Federal Support for U.S. Mining Schools

March 2013

Issue

Mining and geological engineering, mineral processing, extractive metallurgy and applied geology and geophysics programs at our universities are national assets that are critical to maintain and encourage the growth of the U.S. energy and minerals workforce. These programs suffer from dwindling federal reinvestment and R&D funding. Without an adequate pipeline of qualified graduates and faculty at U.S. universities, the nation is at a distinct competitive disadvantage in the production of basic raw materials and energy. Workforce availability has become a significant problem for the domestic mining industries.

Figure 1 shows a steep decline in mining engineering graduates following the mining "bust" period in the 1980s and another drop after 1999. It is not clear if the graduation ramp-up rates seen in the mid- to late 1970s could be reproduced as there are currently fewer mining engineering programs as well as qualified faculty. The nation is now down from 25 accredited mining schools in 1982 to 12 today.

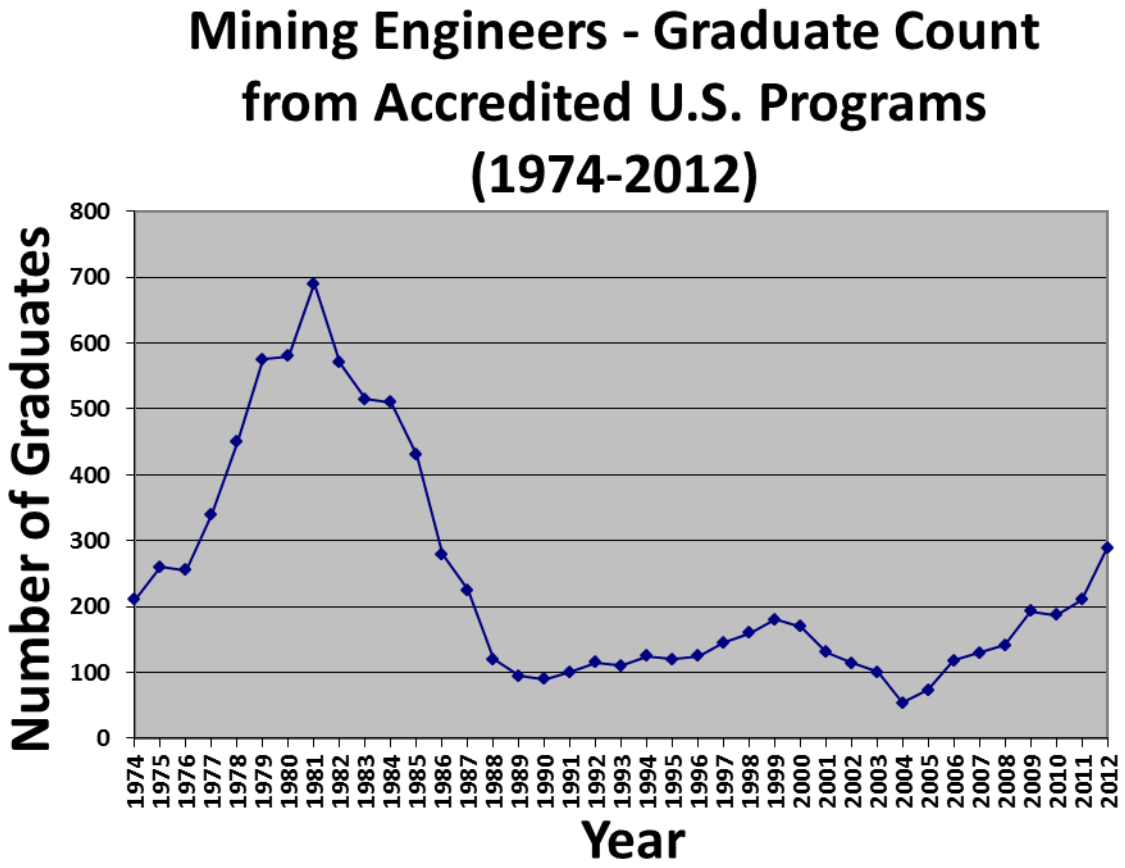

Figure 1. B.S. & M.S degrees conferred. Source SME 2012.

Federal funds are needed to:

- Assist in maintaining accredited programs in mining and mineral engineering;

- Fund career technical education at community colleges and vocational programs in high schools;
- Fund basic and applied research;
- Develop the Nation's energy and mineral resources in a fashion that fosters community-based economic and environmental sustainability;
- Ensure sound environmental protection, and productive secondary use of the involved lands;
- Develop effective, efficient and economically-sound reclamation that supports sustainable communities;
- Improve operational safety and efficiency;
- Optimize the extraction and reclamation operations by encouraging the integration of public policy, law, economics, environmental management, and engineering into activities that foster sustainable energy and mineral development; and
- Promote the ability of the U. S. industrial economy to compete effectively in the world marketplace.

