Book Reviews

Critical Issues in Electric Power Planning in the 1990s

by K. MORGAN MACRAE
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The 1980s began with storm clouds hanging over Canadian electric utilities. What had been a rather stable and secure industry for decades experienced a traumatic period of public distrust and financial uncertainty. Megaprojects struggled through contentious public hearings. Forecasts were rendered inaccurate by a deep recession. And high interest rates, escalating construction costs and rising fuel costs forced utilities to push for dramatic price increases.

In the latter half of the decade the industry seemed to calm down again. Contentious projects were completed or entered their final construction phase. With many utilities exhibiting excess capacity, few new projects were started, in spite of a return to vigorous growth in electricity demand. With less new investment and falling fossil fuel prices, electricity prices edged downward in real terms. Public concern began to ebb.

But what will the next decade bring? Will the electricity industry in Canada now return to the comfortable stable days of the 50s, 60s and 70s? Or have we been lulled by the unsustainable calm of the late 1980s into a false sense of paradise regained?

The latter is more likely according to this new book by K. Morgan MacRae of the Canadian Energy Research Institute. Falling electricity prices, growing electricity demand and negligible new investment in capacity are a combination that is unsustainable. The author demonstrates this in a detailed work that is of importance for anyone (in business, government, academia, the environmental movement and the interested public) who wishes to assess where the electric utility industry in Canada is headed.

The book begins by surveying and combining the 1988/89 peak demand forecasts of all Canadian electric utilities for the decade 1990 to 2000. This yields an average annual growth rate of 2.4%, involving an increase in generating capacity of 23,700 MW over the 10 years. If the 14,500 MW of projects already committed are subtracted from this total, an additional uncommitted capacity of 9200 MW will be required during

the coming decade.

In addition to this base case, two other scenarios are run. In the first, the growth rate is increased from 2.4 to 3.5% in order to reflect the recent tendency of electricity demand growth to exceed the rates forecast by utilities. This higher growth rate raises the total new capacity requirements from 23,700 MW to 37,200 MW. In the second scenario, domestic growth is kept at the base rate, but electricity exports are assumed to increase in line with the current efforts and opportunities of several provinces. This results in a requirement for the construction of 31,900 MW of capacity during the decade.

All three scenarios lead to the same startling implication: although the percentage growth in domestic electricity demand is projected to be the lowest in decades, the 1990s may require the greatest capacity expansion in the history of the Canadian electric utility industry. Moreover, the high costs of this new capacity will require a dramatic increase in utility debt and higher electricity prices. All of this will occur at a time when environmental concerns about energy production, transmission and consumption have never been greater.

Having sketched out a framework for this challenging decade, the author devotes the rest of the book to an examination of the major issues and trends that will influence the planning strategies most likely to be pursued by the utilities. Chapters in the book address: (1) demand-side management (DSM), (2) non-utility generation (NUG), (3) opportunities for and constraints on interprovincial and international electricity trade, and (4) environmental implications of electricity generation and transmission.

Experience from the US suggests that DSM will play an important role in reducing both total and peak electricity demand. NUG will also grow dramatically over the decade, especially from cogeneration. However, the author argues that these two factors will not eliminate the substantial need for utility-developed megaprojects.

Using a model of interprovincial and international electricity trade, ELGEM, MacRae finds substantial economic and environmental benefits to such exchanges. This is primarily because more economical, large-scale hydro from some regions of Canada would supplant fossil fuel generated electricity elsewhere in Canada and in the US. The key obstacle to increased electricity trade will be the siting of high voltage transmission lines. In the final chapter, the environmental effects of electricity generated with fossil fuel are elaborated.

The shortcomings of the book that are worth noting are a few inaccurate uses of terms and definitions and an occasional lack of balance in the selection and presentation of key issues in utility planning for the 1990s.

Although the author carefully describes the benefits from DSM in terms of load shaping and demand reduction, he fails to explain clearly why the key motivation for DSM is to be found in the economics of the power industry: electricity conservation is cost-effective relative to new capacity investment. This is often ignored because, while conservation investments may give higher returns to society, consumers tend to under-invest in it for several reasons. Low electricity prices do not, for example, reflect the true cost of new plants; consumers face capital constraints and they lack information. For these kinds of reasons, the electricity market fails to yield the socially optimal demand- and supply-side investment mix and utilities and utility commissions throughout North America pursue DSM to correct this failure. A quote on page 70 notes that $582 million of the $717 million DSM expenditures by US utilities in 1987 were directed to conservation, as opposed to load management. Yet the economic reasons for this are not adequately explained. Important concepts such as conservation supply curves and least-cost planning are mentioned only in passing and certainly not given the elaboration they deserve.

