

Engineering ethics and sustainable development

BY LEON WASSER, P.ENG.

The recent film *The Day After Tomorrow* portrays, as only the special effects masters of Hollywood can, how severely one environmental problem—the generation of greenhouse gases—can impact the climate of our entire planet.

While the film is obviously science fiction, it serves a useful social function beyond its entertainment benefit, by helping its audience appreciate just how seriously people need to take environmental issues. While all members of society should appreciate environmental issues, professional engineers, due to our leadership role in the creation and application of all forms of technology, have a special duty to be aware of, and responsive to, local and global environmental issues. This increasingly important obligation is just one more aspect of our engineering ethics responsibility.

Global challenge

In April 1963, Dr. Aurelio Peccei, the visionary Italian industrialist, convened a meeting of 30 prominent international experts from a variety of professional backgrounds at Rome's Accademia dei Lincei. This august group explored a number of economic, social and environmental trends using an innovative multi-disciplinary approach, and employing new computer-modeling techniques. This newly created “Club of Rome” then extrapolated these trends to identify and highlight the evolution of long-term global environmental impact patterns.

What they found was that finite non-renewable resources were being consumed at exponentially escalating rates and that many elements of the natural environment were being severely polluted and degraded. They published their disturbing conclusions in the groundbreaking book *Limits to Growth*, which quickly became an international best seller. The fundamental question raised by this book was whether the patterns of development we had employed in the industrial west were viable over the long term.



Meeting the challenges of the environment and sustainable development presents a special opportunity for the profession. With an enhanced quality of life as a motivator, engineers stand ready to put technology to perhaps its greatest test.

Limits to Growth, and other books, including Rachel Carson's 1962 book *Silent Spring*, found a receptive audience in the idealistic days of the late 1960s, which marked the dawn of the global environmental movement. Both scholars and the public, especially the vast baby boom generation, gave “environmentalism” instant attention, as a whole generation became attuned to concerns about the health of planet Earth.

The environmental movement grew rapidly through the energy of highly motivated and educated activists. The motto of the environmentalists was to “think globally and act locally.” The new ecologists were quick to explore a variety of newly identified environmental problems and, even more importantly for our profession, they began to take a more critical approach to both the benefits and costs of rapid economic, urban and industrial development.

This was a serious development for the field of engineering, especially as we are collectively the creators and implementers of technology.

Environment goes mainstream

Environmentalism was now well on the road to becoming mainstream. Society was increasingly challenging preconceived notions about the unmitigated benefits of unregulated economic growth and the acceptability of newly identified pollutants, large-scale resource depletion and other ecological factors. In particular, the exponential growth of urban development, suburban sprawl and related issues began to come under the microscope, especially as the activities of grassroots environmentalists began to be fortified by the new academic discipline of environmental studies.

In cities across the world, and especially in the industrialized west, we began to implement systemic change. We began to systematically monitor, report and remediate many forms of water and air pollution. We started to “reduce, recycle and reuse” some of our solid-waste materials. We became more conscious of our energy-consumption patterns. The reality was that though progress was made in each of these areas, advances were not uniform. Periods of achievement were

interspersed with phases of environmental regression as consumer demand and economic conditions changed. In addition, the lack of common environmental standards and jurisdictional fragmentation made uniform and consistent progress difficult, if not impossible. As such, environmental standards continued to be non-uniform. It was increasingly clear that the strategy of thinking globally and acting locally had its limitations.

Thankfully, a more global response was on its way. In 1987, the United Nations World Commission on Environment and Development, also known as the Brundtland Commission, published a monumental report on the deteriorating state of the global environment. More importantly, however, the commission recommended strategies to promote necessary economic development while limiting the negative impact of this growth.

This major international report dramatically enhanced the profile of the environmental movement. The Brundtland Commission coined the new term “sustainable development,” which it defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” The next major milestone in the development of the international movement was the groundbreaking May 1992 United Nations’ Framework Convention on Climate Change, also known as the Earth Summit. In December 1997, world leaders met in Kyoto, Japan, to discuss how best to act upon the promises they had made at the Earth Summit.

The famous “Kyoto Protocol,” which emerged from this meeting, was the first attempt ever to address a specific global environmental threat by committing some nations to specific remedial actions. The focus of the Kyoto Protocol is the need to reduce the global production of “greenhouse gas” emissions that are melting our polar caps and were cited as a factor in other environmental problems. This, of course, was the problem highlighted

in *The Day After Tomorrow* film. This agreement binds the accord’s signatories to reduce greenhouse gas emissions to a minimum level of 5 per cent lower than their 1990 levels. Actual reduction methods are to be selected by the individual countries. For perhaps the first time ever, the international community was responding on a global scale to an environmental challenge.

Sustainability and the P.Eng.

It would not be an oversimplification to suggest that many aspects of engineering practice can have a serious impact on our environment, especially if we do not apply sufficient care and consideration to our work. As a result, professional engineers, more than any other segment of society, need to have a deep understanding and appreciation of sustainable development principles. We are the masters of technology, the profession granted the knowledge and authority to create the designs and implement the projects that can and do change our physical environment. Consequently, as our understanding of the environment increases, the demands on our engineering professionals will continue to grow.