Background

The United States is the world's largest user of many mineral commodities, with processed materials of mineral origin accounting for over $2.39 trillion in value added to the gross domestic product in 2012. The U.S. has greatly weakened its capacity to produce those raw materials and energy in part through neglect of training the skilled and educated workforce required in the minerals and energy sectors. The consequences are now felt in terms of record high commodity prices, concerns about the availability of resources for the U.S. economy and defense, and a workforce shortage. The workforce issue puts companies operating in the U.S. at a competitive disadvantage and further raises costs to the U.S. consumer.

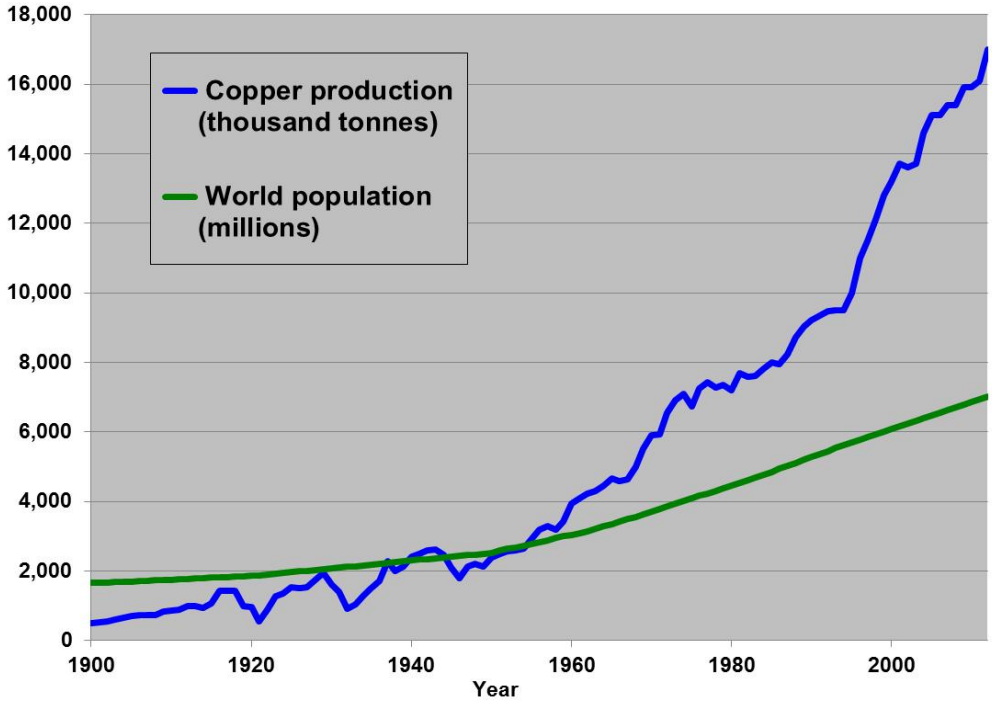

Figure 2. Global production of copper (in metric tons, from 1900 to 2012) has increased at a rate faster than world population as standards of living have improved, particularly in the last two decades. Source of data: USGS since 1995 and U.S. Bureau of Mines prior to 1995.

Mining schools have long sought to find sources of funding to support their programs and to continue to provide the personnel and talent needed by industry and government. A near total lack of funding continues to hamper the efforts of the schools.

- There has been a steady decline in the number of accredited mining and mineral engineering programs from a high of 25 in 1982 to 12 by 2012. (The following universities have closed their mining engineering programs since 1985: University of California Berkeley, University of Illinois, Ohio State, University of Minnesota,

University of Alabama, University of Idaho, Columbia University, University of Pittsburgh, Texas A&M, University of Washington, University of Wisconsin – Madison and Platteville, and the University of Wyoming.)

- There has been a corresponding decline in U.S. faculty (~120 in 1984 to ~70 in 2012) in these programs as well as a shortage of qualified candidates to fill these faculty vacancies.
- U.S. schools graduated 289 B.S. and M.S. mining engineers in the U.S. in 2012, up from an all-time low of 54 in 2004, but still down 60% from a high of 700 in 1981.
- B.S., M.S. and Ph.D. mining engineering enrollment in the U.S. is approximately 1633, up from 906 in 2006; however, global industry demand for mining engineers exceeds supply by 300%.
- 21% (128,000) of the current mining workforce will retire by 2019, and 52% (221,000) by 2029.

Where will the industry find replacement workers? The main competition comes from countries with ongoing mining booms. Australia projects a need of 86,000 new miners by 2020. Canada needs 100,000 new miners by the same date. There is also a significant financial incentive for recent graduates to take foreign mining jobs. A consequence of the shortage in qualified management is multi-billion dollar cost overruns on mining projects and possible negative impacts on worker health and safety by using poorly trained replacement workers.

