Enrollment, Graduates, & Employment in Water Resources & Environmental Engineering

Literature Review by

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Among many other professionals' water resources and environmental engineers play a key role in sustainable water infrastructures design, construction, operation, maintenance, and developing best water resources management practices. Potential employers of these water resources and environmental engineers are diverse and extensive, ranging from local, regional, and state governments up through national governments, and from small start-up companies to major companies in the Dow Jones Industrial Average index. The scope of water and environmental engineering projects are likewise diverse and extensive with scales that span local, regional, national to international levels. Numerous fields of work will require more water resources and environmental engineers in the future, including, river restoration, environmental remediation, hydropower production, water supply and distribution systems, water treatment, and storm water management to name a few. With the advancement of the idea of green technology, the need of water resources and environmental engineers is greater than ever before. To cope with these needs the universities are offering new programs specializing in water resources and environmental engineering. The complex interaction of different components of natural and man-made hydro systems also requires engineer to have an advanced degree in specialized area to fully understand the complexity and to apply the principles for design, construction, operation, and management purposes.

The National Center for Education Statistics (2012) reported that the graduate enrollment in engineering and science programs increased from 101,148 in 1997 to 144,677 in 2009. The increment is about 43% in 12 years. A similar trend has been observed in civil engineering graduate programs, which includes the water resources and environmental engineering option (along with other specialization areas), where enrollment has increased from 17,193 in 1997 to 18,638 in 2009.

The need to extend engineering education beyond a 4-year Bachelor's has been recognized by the professional engineering community for many years with the explosion in

modern technology, and the requirement of an ever-broader education for engineering practice (Dorato and Lyons, 2002). The master's degree are increasingly proposed to be considered as the first professional engineering degree due to the insufficient accommodation of the typical engineering baccalaureate degree to the academic development now required for professional engineers (Goktas and Rogers, 2010; the National Academy of Engineering, 2005). Students are also becoming more aware of the importance of the engineering graduate degree (Goktas and Rogers, 2010). Consequently, the number of applications to U.S. engineering graduate programs increased annually by an average of approximately 4 percent over the period 1997 to 2007 (Bell, 2008). Trend analysis in degree-conferred shows that the number of graduates in engineering and engineering technology from 1949 to 2011 increases significantly. While the number of graduates with Master's degree in engineering and engineering technology in 1949-50 is 4,496 the number in 2010-11 is 43,234 with about 860% percent increase (National Center for Education Statistics, 2012). It is understood that the needs in 2010 is much higher than that in 1950. However, comparing the data from 2000 to 2010 same trend is also observed. In 2000-01 the number of graduates with Master's degree in engineering and engineering technology is 27,187 and that in 2010-11 is 43,234 with an increase of about 59%. The percent changes in the graduates from 2000-01 to 2005-06 and from 2005-06 to 2010-11 are respectively 22.8% and 29.5% (National Center for Education Statistics, 2012) which clearly shows the trend of increase in the graduates with Master's degree in engineering and engineering technology.

Similar trend is also observed in graduates with Masters' degree in civil engineering program alone. While in 1970-71 the number of graduates is 2,425 the number in 2010-11 is 4,860 (National Center for Education Statistics, 2012). The percent change in graduates with Master's degree in civil engineering program[1*] from 2000-01 to 2005-06 is 13.8% and from 2005-06 to 2010-11 is 29.0%. The trends in enrollment and graduation in civil and other engineering graduate programs are increasing and the rate of increment is found significantly highin the last decade. Similar trend (about 34% increment) in graduates from 2009-10 to 2021-22 from Master's programs was also reported for the next decade by the Hussar and Bailey (2013):.

Bureau of Labor Statistics (2012a) projects 10.4% increase in architecture and engineering occupations from 2010 to 2020. The education requirements for these jobs will generally be higher. It is projected that the Master's degree requirement for these jobs will increase 21.7% from 2010 to 2020 (Bureau of Labor Statistics, 2012a). While civil engineering employment is projected to increase 19% from 2010 to 2020, environmental engineering employment is projected to increase 22% for the same time period (Bureau of Labor Statistics,

2012b). Since civil engineering generally includes environmental engineering and other options in civil engineering it is anticipated that the rate of job increase in environmental engineering is significantly faster than general civil engineering. Bureau of Labor Statistics (2012b) projects 18% increase in hydrologist job. This job will generally require Master's degree. While nationwide, the employment in the area of water resources and environmental engineering is projected to grow at a higher rate in the current decade, similar trend is also observed in the county of Fresno. It is projected that there will be 7.5% increase in general engineering jobs from 2008 to 2018 in the county of Fresno (California Employment Development Department, 2013). While the increase in civil engineering jobs will be 4.7%, the increase in environmental engineering job will be 11.1% in the county of Fresno.

1*: Masters in civil engineering includes water resources and environmental engineering with other options.

References

Bell, N.E. (2008). Graduate enrollment and degrees: 1997 to 2007, Washington, DC: Council of Graduate Schools.

Bureau of Labor Statistics. (2012a). Economic News Release, U.S. Department of Labor, USDL-12-0160, February, 2012.

Bureau of Labor Statistics. (2012b). Occupational Outlook Handbook, 2012-13 Edition, U.S. Department of Labor, visited online at http://www.bls.gov/ooh/architecture-and-engineering/civil-engineers.htm on January 19, 2013.

California Employment Development Department. (2013). Projections of Employment by Industry and Occupation, California Employment Development Department, visited online at http://www.labormarketinfo.edd.ca.gov/Content.asp?pageid=145 on January 19, 2013.

Dorato, P. and Lyons, W. (2002). Master of Engineering: Past, Present, Future. Proceedings of the 2002 American Society for Engineering Education Annual Conference & Exposition

Hussar, W. J. and Bailey, T. M. (2013). Projections of Education Statistics to 2021, Fortieth Edition, NCES 2013-008, Institute of Education Science, U.S. Department of Education, January 2013.

National Academy of Engineering. 2005. *Educating the engineer of 2020: Adapting engineering education to the new century*. Washington, DC: The National Academies Press.

National Center for Education Statistics. (2012). Digest of Education Statistics, U.S. Department of Education, July 2012, visited online at http://nces.ed.gov/programs/digest/d12/tables/dt12_320.asp on January 19, 2013.

Rogers, S.W. and Goktas, R.K. (2010), Exploring Engineering Graduate Student Research Proficiency with Student Surveys, Journal of Engineering Education, July, pp 263-278.