We currently witness a considerable excitement over renewable energy. Utah, in particular, has a good portfolio of solar, wind, and geothermal resources. However, the best renewable sources are often found in remote locations that are not presently served by electric transmission lines.

In addition to the needed expansion of the grid, there is a new focus on its modernization. The so-called smart grid is being proposed to offer increased efficiency, flexibility, and reliability. Some of the objectives are to manage renewable sources that are not available on demand and to accommodate new loads such as plug-in hybrid electric vehicles (PHEV). Reliability is also of paramount importance, and stretches from traditional concepts of network stability and handling of peak demand to new concerns over cyber-security.

The expansion and modernization of the grid comes at a time of crisis for the electric power industry. The median age of the workforce is over 50 years, and a recent report from the Center for Energy Workforce Development, available at http://www.cewd.org/, indicates that 46% of electric utility engineering jobs could be vacated by 2012.

This workforce shortage occurs after a period of considerable downsizing in the power engineering programs training B.S., M.S. and Ph.D. students in the U.S. Consider the number of positions lost at some top universities: Carnegie Mellon University: 1975: 8 faculty; 2007: 1, Cornell University: 1975: 7 faculty; 2007: 1, UC Berkeley: 1971: 4 faculty; 2007: 1, Univ. of Missouri-Columbia: 1975: 8 faculty; 2007: 0. Most of the surviving programs are located in the Eastern and Midwestern parts of the country. In the West, only Arizona State University stands with a large program. The last power engineering program in Utah disappeared in the early 90’s.

Reasons for the decline are twofold. First, as the industry grew more efficient, job opportunities for new graduates became limited. Further, the field was increasingly viewed by students as low-tech compared to emerging areas of electrical engineering. Course enrollments continuously declined.

A second factor contributing to the decline of power engineering programs was the relatively low research funding provided by the federal government. Generally, industry also invested little in research. Thus, research universities re-assigned faculty positions after retirements to areas with greater student interest and higher funding potential.

Interestingly, these events occurred despite exciting developments in power electronics, variable speed drives for motor controls, and many other areas of power engineering. Research continued at a strong pace in Europe and Japan, while solid educational programs were sustained in India and other Asian countries, where they were less vulnerable to the vagaries of research funding, and there was greater appreciation for the critical role of electric energy.

Regardless of the reasons for the present situation, there is now interest across the U.S. in reviving power engineering programs. In a brand new initiative at the University of Utah, the Department of Electrical and Computer Engineering hired Professor Faisal Khan to rebuild a power engineering program. Funds were obtained from the State’s Engineering Initiative, which was created to increase the supply of engineers in all areas. Thanks to the support of Professor Richard Brown, Dean of the College of Engineering, one of these positions was allocated to power engineering.

The new faculty member, Professor Khan, is the ideal choice for the new program. He obtained his Ph.D. in Electrical Engineering from The
University of Tennessee in April 2007, majoring in power electronics with a concentration in power management for future hybrid-electric automobiles. Between April 2007 and June 2009, Professor Khan worked as Senior Power Electronics Engineer at the Electric Power Research Institute (EPRI) in Knoxville, gaining valuable experience in projects related to power distribution, power quality, energy efficiency, the smart grid and the utility side impacts of PHEVs. During his Ph.D. study, he also contributed to several EPRI projects including the 80PLUS initiative for computer power supplies.

Fortunately, local utilities move forward and supported financially the new power engineering program, with donations totaling $232,000. We are thankful to the contributors: the Intermountain Power Agency, Rocky Mountain Power, the Utah Rural Electric Association, Questar, Utah Associated Municipal Power Systems, the Utah Municipal Power Agency, and Reliable Controls. The Intermountain Power Agency also gave $155,000 to create a new scholarship endowment, whose proceeds are used to give scholarships to undergraduate students interested in power engineering careers.

Although only one tenure-track faculty member was hired in the power engineering area, the program is being supported by two additional faculty members: Professor Arn Stolp and myself. At this time, the power engineering curriculum is composed of the following classes:

- ECE 3600: Introduction to Power Engineering (Professor Stolp)
- ECE 5610: Fundamentals of Power Electronics (Professor Khan)
- ECE 5620: Introduction to Power Systems (Professor Khan)
- ECE 5570: Control of Electric Motors (Professor Bodson)

The good news is that student interest in the program is high. While declining student enrollment was partly to blame for the earlier demise of power engineering programs, this issue is currently not a concern. Perhaps students know where the good opportunities are better than we give them credit for.

In order to insure the best training program possible for the students, the power engineering initiative includes a plan to create a new teaching lab. For this purpose, the College of Engineering of the University of Utah allocated $66,000. Professor Khan is working on developing the teaching lab, and we are also trying to raise additional funds.

The other major part of the power engineering initiative is the promotion of new research activities. A research lab with modern facilities will considerably increase the visibility of the program. Towards this goal, a new research lab has been established, named PEARL (Power Engineering and Automation Research Lab). This lab will provide modern facilities for research in areas such as power electronics for energy storage and renewable energy, control system design for optimal energy conversion, and so on.

A couple of related activities are worth mentioning. First, Rocky Mountain Power has supported the department’s engineering clinic program for the past two years. In the program, undergraduate students perform senior projects defined by industry, and with joint industry/departmental supervision. This year, students are investigating smart grid technology under the supervision of Professor Khan.

A second noteworthy activity is the creation of a Utah chapter of the IEEE’s Power and Energy Society in 2009, for which I have served as Chair. An email list of about 100 engineers interested in power has been used to advertise seminars and other news items. In 2009, six seminars were offered, including one offered through a visit from a Distinguished Lecturer of the IEEE’s Power and Energy Society, Professor Sakis Meliopoulos.

While the new program is an exciting development for Utah, the extent of its ultimate success is uncertain. First of all, a single faculty member specifically devoted to the program is not enough. Such a program should be supported by at least one additional faculty member, and preferably three. Unfortunately, the current economic climate is not favorable to this growth. It remains to be determined whether additional faculty members will be assigned in better economic times.

Another concern is that factors that contributed to the earlier demise of power engineering programs may reappear. Currently, there is significant investment from the federal government towards energy. It is unclear how long this trend will continue. Large expenditures under the American Recovery and Reinvestment Act (the “Stimulus Bill”) target quick fixes and rapid returns. Long-term commitment to the electric infrastructure and to renewable energy remains unclear.

A question to be determined is the continued role of industry in Utah. Given its support of the current initiative, there are reasons to be optimistic. Interestingly, a review of power engineering programs that survived the earlier downsizing in the U.S. indicates that these programs have been strongly supported by industry. It remains to be determined whether the one-time support received by the power engineering program in Utah will transform into a continuous commitment.

The State may also have a role to play on this issue. In other parts of the world, state-level support contributes to higher education R&D activities. Sometimes, revenues from the sale of electricity are used for this purpose. While we all enjoy in Utah the fact that our electricity rates are among the lowest of the country, greater re-investment in education and research would secure the supply of highly-trained engineers and support an infrastructure that would make Utah a player in the upcoming high-tech world of electric energy.