The demand for mining and mineral engineering professionals has increased beyond current educational capacity. Therefore departments are trying to expand their programs, hire new faculty, and enroll new students. Given the "boom" in mining globally and the lag in degreed academic program response, it is speculative if schools can meet the demand at least in the near future.

Why should the government care about reinvestment in mining engineering schools?

1. A highly skilled and educated workforce of mining professionals helps to ensure safe operating practices for 350,000 employees at U.S. mines that are responsible for a value chain that consistently contributes more than 14% of the U.S. economy.

2. The cost of retraining a civil engineer to do the job of a mining engineer is 600% higher than hiring a mining engineer. (M. McCarter, University of Utah, 2005, internal report)

3. U.S. Ph.D.-granting universities have experienced substantial declines in the level of state funding, which has forced many to shift their base of support from state revenues to overhead on research contracts and tuition. At the institution level, increases in tuition can help offset the lack of state dollars. Unfortunately at many institutions, tuition revenue does not flow to the college or department level. Budget cuts, however, are implemented at the college and department levels. So, mining programs are in a situation where enrollment declines have escalated their cost-per-degree and the present level of federal, state, or industry research funding for minerals is insufficient to offset budget cuts.

4. As U.S. universities have become more reliant on federal research dollars for primary support of their programs, faculty-hiring decisions are increasingly made based on where federal support is available, or likely to be available, over several years. Since the closure of the U.S. Bureau of Mines, the funding for mining research has been very limited and therefore universities lack the motivation to hire faculty in an area where limited prospects for federal research funding exist.

The age profile of U.S. mining engineering faculty is another limiting factor in expanding capacity. The average age of the faculty is 52. We expect nearly 30 retirements out of the 70 faculty positions in the next 5 years. A smaller number of Ph.D. candidates are expected to consider the option of a university position.

Options for Action

Legislation, similar to the *Energy and Minerals Schools Reinvestment Act of 2006*, must be considered to provide the federal support needed for consistent, long-term reinvestment in our university mining engineering programs. Congress should consider:

- Reinstating of the Mining & Mineral Resource Institutes Act of 1984, which vested the Secretary of the Interior with responsibility for the program;
- Making it national policy to preserve and foster the human capital necessary for national economic, energy, and minerals security;
- Declaring that accredited mining schools and accredited universities with applied geology and geophysics programs that produce the human capital needed for energy and mineral security are national assets;
- Appropriating funding to maintain and encourage the growth of the energy and minerals workforce to meet the national needs;
- Focusing on training the workforce needed for exploration and production of energy and mineral resources as well as mining professionals in government sectors responsible for implementing regulations and conducting research related to these resources
- Funding support for existing programs at Accreditation Board for Engineering and Technology (ABET)-accredited mining schools and accredited universities with applied geology and geophysics programs, including support for students and faculty research in mining engineering, mineral processing, extractive metallurgy, mining and exploration geology and geophysics, and mineral economics; and
- Requiring that all schools accepting funds have a duty to increase the number of undergraduates enrolled in the supported programs and produce more engineers, geologists, and geophysicists for the minerals industry.

SME Statement of Technical Position

Five major federal actions are needed to stave off the crisis in mining engineering schools and to ensure that we have vigorous and respected academic mining engineering departments.

1. There must be dialogue between national, state, and university leaders regarding the importance of mining engineering programs to the U.S. economy and to national security needs.

2. Federal funding for minerals-related research needs to be dramatically increased. Centers of Excellence in Mineral Resources should be developed at the existing research universities and funded at a level sufficient to satisfy the academic metrics of each university and to develop a quality pool for the future professorate.

3. A national mineral resource strategy should be developed that includes policies that allow the U.S. to continue to produce mineral resources in an environmentally sound and profitable manner, particularly in support of national defense, advanced manufacturing, and competitiveness of domestic manufacturing. The National Research Council of the National Academies of Science can assist with a research roadmap to help achieve the proposed strategy.

4. The current distribution of responsibilities for mineral resources management within the federal government should be examined to determine if it is an optimal structure to support the sustainable development of our mineral endowment. A consolidated national minerals policy branch may be effective at coordinating mineral resource activities of all appropriate federal agencies, optimizing interactions with universities and industry, and advising Congress on actions needed for national mineral and energy security.

5. A positive national public message needs to be conveyed by the federal government that mining is essential to the nation's economy, mining engineers are in critical shortage, those who work in the minerals industry are valued members of our society, and mining engineering is a career choice that should be encouraged for our young people.

Loss of people in the mining industry means loss of domestic and global leadership and loss of national economic and defense security regarding minerals that are a basic necessity for quality of life. National policy and adequately funded research programs are required to counter this loss of intellectual capacity needed to populate the mining industry, teach the future graduates, and provide professionals for government agencies involved in mining,