Four interrelated questions, which are crucial for utility planning in the 1990s, need to be addressed:

(1) Why does a potential for cost-effective electricity conservation exist?

(2) What is the estimated magnitude of cost-effective electricity conservation?

(3) How much of this resource can we realistically hope to capture? and

(4) What would the reform of electricity rates, to better reflect long run electricity supply costs, imply for this objective?

These are not easy questions to answer. However, extensive recent research in the US and Europe provides at least enough information to sketch out general trends and potentials.

In the chapter on NUG there are a few statements and conclusions for which evidence is either lacking or tangential at best. For example, the trend from the 1920s to 1970s to build larger plants is the only evidence presented for the existence of economies of scale. Then it is claimed that rising electricity prices in the 1970s suggest the reversal of these scale economies. The only reliable indicator of economies of scale is the unit cost of production and considerable recent research in the US suggests that one should be wary of conventional wisdom. Data for Canada should be relatively easy to collect and analyze. Recent work (not yet published) suggests, for example, that BC Hydro's large hydraulic projects of the 1960s produced electricity at a higher cost than the province's smaller hydro projects of the 1940s and 1950s. This and other work casts suspicion on unsubstantiated assumptions about economies of scale.

The chapter entitled 'Electricity and the Environment,' could be called 'Fossil Fuel Generated Electricity and the Environment,' since 60 of its 61 pages are devoted to that energy source. This imbalance is partly justified, given current concerns about acid rain and greenhouse gas emissions, and the analysis is thorough and enlightening. However, hydro and nuclear capacity provided 69.4% of electricity generation in 1988 and MacRae expects them to account for 68% of the new capacity required to meet the base scenario demand growth. These two sources of energy are also associated with substantial environmental risks and impacts. Indeed, it is not inconceivable that the rising tide of environmental awareness will lead the Canadian public to follow the path broken by Sweden and several jurisdictions in the US, where nuclear or large hydro developments are politically unacceptable. It would be helpful to let the reader know why this might happen.

The chapter on the environment provides the only instance in which the book loses its objective tone. It responds defensively to the suggestion that Canadian policy should limit additional development of coal generated electricity. The author argues (p.236) that such a "politically inspired policy is seriously out of step with the scientific and technical understanding of cause and effect," and that "the electric power industry has seemingly been slated as the target of choice."

A related suggestion, in the conclusion (p.259), is that, "we may simply have to adjust to living in a warmer world." Few of the studies that assess the process of global warming over the next century predict that the trend will stop at some cosy equilibrium, especially if we continue over this period to increase the concentration of greenhouse gases in the atmosphere.

Finally, while it is carefully noted that the three demand growth scenarios are not forecasts, one nonetheless receives the impression that they are intended to represent probable futures. These three scenarios under-represent the broad range of electricity futures that Canadians could legitimately contemplate. A future, that many would argue is also highly probable, is one in which maximal emphasis is placed on environmentally benign approaches to providing the services required of electricity. This would involve a concerted effort to: (1) foster all cost-effective electricity conservation by regulatory and fiscal incentives, (2) increase the efficiency of electricity generation from fossil fuels via increased cogeneration and advanced fossil fuel technologies, and (3) subsidize those electricity generation technologies with promising economic potential and lesser environmental effects (hydro, concentrated sunlight, biomass, wind, photovoltaics). One might even argue that such a strategy would be cost-effective relative to the scenarios tested in this book, especially if all environmental costs could be adequately incorporated.

This book is a timely and important reference for anyone wishing to update themselves on the fast-changing Canadian electric utility industry. The extensive references are comprehensive and

current. There is a useful glossary and a companion volume contains supplementary appendices on: (1) the history of the electric utility industry in each Canadian province, (2) detailed analyses of future capacity potential in each province, (3) a summary of recent US policies and experiences, and (4) a description of the method and detailed results of the ELGEM model.

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Towards a Commercial Future: Ethanol and Methanol as Alternative Transportation Fuels

by MICHELLE HEATH
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This book provides a valuable review of an interesting, recent attempt to introduce a new fuel to the Canadian gasoline market.

