employers. Recruiting efforts are enhanced by an appearance on the *Working Mother* list, and companies have experienced higher stock prices and market capitalizations.

Of course, amenities like childcare facilities and flexible scheduling don’t



■ Figure. Percentage of chemical engineering degrees awarded to women, 1975–2002 (selected years, rounded to whole percentages).

benefit only mothers — they help any employees with children or elderly parents, telecommuters, and others. Whether supportive worklife programs are helping to change the old paradigm of stay-at-home mother, breadwinner father, or are developing because the numbers of dual-earner couples and working women are growing, the workplace is improving for a broad spectrum of employees. “The key is flexibility and allowing people to get things done,” explains Emily Deakins, general manager of diversity and inclusion at BP. “Your productivity doesn’t equate to

Sometimes an employer’s concern for the family’s well-being can go overboard. In 1988, when she had been with DuPont for about a decade, Gulyas (then in Delaware) expressed interest in a promising leadership position in Europe. The reaction of her male VP: “I don’t think you understand, Diane — this job is in Switzerland, and your husband [not a DuPont employee] won’t be able to get a work permit.” Stifling a chuckle, Gulyas answered, “With all due respect, thank you for your concern, but that’s my problem.”

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how many hours you’re sitting in your office with your suit coat on the back of your chair.” Adds civil engineer Martha Gilles, Hawaii refinery manager for ChevronTexaco: “Allowing people to spend time at home while still being engaged in the business helps business a great deal.”

WORKLIFE BALANCES

One of industry’s biggest challenges is providing an infrastructure that allows women to pursue their professional careers without giving up their personal lives. “I have many friends who left their careers to raise families and wanted to return to engineering — but were afraid they’d be too far behind,” points out chemical engineer Kimberly Chilcote, environmental coordinator at American Electric Power (another *Working Mother* best employer). BP engineering recruiting manager and chemical engineer Tami Joslin, who has been with the company for 24 years (first with Amoco before the merger) adds that she chose not to have children until the age of 37. Back in the 1980s, she says, “My friends who had kids in their 20s basically stopped their careers.”

In this respect, conditions seem to be improving. Chemical engineer Diane Gulyas, group VP of electronic and communication technologies at DuPont, mentions a colleague high up in the company’s finance function who worked a part-time schedule for several years after having twins, even bringing them to London on assignment for a few years.

Barnes found her employer quite supportive when she took a leave of absence in late 1998 to give birth to quintuplets. Returning to work after eight months of leave, she moved from a primarily technical function into her first supervisory role, as technical supervisor for the organization’s olefins group, leading a team of about 15 engineers. She has since moved to exploration and production technology, still in a team-leading role.

Barnes credits her employer with enabling her to raise her suddenly large family without sacrificing her career aspirations, allowing her to try a variety of roles to find the right fit, and supporting her dual-earner family. Her husband, a mechanical engineer, is a refinery manager at BP.

Accommodating both partners’ careers is a tall order, says Barnes. “How do you move two people into leadership roles at the same time, find spots for both, keep them happy, and keep them on an ideal career progression?”

“To their credit, I’m sure I was the first woman to go with a nonworking trailing spouse,” says Gulyas, who gives the company high marks for taking a huge chance on her then-unknown managerial prowess. The Switzerland position marked

The X factor

The discussion of women’s vs. men’s salaries is tricky for several reasons, including the many variables at work, some of which are difficult to quantify or even identify. Women tend to be younger and less experienced than their male colleagues in the science and engineering population. Women are more likely to interrupt their careers to have children or deal with other family issues, which can have an adverse effect on compensation, given the tendency to compensate workers for experience and uninterrupted tenure. NSF’s SEI 2002 analyzes women’s vs. men’s salaries after “controlling” for various factors such as age, experience, and family situation; as these factors are considered, the female/male ratio becomes more equitable (table).

The point can be made that controlling for these factors implies intrinsic discrimination against women workers, since they tend to be the primary caretakers in the family, and may be subtly discouraged from pursuing careers in male-dominated industries. At the same time, points out Francine Blau, professor at Cornell’s School of Industrial and Labor Relations, the U.S. labor force is undergoing dramatic changes: Women used to leave the labor force until their children were grown, but now the majority of women with a year-old or younger child remain in the workforce. And the traditional paradigm of breadwinner husband with homemaker wife is becoming less the norm (“She Works, He Doesn’t,” proclaimed *Newsweek’s* May 12, 2003 cover story).

Salary figures do not depict women and men working side by side in the same occupations. For example, more men tend to be in unionized and blue-collar jobs — including skilled craft jobs — as well as management, while women tend to be in white-collar and service occupations, says Blau. Even in the relatively specialized subpopulation of science and engineering, important qualifying factors affect the numbers: women tend to be in the social sciences, and are less likely to be employed by for-profit enterprises and more likely to be in educational institutions. And women are less likely than men to be engineers, which is the second-highest-compensated group in science and engineering, after computer and math scientists. But then again, chemical engineering, the highest-compensated engineering discipline (\$71,900 average, vs. \$62,400 for mechanical engineers and \$58,000 for civil engineers, reports SEI 2002), has the highest percentage of women.