We have been confronted over the years by new and unanticipated negative consequences of our designs and projects. Although we continue to uphold high professional standards, there have been occasions where unintended or unanticipated problems have resulted. New issues as varied as the depletion of the ozone layer, the problem of urban solid waste, and the need to develop new energy options constitute new challenges for engineers. It should also be kept in mind that many problems resulting from a variety of technologies were not on anyone’s radar screen at the time of the original designs. As but one small example, the designers of the early internal combustion engine could not have begun to anticipate that their inventions could have such a serious impact on our atmosphere and global climate.

Although it must be understood that none of us is a prophet, professional engineers need to anticipate, to the best of our ability, the full range of impacts of our designs and creations.

In practical terms, what this implies is the continual need to keep ourselves informed about all aspects of our areas of practice that may negatively affect the environment. We need to increase our awareness of the ever-evolving challenges and issues that may emerge from time to time. The formal term for this is “environmental scanning”—the active search for new issues of concern for your professional practice. Most importantly, we need to stay abreast of new discoveries and findings, government policy changes, regulatory changes and new environmental sensitivities, as well as business and consumer trends. From a practical point of view, this means lifelong learning is not an option for engineers, it is a vital part of our professional practice.

In addition, aside from creating and applying appropriate technologies, we need to continually improve our communication skills, while simultaneously honing our technical skills. We need to be able to better explain how a specific technology is to be employed, why it is the most appropriate solution for a particular application, and how any environmental consequences of the technology have been considered and addressed. We not only need to be masters of technology but, increasingly, we need to be the proponents of appropriate technologies. In addition, we need to be capable of effectively communicating the merits of each available alternative technology.

As but a few examples, professional engineers must explain the competing merits of wind energy, geothermal energy and cogeneration development. Similarly, our professionals may be called upon to explain the benefits of competing technologies in the realm of urban transportation, waste management and urban development. This, however,

is premised on having a professional cadre that is both aware of, and sensitive to, available technological options and has a full appreciation of environmental issues and the principles of sustainable development.

Canadian response

Canada has been at the forefront of the environmental movement from its earliest days. Perhaps this is a reflection of our national gratitude for living in such a vast and beautiful land. In fact, one of the first academic units devoted to the new field of environmentalism was York University's Faculty of Environmental Studies, founded in 1968 (www.yorku.ca/fes/index.asp). Many grassroots environmental organizations started in Canada, including the now global activist group Greenpeace, which was founded in Vancouver in 1971 (www.greenpeace.ca/e/).

Canada has spawned numerous environment-friendly initiatives, including the Sustainable Toronto Project (www.utoronto.ca/envstudy/sustainable_toronto/project.htm) and the International

in considerable work for professional engineers in developing and implementing the changes that will move us closer to our greenhouse gas target.

The Ontario Ministry of Public Infrastructure Renewal discussion paper, *Places to Grow*, is a major government initiative that will help guide urban development in the Greater Golden Horseshoe region of central Ontario in a manner consistent with our Kyoto commitments. This discussion paper reflects many aspects of sustainable development thinking by proposing a managed strategy that employs many sustainable development concepts, including "managing economic and population growth in Ontario in a way that promotes vibrant communities, a strong economy, and enhanced environmental sustainability" (www.pir.gov.on.ca).

In particular, the policy paper advocates a number of principles that further these objectives. Among them are the promotion of compact urban design, urban intensification, protection of prime agricultural land, transit

the engineering profession develops its opportunity for the application of sustainable development principles. Consequently, the need for professional engineers who are sensitive to the demands of sustainable development will only grow over time. Moreover, each new challenge will constitute a new opportunity for a bright, creative and resourceful engineer.

The fundamental obligation of all members of our profession is that we uphold our engineering principles throughout our professional lives. In particular, we need to give full consideration and attention to the safety of all we serve, including Mother Earth herself. As the masters of technology in our modern world, professional engineers have a special responsibility to consider the full range of alternative technologies available for us to employ. We especially need to become more familiar with the potential negative environmental impacts of the technologies we work with. To guide us, we have the benefit of a wealth of environmental resources, as well as a new guiding principle, "sustainable development."

The challenges stemming from society's new demands constitute new opportunities for professional engineers to develop the solutions required. Our profession collectively possesses the skills and expertise to resolve all of the challenges of an increasingly demanding array of issues. Contributing to the resolution of global environmental challenges should be regarded as fulfilment of the highest standards of engineering ethics. Those engineers who rise to these new challenges are fully deserving of the stature and success for helping to make our communities and, ultimately, our planet, better places to live. ❖

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Institute for Sustainable Development based in Winnipeg (www.iisd.org/). Perhaps more important for engineers, Canada was one of the first countries to ratify the Kyoto Protocol when it submitted its agreement on December 12, 1992. Canada's commitment under the protocol is to reduce its greenhouse gas emissions to 6 per cent below 1990 levels by 2012. This would represent a 26 per cent reduction from projected 2012 levels. Although we have not finalized our Kyoto Protocol national plan, a firm commitment to the goals will result

supportive land use, encouragement of "Brownfield re-development" over "greenfield development," and preservation of natural heritage features such as the Oak Ridges Moraine and Niagara Escarpment.

The challenge for the members of our profession will be to implement the concepts and strategies outlined in these and other government initiatives into actual projects. Once again, engineers are being challenged to find new approaches and solutions to society's challenges as every field within