
Editorial

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Before 2050, our global civilisation faces one of its greatest challenges – to match our demands to the limited resources of the planet. Business as usual will not be enough to ensure the ongoing viability of our community. Radical changes in mindsets, behaviour and whole systems are needed to avoid the collapse of our social structure, our economic structure and our environment.

For many, 2050 is a long way off, but the changes that we need to make before then are fundamental and urgent. It requires leadership from scientists, engineers, and designers to create a future that serves the needs of the people, while protecting our planet. We need change that sweeps through our economic, education and infrastructure systems and engages and motivates the individuals that make up our society.

In December 2010, the Fourth International Conference on Sustainability Engineering and Science was held in Auckland, New Zealand. This conference is aimed at contributing to knowledge development, identifying good engineering practice, and creating national and international networks for collaboration and research in the field of sustainability engineering and science. The conference held in December 2010 showcased current successes, shared challenges and highlighted the directions and connections required to transition to sustainability. The aims of this conference were:

- to establish the science of sustainability and its application to business, government and society
- to present the latest in sustainable research and development
- to develop design and methodology protocols
- to provide an international forum for discussion on engineering and science research into achieving sustainability
- to determine mechanisms for ongoing discussion, collaboration and dissemination of such research for the future.

Among the delegates there was a strong focus on moving towards sustainability and very little discussion regarding the meaning of sustainability. However, it was clear that the complex nature of the systems involved meant that simple answers or directions were not going to be found. With the downturn in the economy and the resulting responses from

government and industry, there was also some concern that, rather than rethinking current economic strategies and identifying new directions, old models were being more firmly embedded. Consequently, the gap between rich and poor is widening, there is the potential for increasing rates of environmental degradation, resource consumption and losses to social and educational programmes – in short, business as usual.

Regardless, it was notable that sustainability concepts and practices are now being embedded into strategies and plans for cities and companies around the world. New economic models are being developed, based on a stronger ethical stance and incorporating thermodynamic and ecological approaches. Ethical and sustainable investing is now common and seen as a way to show support for companies with a sustainability focus. Delegates discussed integration and transdisciplinarity, not necessarily new, but which are increasingly becoming the direction that companies and educational institutions see for the future.

As the presented papers indicated, significant research, development and application of sustainability to cities and urban areas has been undertaken. There is a stronger focus on city councils serving and engaging with the communities, rather than setting business-led agendas, with a focus on engineering and technical solutions. Transportation, in particular, was of concern due to increasing petroleum costs and likely decline in supply. Any lack of options in transportation would lead to lower adaptability under shortage scenarios and consequently, city planners needed to provide greater options. It was proposed that a shift of focus from fossil fuel-based vehicles to public transport and electrified rail was needed. Models for expansion of urban areas to accommodate increasing population in a sustainable and efficient fashion have also been developed. Lifecycle assessment of costs and environmental impact for buildings and infrastructure are being undertaken to enable cities to make better choices for developing the built environment.

Another focus of research was system limits. By developing a model of the water system for Waiheke Island, limits and risks to the system were identified and will provide a basis for more effective water management strategies. A total watershed management approach was proposed to provide a more sustainable future for water management. Ecological footprints for New Zealand have been calculated and presented to communities to enable them to make more informed lifestyle choices. Research on current and projected carbon emissions focused on using backcasting to identify options for emission reductions, such as better energy efficiency in buildings and passive cooling building designs. The use of urban form to better manage air quality standards was still another proposal, while waste management was identified as a major concern across Asian cities, which are now incorporating reducing, reuse and recycling models.

Limits to resources were determined as risk factors. The future of coal consumption in Australia shows that it will result in significant environmental impacts. Research into metals indicated that, while most are not in short supply, the environmental and economic cost of extraction will increase. Energy supplies and alternatives to fossil fuel, including biofuels and renewable energy options such as wind, solar, hydro and geothermal, were also proposed.

One major result from field trials for sustainable buildings and sustainable technologies is that user behaviour often dictated successful outcomes. Options to provide residents with data on energy and water use are being used in efforts to influence user behaviour. Community advocacy and innovative social market mechanisms were also being used to encourage more sustainable living. However, green and sustainable

buildings are becoming increasingly common, with improving designs and better understanding of the payback and perceptions of such buildings, including how such buildings can be incorporated into urban systems.

Incorporating sustainability into product design is becoming an increasing focus for companies. Models to assist companies in developing new products and services through system innovation using transdisciplinary workshops and taking advantage of radical, new technologies and user practices are being developed and implemented. Product-service systems, if properly designed and implemented, are proving to be more sustainable than product systems. New systems, such as Design for Biodiversity, were also proposed, which better reflected long term biodiversity goals. Lifecycle assessments are becoming increasingly common and there is greater awareness and demand to know where products and materials come from. Companies are now assessing their overall operation to identify sustainability and risk issues and develop strategies to shift towards more sustainable options for energy and water management.

On the practical engineering and science side, there is an increasing movement towards better water management, renewable energy and energy management, sustainable buildings, decentralised infrastructure, liveable cities and better urban transport models. New and more efficient technologies and materials are being developed. Infrastructure for electric vehicles is now starting to be developed, although the technology is still very immature.

In addition, increasing the focus on embedding sustainability into education at all levels was discussed. There was a sense of frustration at the slowness of the uptake of sustainability in some institutions, particularly at the tertiary level. Models were proposed to illustrate how sustainability could be embedded but it was also recognised that there were significant hurdles which would need to be overcome before they could be applied.

The transition towards sustainability is already underway. It is being driven by a strong, grass roots shift towards sustainable communities and healthy living, which is, in turn, driving local governments and companies. Future risks and limits are now being recognised and, rather than strict engineering or technical solutions, more human-based responses, recognising human behaviour, values and ethics, are being implemented. Companies which have future vision and listen to their stakeholders are now implementing new innovative processes to develop innovative product-service systems which are more sustainable.

This special issue presents the top papers from this conference and illustrates the quality and breadth of research being undertaken in the field of sustainability science. This research is being applied to the real world and is leading to new directions and new visions. While we still face significant risks to our future, global society is responding. The response is slow but strong and, even in the face of economic crises, still advancing. Even more important, communities are being engaged in the science and in the visions and being given voices which are being heard.

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