Part Three: Past, Present and Future

By Dean Gordon R. Slemon

Gordon R. Slemon – Chairman of Advisory Committee (this publication), is Dean of Applied Science and Engineering, University of Toronto. Dean Slemon has received his degrees from University of Toronto, Imperial College of Science and Technology – London, and University of London. He is a Fellow of the Institution of Electrical Engineers, of the Engineering Institute of Canada and of the Institute of Electrical and Electronic Engineers.

Parts One and Two of this book have traced the developments in communications, power applications and electrical engineering education in Canada during the past 100 or so years.

In the earliest days consumption of electrical energy was mainly for telegraph and telephone communications. Later electricity was developed for lighting, heating and motive power. At first our power systems were small and isolated. Heavy d.c. cables emanated from widely scattered generating stations and supplied only enough energy to light up a few street corners, put light into a few homes and drive a few motors in nearby shops. Then a.c. transmission was developed and electricity was quickly recognized for its capacity to relieve the drudgery of all Canadians and lead them to a better quality of life. By 1900 Canada's total generating capacity was 130,000 kilowatts. The country's population was 5 1/2 million and over 40% of the labor force was employed in agricultural pursuits.

Today electrical energy uses have expanded to include radio, television, electronic controls, medical applications, computer operations, satellite communications, scientific space ventures and dozens of new and different purposes too numerous and far reaching to even summarize. In the 1920s Canada's annual consumption of electrical energy per capita was about 550 kilowatt hours. Today it is about 16,000 kilowatt hours. In the meantime our population has grown to 25 million. Less than 5% of our labour force is engaged in agriculture. More than three quarters of our people live in urban centers-mostly in our 17 or 18 metropolitan areas.

This phenomenal growth in consumption has been met by a corresponding increase in our total generating capacity of more than 670 times, in this century, to approximately 90,000,000 kilowatts.

During the 1990s our population is expected to exceed 30 million with 85 to 90% living in urban centers. To provide for this further growth at satisfactory standards of living, health, safety and "the good-life" we must continue with the development of our capabilities in all fields of electrical applications. What level will our consumption of electrical energy be and where will it take us in the years ahead?

Predicting the future is a precarious occupation. While predictions are possibly interesting and intriguing to today's audience, they will almost certainly be proven wrong. Future historians will undoubtedly unearth these predictions for the amusement of students and readers. On the other hand, we often tend to create the future that we predict. In that sense, prediction becomes part of planning and we might well plan for the future that we wish to happen.

Canada's wealth has been derived largely from the export of raw materials from our mines, forests and farms. In the future, we may expect increasing competition in world markets for the sale of these raw materials leading to a need for the application of the most advanced techniques of exploration, management and processing. All these depend increasingly on electrical engineering methods of instrumentation, control and computation. To maintain our position in the world economy, more electrical engineering research will be needed, both in the resource industries and in universities.

In the past, much of our electrical manufacturing has been carried out by branch plants of foreign companies. In this process design and manufacturing information was imported. With lowered tariff barriers, this situation is rapidly changing. Electrical manufacturing companies in Canada must now compete in the world market. This requires the development of distinctive, Canadian products through higher levels of research, design, manufacturing and marketing than in the past. The plants of multinational companies already in Canada will increasingly have world mandate for certain product lines. More Canadian companies can be expected to enter the world market arena, particularly in specialties which fit in the interstices of mass markets filled by the major world corporations.

To some, the field of electric power may appear to be fully developed and thus to have a rather unexciting future. It must, however, be noted that the health and welfare of our highly urbanized society will continue to depend heavily on the availability of plentiful, economical electric power. In this sense, Canada has been extremely fortunate in the past in the development of electrical energy from hydroelectric and fossil fuel sources. In addition, Canada has developed a distinctive and world class nuclear energy source. While the current world market situation remains depressed, CANDU and its successors should continue to be strong contenders in the world market for future electric power supply. In addition, it might be expected that small nuclear power sources would be developed for application in remote locations in the Canadian North.

Renewed attention is being given to development of large remote water power sites and redevelopment of smaller water power sites which are not yet fully utilized. Increased use of electrical instrumentation, control and communication techniques allow these to be fully automated and unattended.

It is difficult to predict if other alternate sources of electric energy, currently under investigation, will become important. Canada is contributing substantially to world research in solar cells, but thus far they are applicable only in specialized circumstances. Wind power does not appear to be a major factor in the future, although, again, some specialized applications may be appropriate. Electric power from nuclear fusion has long been predicted but formidable difficulties will continue for several decades. It is still doubtful if fusion power will compete with electric power from nuclear fission.

Communications has been a priority in Canada from the days of earliest settlement. Canada has established a position of world leadership in some markets and has the potential to stay with the world leaders producing the hardware and software for future communication needs. Because of its size, relatively low population, and the remoteness of many of its communities, Canada is especially dependent on satellite communications. It may therefore be expected that Canada will place continued emphasis on the commercial development of space technology for communications applications. One of the major motivations for expansion in communications in the future arises from the desire to provide high quality education services throughout the country. To the extent that communication services are developed to meet Canadian needs, they will undoubtedly be applicable in external markets.

Acquisition, storage, access and processing of information of all types (beyond what has been called communication in the past) has undergone and will continue to undergo a revolution undreamed of 30 years ago. The technology behind this "high tech" development is predominantly electrical and electrical people will continue to be highly involved in its evolution and application in offices, factories, commerce, transportation, institutions and homes. Canada's relatively high standard of living can be expected to remain in the forefront through developing and implementing its own variety of advanced technology.

Canada has one of the best health systems in the world. Our health industry features a good mix of public and private involvement. Much of current health delivery involves highly sophisticated application of instrumentation, control and computing, all of which have areas involved in electrical engineering. From this base, it should be possible to develop a world ranking medical engineering industry with significant export sales.

Canada has also developed one of the best systems of engineering education in the world. It features high quality, well established graduate schools and excellent engineering research, funded from both government and industrial sources. Among the engineering disciplines, electrical engineering has, in recent decades, become the largest, with increased dependence of all engineering activities on energy, instrumentation, control and computing. This predominance of electrical engineering is expected to continue. In addition, we would expect a continued growth in electrical engineering education at the Masters and Doctorate levels as the research and development needs of Canadian industry expand.

A major feature of electrical engineering education in the past, was that it was the first to develop a system approach. This kept the view of electrical engineers broad and general. As new technical areas came along, electrical engineers readily adopted them. Examples include nuclear, computer and space technology. The same pattern can be expected in the future. Electrical engineering has already infused itself into all other engineering areas and into most non-engineering areas. As new developments, inventions and needs come along, electrical engineers will be there to amalgamate them into their systems to provide better goods and services for the public.

Canada's development during the past century has paralleled the development of electrical systems of all types and applications. We stand among the top few of the nations of the world in the use of this magical medium of energy. That is a predominant reason why we enjoy our high standard of living in spite of our relatively small size and short history. We may well look to an ongoing favorable and fortunate position in the future through sustaining our advanced knowledge and application of electrical energy for the benefit of our economy and our society.