



# SUSTAINABILITY

*Engineering the Way Forward*



*The Institution of Professional Engineers New Zealand (IPENZ) is the lead national professional body representing the engineering profession in New Zealand. It has approximately 10,000 Members, including a cross-section from engineering students to practising engineers to senior Members in positions of responsibility in business.*

*IPENZ is non-aligned and seeks to contribute to the community in matters of national interest giving a learned view on important issues, independent of any commercial interest. As professional engineers, we have not only a deep concern over New Zealand's sustainability issues, but also a particular set of skills with which to analyse these issues and propose solutions.*

*This contribution has been prepared in association with the New Zealand Society for Sustainability Engineering and Science (NZSSES). NZSSES is a Technical Interest Group of IPENZ, established to contribute to knowledge development in the field of sustainability engineering and science research and whose members have particular expertise in this field. The Position Paper was further peer-reviewed by a wider grouping within the IPENZ Membership.*



# Introduction

The Brundtland definition of sustainability, “ensuring that the needs of the current generation are met without compromising the needs of future generations”, is widely accepted as a good basis for assessing progress towards sustainability.

New Zealand has committed to making progress towards sustainability at least as fast as other developed nations, and it has even been suggested that we should be the world leader. However, the *Environment New Zealand 2007* report shows that results have been mixed. Particular concerns are:

- The trend of increased use of many resources has created more resource pressure.
- The state of much of the environment has worsened, because the end products of resource use are having increasingly negative effects.
- Policy actions taken over the last decade have to date made little difference.

As the title indicates, *Environment New Zealand 2007* has an environmental focus, but sustainability has a wider societal perspective and involves a longer timeframe. To make major progress on many issues we must understand the reasons why policy interventions have not been as successful as hoped, and develop a new policy framework.

In this Position Paper, IPENZ sets out its views on the issues and how policy makers can respond in different ways than in the past.





# *The Challenges for Sustainable Policies*

The two most common policy approaches to improving sustainability are behaviour change – getting people and institutions to adopt sustainable approaches to using products and processes – and technology change – changing those products and processes. An example of behaviour change is an increased emphasis on renewable energy, and an example of technology change is the introduction of carbon capture and storage.

Technology change can achieve real and lasting results, but it normally requires spending significant amounts of research and development capital. The investment decision-making process is critical for determining the extent to which sustainability outcomes are realised. There are a range of reasons why capital decisions do not provide sustainable outcomes:

- The actual cost of performing a systems-based analysis to determine the most sustainable option is often substantial, and unless sustainability is an underlying driver there may be no motivation to do so.
- Defining system boundaries is difficult – something that appears sustainable in one context may have adverse effects of another kind, and when the boundaries are widened to encompass all important effects, the expense is greater.
- Transitioning to sustainable technology may in the short term require enhanced non-renewable resources to achieve success, and unless this is recognised it can act as a disincentive.

- The expertise and skills in sustainability techniques required to undertake a systems-based analysis are not readily available, and this creates a barrier to considering more sustainable options.
- Sustainable solutions normally require a longer-term perspective, higher initial capital outlay and longer payback periods, which may not be commercially acceptable.
- A sustainable solution, like any technology, may be superseded by new technology before it is paid back.
- The full cost of using finite resources, including externalities, is only just being recognised in investment analysis.
- The intended ownership of a capital asset may only be short term, which means long-term payback is not considered.

Nevertheless, there are both organisations and individuals who are taking positive steps towards sustainability and either deliberately or intrinsically overcoming these barriers. Some consumers are taking action by choosing products and services with “green credentials”. Some producers and those in the service industries have recognised the marketability of delivering sustainable products and services, and conducting their business in a sustainable manner.

However, to meet New Zealand’s international obligations and make tangible progress towards a sustainable future, concerted actions are required at all levels of society.

# *The Role of Policy*

Higher-level government interventions are necessary to realise national and international goals, and support the overall transition towards a sustainable society. An example of this is the introduction of an emissions trading scheme.