The ratio of women’s/men’s salaries has held fairly steady for the past decade, hovering around 83–85% for women employed as engineers, according to SEI 2002. The rates tend to fluctuate considerably with years of experience. In addition, women with engineering degrees (but not necessarily working as engineers) tend to have lower salary ratios, and seem to suffer extremely low ratios — about 10–70% — at about 20–25 years of experience.

not only her entry into international business, but her first business-management role heading up a \$200-million business. When her three-year assignment was almost up, the company offered to return Gulyas to the U.S., citing the hardship of her nonworking husband. "I'm glad you appreciate the hardship," she answered, "but I really want to stay." She then moved to Belgium, becoming a production superintendent.

ADDRESSING MICROINEQUITIES

As more women enter industry and provide more role models at all levels, they pave the way for others to follow. Entering AEP as a new graduate about 11 years ago, Chilcote found herself a young, female chemical engineer in a sea of middle-aged men. "A lot of people just look at you funny," says Chilcote, who immediately set to work proving her knowledge, capabilities and willingness to "get down and dirty with the guys." When her coworkers saw she didn't intend to sit at her desk and issue orders, their respect grew. "It was a big thing, earning their trust and building relationships," says Chilcote. Her male colleagues opened up to her as they hadn't with other supervisors, especially about their families and personal matters.

Certainly, one of the biggest benefits of diversifying the workforce is bringing a wider range of perspectives and problem-solving skills to the table, and women as a group offer different and complementary capabilities than those of their male counterparts. Grubbe in the early 1990s was heading up a team of about nine engineers and 30 technical staff; the team's few female engineers had eventually moved on to other assignments. One day, one of the men came to her with an unusual request: to get more women into the group. "We did better work when they were here — we had to answer their questions and teach them; we were more creative, and had more fun," said the designer, who had been delegated by the team to make the request.

While overt discrimination against women in the workforce seems to be on the wane, women engineers face subtler barriers to advancement. Some say they still feel the need to "prove themselves" by having to be more technically proficient, put in longer hours, and complain less than their

male counterparts. "I believe the hardest challenge that I have faced — that most of us do — is being taken seriously as an engineer and a manager," says Christine Eggert, manager of Commercial Customer Service at Sikorsky Aircraft. Eggert, who has been involved in diversity efforts both inside and outside her company, says that one of the ways she addressed that obstacle was by completing a doctorate in management, which took six years of part-time study.

Layne mentions a term she heard at a workshop that seems quite apt: "workplace microinequities." For example, many agree that the traditional model of the aggressive, loud alpha male often means that softer-spoken, less-assertive individuals who are reluctant to interrupt a speaker aren't always heard.

"We still find that women may not be included in informal networks in the workplace, such as going out with the guys for drinks or golfing on weekends," Layne points out. Women who emulate "male" behavior can be criticized for being too aggressive. At the same time, "You'll hear about a woman in a meeting bringing up an idea that's ignored; when a man brings up the same idea a few minutes later, it's considered," she says.

Microinequities and all, the consensus seems to be that progress is being made. "Ten to fifteen years ago, we had extensive, very active, formal women's networks offering brown-bag lunches and meeting to talk about the challenges we were facing," says Gulyas. Today, the women's networks have become more of a forum for events and issues of interest to men as well as women, rather than as a vehicle to address systemic problems faced by women. "It's easy to find other women to have lunch and talk, so you don't need that formal structure," she explains.

The women's networks are alive and well in some European and Asian countries, where Gulyas says women face many of the barriers that their U.S. counterparts battled years ago. In the U.S., DuPont's formal networks are now addressing other challenges, such as supporting underrepresented minority groups — so the African-American and Hispanic networks are highly active these days. BP, says Barnes, is focusing on expanding its diversity in all ways — a current emphasis is on ensuring that the younger, less-experienced workers have an equal voice.

In any case, the days of "women don't belong here" seem to be fading. "It may not go as fast as we'd like all the time, but you have to ask, Is there change, and is it in general going in the right direction?," says Grubbe. "The bottom line is — yes." To put it another way, "I'm not seen as 'the woman refinery manager' anymore," says Gilles. "Now, I'm just the refinery manager."

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Table. How women's salaries compare to men's salaries.

	Bachelor's	Master's	Doctorate
All with science/engineering degrees	-35.1%	-28.9%	-25.8%
After controlling for:			
Age and years since degree	-27.2%	-25.5%	-16.7%
Plus field of degree	-14.0%	-9.6%	-16.7%
Plus occupation and employer characteristics	-11.0%	-8.0%	-8.4%
Plus family and personal characteristics	-10.2%	-7.4%	-7.4%
Plus gender-specific marriage and child effects	-4.6%	NA	-3.1%

The SEI observed that "Marriage is associated with higher salaries for both women and men, but marriage has a *larger* positive association for men. Children have a positive association with salary for men but a *negative* association with salary for women." (Emphasis added)

Source: National Science Foundation's Science & Engineering Indicators 2002.