

Shortcomings of current environmental impact assessments
of large-scale hydroelectric projects

Presentation to the Lower Churchill Hydroelectric Generation Project
– Joint Review Panel

by

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I write to you as a retired scientist who spent much of his three-decade-long career with a federal natural-resource department doing environmental impact assessments (eias), reviewing Environmental Impact Statements (EISs), and establishing biomonitoring programs for various environmental disturbances. For example, I was part of a research team studying potential environmental effects of the original Mackenzie Valley Pipeline proposed in the 1970s (cf. Berger Commission). I was also part of a research team studying the environmental and social effects of the Churchill (northern Manitoba)–Nelson River diversion and flooding of the Southern Indian Lake, a Manitoba Hydro project, in the 1980s. More recently, I was part of the research team that developed a biomonitoring program using aquatic invertebrates for the Fraser River in British Columbia.

During the course of my career, I have also been involved in reviews of EISs of other hydro developments, mines, pulp and paper mills, and other industrial developments.

I contend that eia in Canada has not progressed much in the past three to four decades. It is usually a rigidly defined, bureaucratic process that produces astonishing amounts of descriptive work that does little to predict effects of a development. Instead, a mainly experimental approach should be used to frame predictions, and these predictions need to be followed up in post-project monitoring to judge their accuracy. The eia process improves in this iterative way.

Neither has the eia process been really successful in dealing with cumulative environmental effects of development of entire river systems. These effects are now noticeable at global scales, but are mainly the purview of research studies.

I will use the remainder of this report to examine these two deficiencies in most eias of hydro development.

Post-project monitoring

A study design involving a predevelopment predictive phase¹ and a postdevelopment monitoring phase is part of an optimal framework for assessing hydroelectric developments (Rosenberg et al. 1987). Moreover, “Predevelopment predictions alone are not adequate to protect the habitat or the resource users. Such predictions should be recognized as planning aids that require testing in the postdevelopment period to establish their veracity and complete the environmental assessment process” (Hecky et al. 1984, p. 731).

The lack of an adequate post-project monitoring program does not allow predevelopment predictions to be tested, and as a result, eia does not improve². The power of a research-based, post-project monitoring program was demonstrated by Hecky et al. (1984) in their study of the environmental effects of the flooding of Southern Indian Lake in northern Manitoba as part of the Churchill–Nelson River diversion and hydro development in the lower Nelson River. Dramatic, unpredicted effects, especially at higher trophic levels in the Lake, were identified. Yet, this phase of eia is often neglected: opponents of development have “lost the battle” and move on to other projects, the proponent wants to operate the development at minimal cost, and government agencies responsible for monitoring fail to keep the proponent’s feet to the fire.

¹ The predevelopment phase of eia should always have a go/no go option (Rosenberg et al. 1981).

² Post-project monitoring is also useful to establish the need for environmental mitigation and compensation for resource users, providing the predevelopment phase is properly done.

My perusal of Nalcor Energy's Lower Churchill River EIS revealed only vague promises of post-project monitoring. In this regard, a single benthic invertebrate study composed of two surveys was done in 1998. It is difficult to imagine the possible use of such limited, descriptive data in an eia, unless these data formed the basis of a biomonitoring program. Benthic invertebrates are frequently used in such programs (Rosenberg and Resh 1993), and powerful biomonitoring methods are readily available (e.g., Reynoldson et al. 1997, Rosenberg et al. 1999). It is a pity that 13 years in which to develop reference conditions for monitoring possible future changes in habitat and water quality have been wasted. If the project is approved, a panel of monitoring experts, drawn from across Canada, should be convened to help Nalcor Energy establish a scientifically defensible monitoring program one module of which would be devoted to aquatic invertebrates. The program should be continued for several years of "no effects" before monitoring is reduced or eliminated.

Cumulative effects

Cumulative effects over large geographic scales are not usually part of EISs of hydro development for at least two reasons: 1) the terms of reference for most such EISs are too narrowly drawn, and 2) jurisdictional wrangles (i.e., offshore areas are not the purview of provincial governments and the federal government is not terribly interested in studying cumulative, offshore effects). Yet, large-scale

hydro development is having global-scale environmental effects (Rosenberg et al. 2000). Every major river development adds to the global impacts.

In north-temperate rivers, the root of the problem is alteration of the normal hydrograph (Rosenberg et al. 1997). Downstream, offshore areas are cradles of biological productivity because of the delivery of nutrients by freshwater runoff and because freshwater runoff to the ocean causes mixing and entrainment of nutrient-rich ocean water into the surface layer (Neu 1982). Hydro development in north-temperate rivers characteristically traps high spring water flows in reservoirs and releases higher-than-normal flows in winter when electrical power generation is needed (Rosenberg et al. 1997). Thus, normal flows are attenuated in spring and enhanced in winter. In an ecological sense, runoff is being transferred from the biologically active part of the year to the biologically inactive part of the year—it is like watering your garden in the winter (Neu 1982).

Worldwide river development has seriously disrupted normal water flows. An estimated 10,000 km³ of water have been impounded in reservoirs (Rosenberg et al. 2000). In addition, chains of reservoirs built along river systems profoundly alter normal sediment and nutrient transport and downstream deposition, with resultant negative ecological effects (Rosenberg et al. 1997, Vörösmarty and Sahagian 2000, Ittekkot et al. 2000). Plants and animals in various parts of the world have also been seriously, negatively affected by development of entire river systems to manipulate water (Nilsson and Berggren 2000, Dudgeon 2000,

Pringle et al. 2000). Careful research has revealed these warning signs, if we want to heed them. Acting after extirpation of a species is too late; we can do better.

Nalcor Energy's EIS of the Lower Churchill River should include the extant development at Churchill Falls as well as the two further developments proposed because it is total river development that is manifested in downstream, offshore areas. Moreover, should the project be approved, the downstream, offshore effects of total river development and altered hydrographic conditions should be examined by an appropriate, scientifically rigorous, research program.

Ecological alterations will almost certainly be found.

Conclusion

Proponents of hydro development often like to claim that hydro is a "clean" energy source, that water flowing to the ocean unimpeded is "wasted", and that local residents (in Canada, mainly aboriginal peoples) will benefit from the development. Rosenberg et al. (1995) have disputed these claims.

Nalcor Energy's EIS of Lower Churchill River hydro development is typical of many I have seen over the years. Claims, in the Executive Summary, of no major effects that cannot be handled and of creating better fish habitat than existed before are examples of hubris. The exhaustive study of the flooding of

Southern Indian Lake has taught us about unintended consequences, and it is impertinent to believe that human intervention can do a better job in shaping the environment than thousands of years of natural ecosystem evolution. More attention should be paid to the substantive issues raised above, and less to promoting the project. Given our experience with eia over the last three to four decades, we should expect more of a contemporary EIS.

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