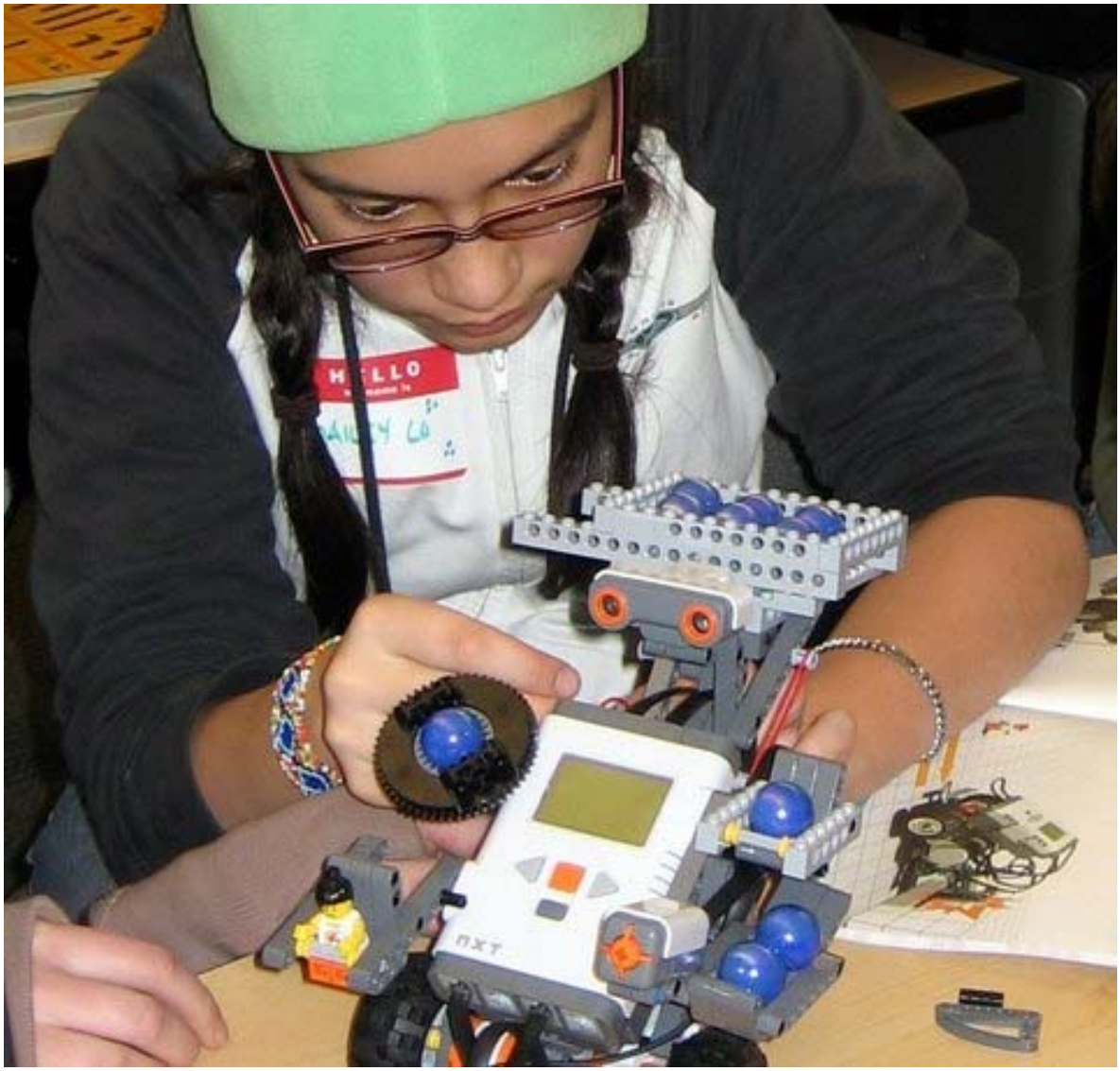
Increasing Women in Engineering

APEGGA Business Plan
July 2010



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This document is produced to guide APEGGA's strategy and action plan in this area and to align with and/or inform the national strategy through Engineers Canada.