Use of oxygenates (i.e., alcohols or ethers) as gasoline extenders and octane enhancers has attracted considerable attention in the past decade. On 15 October 1985, the Standing Committee on National Resources and Public Works began a feasibility study on the production and distribution of gasoline blended with octane enhancers. Following a series of public meetings, the Committee made the following recommendations in its May 1986 report: the use of methanol and ethanol as blending agents should be encouraged; the Canadian government should increase support for research, development and demonstrations required to introduce alcohol-gasoline blends on a broad base; and, in cooperation with provincial governments and industry, the federal government should establish guidelines and standards for alcohol-gasoline blends.

Under its Western Economic Development Initiative, the Government of Canada has, since 1986, provided financial support to specific ethanol plants. It has also supported alcohol-fuel research and development and the development of fuel standards. One wonders, then, why the use of alcohol as a fuel remains limited. There are a number of reasons. As demonstrated in CERI's report, alcohol-fuel use is currently financially unattractive. In addition, certain benefits associated with oxygenated gasolines have not been taken into account and there is opposition from refiners and car manufacturers.

The blending of oxygenates into all or some Canadian gasoline would have a number of positive effects in the areas of environment, agricultural and regional development and energy policy. First, there are substantial environmental benefits to be gained from the use of oxygenated gasolines and neat alcohol if the volatility of these fuels is controlled. Secondly, ethanol production would provide increased demand for low quality, difficult-to-sell grain, thus stimulating a farm economy that has been suffering from surplus production and low prices in recent years. Regionally, diversification of local economies and increased employment would result from the building of oxygenate plants, especially ethanol plants in the western provinces.

Alcohol-fuel use would also have significant positive effects on the energy balance. The use of oxygenates could partially replace octane loss due to lead phase-out and help diversify the transportation energy mix. Addition of oxygenates to all Canadian gasolines would result in oil displacement ranging from 25,000-50,000 barrels per day. The blending of ethanol or methanol in today's gasoline could help develop a future market for these alcohols as fuels in their own right. The key steps required would be partial development of the infrastructure needed to deliver fuel alcohols, including bulk pipeline shipment of alcohols and familiarization of fuel marketers, vehicle manufacturers and the public with the production and use of fuels containing these alcohols.

Chapters 1 and 2 of Heath's book provide an overview of technical and commercial issues associated with the use of oxygenated gasoline that includes MTBE (methyl tertiary butyl ether), the oxygenate preferred by the oil industry. Chapter

3 presents a comprehensive description of ethanol production, use and distribution and provides a financial assessment of the cost of producing and using ethanol. Some of the numbers used in the analysis may be questionable but, overall, the conclusions are valid.

Chapter 4 provides a thorough analysis of methanol and addresses the MTBE issue. MTBE, an ether made of methanol and isobutylene, is already being used by most refiners in Canada. Development of an MTBE industry looks promising. This chapter also raises the question of use of ETBE (ethyl tertiary butyl ether), an ether made of ethanol and isobutylene. ETBE could represent a longer term alternative blending fuel if methanol, used in MTBE production or as an alternative to diesel, becomes significantly more expensive. Demand for methanol is expected to increase rapidly due to environmental pressures in the US, perhaps leading to significantly higher prices. Moreover, if grain prices remain depressed or if ethanol production technology improves significantly ETBE may become a viable alternative to MTBE. Due to the similarity between production processes, producers could switch between MTBE and ETBE production whenever ethanol prices compare favourably with methanol.

The book concludes with several good reasons for initiating a transition in the immediate future towards ethanol or methanol as octane enhancers or gasoline extenders. Among these are uncertainties related to future sources and prices of energy, environmental concerns, the need for agricultural diversification projects due to unstable grain prices and declining diesel fuel quality. It is concluded that lower oil prices have once again masked the need for Canadians to have alternative fuel sources available to turn to when price shocks push oil and oil product prices to high levels. These uncertain parameters in the market environment make private sector investment in the development of new energy sources such as ethanol appear uneconomical in the short term, but the long-term benefits of octane enhancement, fuel security and cleaner air should be given serious consideration. Chapter 5 also reviews the rationale for determining whether ethanol and methanol are, or can be, plausible fuel substitutes in Canada and, if so, what effects this may have on the stakeholders in the transportation energy sector.

This book is an excellent attempt to deal with a complex issue, providing the reader with a good overview of all the problems related to the introduction (of production and use) of oxygenated gasolines in the Canadian market.

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