Policy actions fall into the following categories, listed in order of increasing level of economic intervention:

- Public education would provide appropriate information on and raise awareness of sustainability and the steps society can take.
- Consumers, households and businesses could be incentivised to make decisions for the longer term.
- Pricing mechanisms, which include externalities, could be introduced.
- Regulating activities and mandating minimum performance standards would withdraw technologies that demonstrate poor life cycle performance from the marketplace.

In addition, government can demonstrate leadership and act as a role model by taking a sustainable approach to the government's own activities. Examples include sustainable procurement policies and the Govt<sup>3</sup> initiative, which in turn create markets, or developing a skilled workforce within government, which can then move to the private sector. This contributes to lowering one of the barriers to sustainable outcomes.



# *The Characteristics of Sound Sustainability Policies*

Policy interventions designed to address sustainability need to have the following characteristics:

- The desired outcome needs to be clear and based on society's sustainability values.
- Interventions need to be prioritised by sector and activity according to where the best value is likely to be achieved. They should be focused on activities with the greatest environmental impact, and areas that have the greatest potential for environmental improvement at least social cost.
- Interventions need to gain the support of those affected because introducing policy interventions is essentially a political process. Similarly, technology changes need to be accepted by consumers.
- The public, communities and businesses need to be engaged and consulted throughout the policy-making process.
- Interventions need to recognise the dynamic nature of products, processes and systems, as the most significant gains are likely to be technologies that are path breaking and radically different from the solutions we have in place today.
- Interventions need to be outcome focused and must always lead to an improvement on minimum standards.
- Picking specific "winning" technologies is inherently risky, but selecting broad technology directions should be encouraged.
- Interventions to decouple economic growth from resource use need to be accompanied by measures to reduce consumption demand.
- Interventions need to take account of the international context, and recognise that New Zealand is part of a global social, environmental and economic community.
- Interventions need to be evidence based and founded on a substantial stream of operational research and analysis.
- A multidisciplinary approach is required, involving scientists, engineers, technologists, social scientists, economists and environmentalists working beside policy advisers.



# *The Science and Engineering of Sustainability*

To meet these challenges, a discipline is evolving: sustainability engineering and science involving the study of complex systems. Already this new discipline is reflected in the sustainability engineering courses offered at our universities and by recently introduced local government decision-making processes that use sustainability criteria to make infrastructure decisions.

The study of complex systems needs to consider product life cycles within systems and interactions with other systems. As this discipline evolves, it will improve our understanding of human systems – their dynamics, vulnerabilities, resilience, strengths and weaknesses – particularly in relation to environmental systems and resources. It will also ensure that environmental systems remain functional.

Attention needs to focus on using dynamic models as a tool to understand the basic form and function of dynamic and human systems, and using this information for designing policy interventions and decision making. The development of a dynamic model for a community will require significant research and quantities of data but will greatly improve understanding of the dynamic system of the community, its feedbacks, interlinkages and spatial and temporal scales. Therefore, research, modelling and an improved understanding of the application of these models is required to provide a basis for policy making.



# *The Way Forward*

In order to progress towards being a sustainable nation, New Zealand needs to take the following approaches:

- Policy development needs to be prioritised according to where it is likely to achieve the best environmental outcomes.
- Policy solutions need to be evidence based and founded on sound operational research, modelling and analysis.
- Sustainability research and analysis needs to be multidisciplinary – involving a wide range of professional disciplines working alongside policy makers.
- These professions need to be provided with the necessary funding and skills to research, analyse and advise on sustainability issues.
- Investment decisions need to be based on a framework that recognises the value of sustainable options and the costs of environmental externalities.
- Policy solutions must recognise the impacts of and the inter-relationships with international community initiatives.
- Designing sustainability policy initiatives needs to be a collaborative process which engages communities and businesses.

It is likely that the required actions will need to be at the interventionist end of the spectrum, and involve mitigating the impacts of the transition. However, moving towards sustainability is not optional.

By implementing such policy actions, the New Zealand Government will ensure the right signals are being sent and New Zealand as a whole is on the right path to becoming a truly sustainable nation while working towards an increasingly sustainable world.





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