Goal

APEGGA's goal is to increase the participation of women in engineering at the professional level to 30 percent by the year 2030 (30 by 30).

Opportunities and Challenges

The Profession

The role of engineering in society is changing rapidly and dramatically, driven primarily by changes in demographics, globalization and rapidly evolving technologies. The changing workforce and technological needs of a global knowledge economy is changing the very nature of engineering practice, demanding far broader skills than simply the mastery of scientific and technological disciplines. Moreover, challenges such as the off-shoring of engineering jobs, the decline of student interest in scientific and engineering careers, immigration restrictions and inadequate social diversity in the engineering workforce continue to be of concern.

From the 1960s, when there were few to no women in the profession, women's participation has grown significantly to 6,368 active Members. There are an additional 2,194 (26 per cent of the total) who are now inactive. On the other hand during the same period APEGGA has experienced a loss of 32 per cent of the men to inactivity. While it is not clear what percentages of these men or women are still active in the profession somewhere, US research has shown that women leave the profession in greater percentages than men.

Due to strong leadership by the universities and women's organizations, Alberta is one of the leading Canadian jurisdictions with 22.7% women at the undergrad level, although this appears to have plateaued in the last decade. Participation drops to 20 per cent at the E.I.T. level and to 10.7% at the professional level with men outnumbering women especially at the upper management levels.

There is still much that could be done by APEGGA to encourage women to enter, and to remain in the engineering field. Advice from some of its female Professional Members to do nothing special for them led to a philosophy of only supporting other organizations involved in promoting science and engineering to women. Given that APEGGA is a leader in supporting and promoting the engineering profession in Alberta, there exists an opportunity for APEGGA to continue demonstrating its leadership and Member support by taking a proactive role in the attraction and retention of women.

The Canadian Workforce

The workforce of the future will likely look very different than it does today. Alberta's overall population is expected to grow over the next ten years. The average age of Albertans is increasing as the Baby Boomers age; the 55 and older age group is predicted to make up over 37 per cent of the population. After 2010, retirements are expected to be a major factor in the Alberta labour market. And while the 0-18 year-old cohort is also increasing more rapidly, the 35–54 year-old age group is expected to decrease significantly (Calgary Board of Education, 2010). Peter Drucker observed that, "the confluence of a bulging aged population and a shrinking supply of youth is unlike anything that has happened since the dying centuries of the Roman Empire." (Duxbury, 2010).

- Women represent 47.4% of the working population but only 12.2% of engineers in Canada (2006 Census data).
- This lack of diversity will have serious long term consequences for industry, for our economy, for women and for society as a whole.
- In order to address the impending skill shortages, immigration is going to have to increase dramatically. However, not all immigrants will have the necessary skills to replace all the highly skilled engineers who will be retiring over the next few years.
- These demographic changes will have profound impacts on organizations.
- Corporations will need to focus on recruitment of new employees, retention of all employees, succession planning, work-life balance, career development and knowledge transfer (AAUW, 2010).

Education Environment

- In elementary, middle and high school, girls and boys take math and science courses in roughly equal numbers and approximately as many girls as boys graduate from high school with the academic credentials necessary to enter the engineering faculties.
- At the University of Alberta in the science faculties women make up 53 per cent of undergraduates, 38 per cent of graduate students, 28 per cent of post doctoral students and only 17 per cent of faculty (Dr. Margaret-Ann Armour, presentation at CCWEST, May 2009).
- In 2001 the University of Alberta had a stated goal of increasing women faculty in science and engineering – as a result of this concentrated effort, the percentage increased from 14 per cent in 2001 to 17 per cent in 2007.
- In a 2008 study, research showed that female and male faculty leave at similar rates; however, women are more likely then men to consider changing jobs within academia. Women's higher turnover intentions are mainly due to dissatisfaction with department culture, advancement opportunities, faculty leadership, and research support (AAUW, 2010).
- Policy makers are increasingly beginning to recognize that the remaining barriers to women's progress in academia are systemic and rather than trying to change women to fit the science and engineering, these fields need to be changed in order to accommodate women (Zoli, 2008, p. 20).
- In the former Soviet Bloc countries women are well represented in the sciences and engineering (over 50 per cent women). This may be due to ubiquitous state-funded

