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Editorial

In a previous issue this editorial focused on the long-term energy crisis that is facing all nations, big and small, whether in the developed world or trapped in poverty or internal conflict. The crisis is real, and surely will descend on all countries within the next decade or so. Without doubt it is ultimately the supply of electricity that drives a nation's as well as the global economy. Electricity generation thus becomes not only critical to the survival of a nation's economy and way of living, but also key to the eradication of poverty, and providing the essential qualities of life for about three quarters of the world population. We should also not forget that energy solutions are multi-disciplinary, and have a great impact on civil engineering and the construction industry just as much as on mechanical and electrical engineering. Further, by the very nature of the technology of power generation, the key players in the debate and in the development of an integrated long-term vision and energy strategy have to be engineers.

In the discussion of new energy resources, we must not forget that energy consumption—not merely energy supply—is also critical, and lies at the very heart of the problem. How can we make society more energy conscious and energy efficient? How can we improve energy efficiency at home, at work and in our transport systems—the main sources of energy consumption in our day to day life? Currently some 25% of the world population consume about 75% of the world's material and energy resources. This should not altogether come as a surprise because many of the gadgets and devices that we use in every day life not only consume a lot of energy but also waste a lot of energy—and they are also designed by engineers! We need to concentrate as much on reduction of energy consumption as on the creation of new energy resources.

This scenario inevitably brings us to the debate as to how we can increase the contribution of renewable power sources. There is no doubt that the renewable sector is a key player in the energy debate, and that civil engineers and the construction industry will have a significant role to play in its development and implementation. The challenge is not only to make all renewable power supply reliable and secure but also to remove the misconception that all renewable power sources provide only intermittent and unpredicted supply. The storage and distribution of renewable energy will also pose many technical challenges. We also have to accept that the provision of electricity from renewable sources is not going to be easy or cheap. There is also now enough evidence to confirm that a free market policy cannot and will not ensure an uninterrupted supply of oil, gas or electricity at reasonable and competitive prices. We need a central authority, and a new multi-disciplinary professional society to develop a planned and co-ordinated vision and strategy of investment and research to establish low carbon dioxide producing energy technologies.

How does this all impinge on civil engineering and the construction industry? It is clear that the challenges of the 21st century are totally different to those faced in the 20th century. To begin with, we need to completely rethink and overhaul the education and training of civil engineers to create a new breed of engineers totally committed to sustainable development. The principles of engineering will never change but the problems and the difficulties that nations face are such that there are no unique or simple solutions to embrace all economies, cultures, environments and climatic conditions. We need to reassess and redefine the purposes of structural design—should design be focused on durable and a guaranteed service life, and in the context of the discussion on energy, should all structures be not merely energy and water-efficient, but also self-sufficient in energy and water? Should all building design incorporate strategies for health monitoring (as appropriate), demolition, reuse and recycling? Should we adopt a "HOLISTIC" approach to design which will integrate material characteristics and structural performance under real mechanical and environmental loads? The challenges are enormous, wide and varied, but civil engineering and the construction industry cannot merely close their eyes and pretend that everything will be alright in the end.

There are two important steps that the civil engineering community can adopt immediately to ensure sustainability in construction. The first is to adopt a "HOLISTIC" approach in the selection of materials and

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in structural design. The second is to ensure that all building structures and housing complexes are designed to be "GREEN" in the sense that they are self-sufficient in both energy and water consumption. That these concepts can be readily achieved in practice can be illustrated by many examples. The San Francisco Public Utilities Commission, for example, is planning many solar panel projects to enhance the generating capacity of the existing city's electricity grid. It is reported that the city's first solar project which consisted of solar panels with a capacity of 675 kW was installed on the rooftop of the Moscone Centre. In general terms, it is assumed that 1 MW of power can generate sufficient electricity for 1000 houses. Currently the Commission is planning to install solar panels on publicly owned structures to add 10 MW of generating capacity within the city. The long-term goal is to generate an additional increase of about 40 MW over the next few years.

The total commitment to the principles of sustainable development is also illustrated by the 27-storey apartment building recently completed in New York City's Battery Park. It is reported that the building is constructed largely of recycled and locally manufactured materials; the piles on which the structure is supported are made from pipes originally used in oil drilling. The building is to be equipped with photovoltaic cells, and there is an independent wastewater system under its basement. It is planned that some 25,000 gal or 95 $m^3$of the building's sewage will be treated each day to be pumped into its toilets and cooling tower. Even if "green" buildings of this kind are slightly more expensive to design, construct and maintain in good order, the long-term environmental benefits in terms of reducing energy and potable water demand will be far more influential in reducing global warming and in creating a sustainable society.