BY JOHN VELLONE

The notion of sustainability is often bound up with environmental issues. Yet there are other design, innovation and technology-management elements of sustainability that are beginning to inform an engineer's outlook.

In 2002, politicians, business leaders, scientists and engineers converged at the World Summit of Sustainable Development (WSSD) in the beautiful South African town of Johannesburg. Once home to Nelson Mandela and Mahatma Ghandi, Johannesburg and the summit produced yet another "revolutionary" concept–that sustainable development must be implemented with concrete actions and measurable results. "It is important that everyone, from policy makers to the general public, understand the roles that science and technology have to play in achieving environmental protection and human development" (WSSD, Agenda 31, Chapter 21). For the first time, the world looked to engineers to guide sustainable development policy and implement real technical solutions.

What are some of the general understandings of sustainability that might inform an engineer's outlook? In a commonly quoted definition, Irving Mintzer, senior researcher at the Center for Global Change, states, "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." It is about striking a balance among the economic, social and ecological impacts of development.

Sustainable practices are already alluded to in standard engineering codes of ethics, which hold a commitment to public welfare as paramount; however, sustainable development is a more practical concept. Sustainability strives to demystify the vague wording of public welfare by applying measures to the environmental and human impacts of decisions. Once you have measurable outcomes, you can start applying rigorous analysis to the process to ensure, first, that the measure is valid and reliable and, second, that your decision results in the outcomes you desire.

From an engineering point of view, sustainability is about closing the loops in process-control diagrams. Instead of drawing a box around a system of interest (whether it is a manufacturing process, a company or a country) and identifying the inputs and outputs, sustainability is about recognizing that unlimited input supplies (of resources, energy, people, etc.) and unlimited output dumps (garbage dumps, clean water supplies, etc.) do not exist.

Sustainable design, simply put, asks engineers to draw the box larger than ever before, to close the loops from outputs back to inputs and apply rigorous analysis to each new stage of the cycle.

Impact on engineering

Sustainability is having an unquestionable impact on the way engineers do their work. Traditional engineering areas have become dominated by a focus on sustainable development. Urban private and public transportation, and water, wastewater, solid-waste and utility management, are just a few areas where sustainable design has taken root and engineers are making a great difference. Engineering programs at universities across Canada are even starting to implement sustainable design practices into their curricula. The University of Calgary rolled out a first-year design project with a sustainable development focus just last September. Even the technology sector is being forced to deal with sustainability as it works to handle questions of how old computers, often filled with circuits laden with dangerous heavy metals, will be disposed of. The province of Alberta is soon to roll out the first e-recycling program in Canada to recycle some of the 190,000 televisions and 90,000 desktop computers that will be disposed of in the province this year.

Paul Hawke, author of *Natural Capital*, equates the shift towards sustainable development today to the shift towards mass-producing manufacturing technologies during the Industrial Revolution. Canadian engineers can no less ignore the requirements of sustainable design today than they could the forces of the Industrial Revolution 150 years ago.

Sustainable engineering solutions

The Kyoto Protocol, commonly referred to as an innovation agenda, is designed to drive new sustainable technologies so Canada can reach our emission reduction targets. Engineers will be at the forefront developing and testing those new technologies. One just has to browse through the strategies list of more than 200 Canadian engineering companies

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that offer technologies, products and services to address the climate change challenges faced by every sector of the economy. Even before the Walkerton water crisis, engineers have been on the front line, analyzing, testing and building state-of-the-art water supply and wastewater management systems.

But sustainable development isn't just a North American concept. It is the guiding principle of development in some of the poorest countries in the world. Just ask Mike Quinn, a University of British Columbia mechanical engineering graduate, who is currently volunteering with Engineers Without Borders (EWB) Canada. With the support of a grant from the Canadian International Development Agency (CIDA), Quinn is working with a local Ghanaian organization to promote the multi-function platform (MFP) in rural Ghana. Most people wouldn't associate the 10hp diesel engine mounted on a steel chassis as a sustainable technology. But sustainability isn't just about environmental impact, it's about striking a balance with social and economic impact as well.

The sustainability concept that the design box needs to be larger than the problem at hand is still the same–it is just the contents of the box that is different. In the case of rural Ghana, this means not just considering the immediate poverty, but also considering the root social and environmental causes of poverty and that technology (properly implemented) can address these issues and provide long-term benefits to the community.

The MFP can power multiple machines, including agricultural-processing tools like corn or rice mills, or an alternator that can, in turn, recharge batteries, power a water pump, light up to 200 bulbs, or power hand tools like saws and welders. In short, the MFP is a platform that provides the energy necessary to spur small-scale social and economic development. Quinn notes: "The MFP is much more than just an energy tool, as it is chiefly designed to ease the burden on rural women through the mechanization of tedious agricultural tasks." The results are nothing short of outstanding. Men benefit from the use of electricity for hand tools and creation of jobs as operators and repair artisans, and the entire community benefits from an injection of light. Perhaps most importantly, women have more time that can be focused on education for both themselves and their children.

The policy gap

It is not only on the ground overseas and in Canada where engineers are making inroads in issues of sustainability. At international sustainability forums, engineers have taken centre stage–from the World Summit on Sustainable Development to the UN Commission on the Millennium Development Goals. However, public policy makers in Canada have yet to recognize engineers for their unique role in driving sustainable development. Given the importance of engineering in the implementation and measurement of sustainable development, Canadian public policy on sustainable development relies remarkably little on engineering input to policy decisions. If Dalton McGuinty or Paul Martin overlooked the Canadian Medical Association when drafting important healthcare policy, the professionals and the public would be up in arms. The principle is simple. You can't create good healthcare policy without feedback from the medical profession, the practitioners on the front lines.

What hasn't yet been recognized is that engineering is the sustainability profession.

To learn more about Engineers Without Borders, or the MFP project, visit www.ewb.ca.

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Mike Quinn (centre, left photo), a mechanical engineering graduate from British Columbia, is working with a local organization to promote use of the multi-function platform (MFP) in rural Ghana. The MFP supports the notion of sustainability by providing the energy necessary to spur small-scale social and economic development.