day-care and the expectation that women would work outside the home. Additionally, two generations of women provides plenty of role models (Vassileva, 2008).

- Research clearly shows that the under-representation of women in science and engineering is a result of social and environmental factors and are not biological (Zoli, 2008).
- In 1980 in the U.S. there were 13 boys for every girl who scored above 700 on the SAT math exam at age 13; today that ratio has shrunk to about 3:1 (AAUW, 2010).
- Canadian data is available through The Programme for International Student Assessment (PISA). PISA is a triennial survey of the knowledge and skills of 15-year-olds. It is the product of collaboration between participating countries and economies through the Organisation for Economic Co-operation and Development (OECD), and draws on leading international expertise to develop valid comparisons across countries and cultures. More than 400 000 students from 57 countries making up close to 90 per cent of the world economy took part in PISA 2006. The focus was on science but the assessment also included reading and mathematics and collected data on student, family and institutional factors that could help to explain differences in performance.
    - *While overall gender differences in science performance were small, differing attitudes to science among males and females can potentially affect whether students go on to further studies in science and whether they choose a career in science.*
    - *PISA 2006 showed that, in some countries, males and females were similar not only in science performance but also in attitudes. In other countries, however, there were important differences. Gender differences in attitudes to science were most prominent in Germany, Iceland, Japan, Korea, the Netherlands and the United Kingdom, as well as in the partners Chinese Taipei, Hong Kong-China and Macao-China, where males reported more positive characteristics on at least five aspects of attitude.*
    - *Of the attitudes measured in PISA, the largest gender difference was observed in students' self-concept regarding science. In 22 out of the 30 OECD countries in the survey, males thought significantly more highly of their own science abilities than did females (*PISA 2006: Science Competencies for Tomorrow's World Executive Summary © OECD 2007*)*
- Research clearly shows that young women rely heavily on role models when making career choices. However, women scientists are rarely portrayed in popular magazines, movies or television shows and when they are, they tend to be either subordinate assistants or a 'super-scientist', neither of which provide good role models for young women, as defined by self-efficacy theory (Blasidell, 1995)
- In a 2009 study, researchers reported an increase in middle school girls' interest in engineering after the girls were exposed to a 20 minute narrative delivered by a computer generated female agent describing the lives of female engineers and the benefits of engineering careers.

Work Environment

Research shows that women leave science, technology, engineering and mathematical fields at a higher rate than do their male peers. While this data is from the U.S., it is doubtful that Canada would experience significantly different numbers. It is also useful to note, that although our stated goal is 30 per cent women by 2030, the success of any strategy can not be measured by numbers alone.

