Engineering/Technical Education for Developing Countries’ Needs

JOHN H. RIXSE, JR., FELLOW, IEEE

Abstract—This is a reflective approach to engineering and technician training from the viewpoint of a developing country’s needs. It weighs past experience and future needs in terms of what the educational institutions in the developing country can do to become more deeply involved in their own country’s development and how U.S. educational institutions can assist. It also isolates, for illustrative purposes, power engineering education but also ties that into one of the most crucial current and future needs of developing countries—“energy.”

The intent of this paper is to be reflective, to stimulate the exchange of ideas, and to stimulate new initiatives over the next decade. The goal, the need, is for educational institutions of the DCs (an acronym for “the developing countries”) to become more involved in the problems of development of their own countries through engineering and technical education, through participation and through problem solving. Engineering is intended in its fullest professional sense and technician or technology or technical in its most adaptive sense.

The importance of this issue has been readily seen by engineers and developmentalists who have worked in the developing countries. They have seen in practice that the concept of what is good and appropriate for an American student in an American college or university or in subsequent practice is not likewise good and appropriate for students of a developing country. This has been seen both where the student of the developing country is in the U.S. for training and also where the U.S. faculty members have been active in the developing country’s educational institutions. We have learned that, in addition to the general development process, there needs to be a serious reorientation of development assistance in the training and utilization of engineers and technicians.

Even though the objective of this special issue of the IEEE TRANSACTIONS ON EDUCATION has as its major thrust electric power engineering education, this paper must first address the broad field and then deal more specifically with the narrower field of electric power and energy.

Two recent documents are available which accurately represent past experience and thinking. Both resulted from substantial funding by the Agency for International Development. The first, “The Role of U.S. Engineering Schools in Development Assistance” by the National Academy of Sciences—National Academy of Engineering, is typical of past approaches.

A second, “Educating Engineers for World Development”, is the proceedings of a World Congress. Both of these documents reflect the thinking of outstanding panels and have been given wide dissemination.

Another piece of important work which predates these two references and which has not received widespread attention are two reports by the American Society for Engineering Education, “Mid-Level Technical Education and Manpower”—one on Colombia—and the other on Central America which address the issue of mid-level technicians. One significant set of statistics contained in these documents is the UNESCO 1970 report for Colombia showing there were in-country 6334 engineers and only 519 technicians, with 1600 engineers being graduated yearly. Herein lies one of the major problems facing a developing country. Everyone wants to be an engineer, preferably with an advanced degree, just like their counterparts in industrialized countries and very few people want to be or are trained to be technicians or middle level management and supervisory technical personnel which are so needed in order to fill the gap between the professional engineers and managers and the bulk of the craftsmen and labor force. This problem is evident in project after project in developing countries.

A second problem is that the developing country engineers, when they complete U.S. engineering training, approach their responsibilities in their own country seeking to transfer what they have learned to their own home environment. Frequently, they do not seek questions about nor are they prepared to determine how their own developing country situation can best be evolved so as to be compatible with its own needs and its own technical, cultural and social requirements. In other words they are repeating the same approach, complete with its ineffectiveness, of the American engineer, inexperienced with developing country situations, who assumes that the way we do it in American is the way it should be done in a developing country.

The need is for the best minds in the U.S. and in the developing countries to seek adequate answers to this question—“How can developing country educational institutions, and how can U.S. educational institutions working with developing country educational institutions, assess, evaluate and set a course of action that would put the developing country educational institutions—their faculty and students—into the midst of helping to solve current and future needs of the developing countries? This paper has indicated two things, but no doubt there are other elements which require specific attention.

There is a need for all engineers in developing countries to be
trained toward meeting specific developing country problems, whether trained in the U.S. or their own country. I see a need for sharply increasing the training of technicians and a mid-level technical management and supervisory cadre. This is not to say that there is not a need for some graduate level training which could lead to research and top management, but even that type of training should be responsive to local needs.

Now as to electric power and energy, a crucial need in every developing country, the problem is as broad as the spectrum of the rainbow, the problem has been worsened by the rapid rise in fossil fuel costs, particularly for petroleum products, and by the felling of forests for firewood and land clearing, both responsive to the out-of-control population growth, the need for more food, and the trend of developing countries to industrialize as a means of joining the world economic community. Many developing countries are actively seeking, planning or developing rural electrification systems, expanded urban electric power systems, nationwide electric power grids, gigantic hydroelectric and fossil-fueled power plants and, even some nuclear power plants. Admittedly, this depends in part upon the degree of a developing country's current economic condition including the degree of its movement toward economical soundness, industrialization and improved agricultural development. These developing countries are faced with a myriad of problems running the gauntlet from the most complex to the simplest in engineering, economics, management, construction and operation in the field of electric power. But through it all the greatest number of people are needed for the simplest problems. A close cooperative, collaborative linkage between industry and the faculty and students of engineering and technology schools is essential.

The developing countries have been ahead of the U.S. in seeking ways and means of basing their future growth on utilization of their indigenous resources, particularly their renewable resources. This has introduced a major new dimension to the problem for which both engineers and technicians need to be trained. Increasingly developing countries, the poorest to the richest, are asking "how can we make use of solar energy, small water powered projects, agricultural and industrial waste, low grade timber, wind, tides and geothermal, and how can these be worked into our own social, cultural and economical development?" Here again not only are research and top-level professional engineers required but a greater number of technicians, technical assistants and mid-level management and supervisory personnel.

Power engineering can no longer be kept separate from total energy—power engineering is part of energy engineering. Even though most of the industrialized world face energy problems, the truth of the matter is, the problem is even greater for developing countries. But in the developing countries we can see the need for training of people to address those problems in their own context and not assume that the industrialized educational systems will automatically serve developing country needs in conjunction with serving its own needs.

REFERENCES