- In a study conducted in 2008, researchers found that in the private sector women cited feelings of isolation, an unsupportive work environment, extreme work schedules, and unclear rules about advancement and success as major factors in their decisions to leave their chosen career.
- Instances of explicit bias are decreasing; however, implicit bias continues to have an adverse effect. Implicit biases may reflect, be stronger than, or in some cases contradict explicitly held beliefs or values.
- These unconscious beliefs may be more powerful simply because we are not aware of them.
- There is an implicit association with males and science and mathematics.
- A research study conducted in 2003 found that letters of recommendations for men and women were substantively different in skills emphasis.
- People tend to view women in traditionally masculine fields, such as most science, technology, engineering and mathematics (STEM) fields as either competent or likable but not both.
- Research conducted in 2004 (Heilman) showed that women who are acknowledged as successful in their field were consistently rated as less likable than a male who was described in the same terms.
- This bias did not exist in fields that are considered female or gender neutral.
- In a study conducted in 2007, researchers (Heilman and Okimoto) found that successful women in traditionally masculine occupations are less likely to be disliked if they are seen as possessing communal traits such as being understanding, caring and concerned about others. Men who were successful did not need to display communal traits in order to be likable, their success was enough.
- STEM fields are perceived as male, even in fields like chemistry and math where almost 50 per cent of the degrees are now awarded to women. However, when a woman has shown herself irrefutably to be competent, she then pays the price of social rejection.
- Well documented gender differences exist in the value that women and men place on doing work that contributes to society.
- The need for work/life balance is no longer seen as a women's issue but is beginning to be seen as a generational issue.

Measures of Success

- percentage and actual increase of women in the profession
- percentage of women who attain leadership positions within their organizations
- improvements in effectiveness and efficiency of the organizations that are heavily or totally dependent on engineering for their business

Values/Beliefs

- APEGGA has a role to play both provincially and nationally.
- Powerful and persistent demographic, economic and educational trends have created a convergence of needs for the development of a strategy to support women in engineering.
- Forecast shortages of engineers demand that we encourage underrepresented groups to consider careers in engineering although this is not the only strategy that

should be employed to address skilled labour shortages. Immigration must continue but the province will benefit more if its citizens are trained to a higher level and the province imports lower trained workers.
- A consistent, sustained effort is required.
- There may be something inherently unattractive to women about engineering that may prevent us from ever reaching the same percentage of women in engineering as in the Canadian workforce (47.7%).
- While many women are driven more than most men by a need to work with and to help people, it is possible for this need to be satisfied by a career in engineering.
- Improvements in the participation of women in the profession must and can be achieved at both the attraction and retention levels.
- Young women are strongly influenced by role models.
- There is systemic discrimination toward women in some corporations and by some individuals. These corporations and individuals may not know that they are discriminating.
- Diversity in the workplace has long term benefits for the corporations and for society as a whole.
- Demographic and generational changes will require organizations to provide work places that are systemically different than the workplaces of today.

Strategies

Lead

- Take a leadership role in increasing the number and percentage of women in the profession at the provincial and national levels.
- We will continue to be active in the K – 12 outreach area.

Attract

- Focus on raising public awareness of the profession's role in enabling society through the design and construction of things that benefit all society.
- Focus on raising public awareness of the profession in order to emphasize its responsibility to protect the public interest.
- Maintain the respect and profile that APEGGA has earned in the K – 12 school system.
- Partner with other organizations that have strong(er) programs that meet APEGGA's objectives, particularly with regard to encouraging kids to stay in the maths and sciences in grades K through 6. However, continue to offer programs that APEGGA is good at, e.g. Science Nights, Science Fairs, science olympics, support for math and science teachers.
- Rebuild APEGGA's outreach program to focus primarily, although not exclusively, on career development in grades 7 through 12.
- Rebuild APEGGA's outreach program to focus primarily, although not exclusively, on women and aboriginals in grades 7 through 12.
- Partner with groups in the universities to support female undergrad and grad students.
- Partner with key school divisions to enable access to the students
- Continue to expose youth to professional engineers, particularly young women to women engineering role models.

Educate

- Encourage the Government of Alberta to increase the province's capacity to educate more engineers.

Retain

- Provide Permit Holders with information that will enable them to create a work environment that is supportive of women.
- Continue to provide/facilitate mentoring through the APEGGA program, explore a partnership with the current Cybermentor program for young women and explore networking opportunities and leadership training with other potential partners.
- Recognize organizations or individuals that support women.

Actions

Lead

- Continue to have Council representative on Engineers Canada Women in Engineering Advisory Group (WIEAG) and provide well researched input.
- Send WIEAG representative and staff member to two international conferences specifically targeted at women in engineering.
  - WE 10 – The annual conference for women engineers – November 4 – 6, Orlando, Florida
  - ICWES 15 - The 15th International Conference of Women Engineers and Scientists, 19-22 July, Adelaide 2011

- All APEGGA management and APEGGA Council take part in Women in SETT Leadership Program (WINSETT)
  - Objectives: (i) to inspire and strengthen leadership knowledge, skills and roles in women in SETT; (ii) to contribute to creating SETT work environments that are respectful, inclusive.

Attract

- Enhance the partnership with ASLA for in-class curriculum-based programming for all students in grades 1 through 6.

- Explore funding or in-kind support relationships with the following organizations to enhance programming for young women in grades 7 through 12.

  - Wisest
    - SET program
    - Choices
    - Summer research project
  - Wiser
    - Engineer Girl
    - Engineer your Life
    - Discover IT
    - Wonderville
    - Space.com
    - Explore IT

- Cyber-Mentor
- DiscoverE
- Minds in Motion
- Alberta Science Literacy Association
- Engineers Without Borders

- Continue to work with and explore funding possibilities with UA Wise, WISER and the Grad Students Association Career and Mentoring Program to enhance support for women in university.

- Explore partnerships with the Edmonton and Calgary school boards to assess where gaps exist in career development programming for all students in grades 7 through 12, but with a focus on young girls. Ensure that we have an agreement to enter their schools and a program through which to deliver materials/presentations on the profession.

    - Edmonton Public is embarking on the development of a Second Life platform for delivery of career programming for students in grades 7 – 12. Follow up planned.
    - Calgary Catholic is interested in improving their career programming. Follow up planned.
    - Edmonton Catholic and Calgary Public have been contacted and preliminary meetings have been held.
    - Edmonton Catholic and APEGGA are exploring a Memorandum of Agreement to enhance APEGGA's presence in the Junior and Senior High Schools.

- Work with APEGGA Communications Department to develop resources for Members to use in career development presentations.

- Create a series of video vignettes with an interactive component to show engineers at work. This would include all engineers, but would showcase women and aboriginals.

- Re-design the APEGGA outreach web-site to be a portal to a vast array of outreach materials for Members and/or teachers about engineering. This could include links to other organizations, such as Women in Engineering Program Advocates Network a U.S. based group which is creating resources for teachers to use to present engineering as a viable career path for young women.

Educate

- Call on the Minister of Advanced Education, the Minister of Education and Minister of Employment and Immigration as required, to encourage more capital and operating funding for engineering education.

Retain

- Partner with WinSETT to provide professional development days/seminars/conference for engineers in leadership skills and career development with a special emphasis on women engineers.

- Provide networking opportunities for women in engineering to meet other women engineers.

- Provide mentoring opportunities for women engineers through face-to-face mentoring program and/or a cyber mentoring program such as MentorNet.

- Provide continuously updated information regarding policy and practises that are women and Generation Y friendly to our Permit Holders.

- Create a Summit Award® to recognize companies or individuals for their support of women in the engineering profession.

Conclusion

While it is difficult to calculate a true benefit/cost ratio because of the difficulty in ascribing a dollar value to the non-quantitative benefits that will result from the development of these resources. Our first measurement of success would be the developed of the web-portal. Once the portal has been established, we could then monitor usage. We would measure the success of the program by an increased interest in engineering and/or geo-science as a career possibility for women. And, ultimately we would measure our success by increased numbers of women APEGGA members. One must be cognizant of the long term nature of all these measures.

Although it is difficult to calculate a benefit/cost ratio, it is respectfully submitted that the development of a new and exciting outreach web portal and resources is required in order to properly carry on APEGGA's Outreach initiatives and that the non-quantitative benefits justify the dollar costs

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