

Sustainable waste management

John Tzilivakis, one of three joint winners of the World Resource Foundation's essay competition on sustainable waste management, addresses the technological and socio-economic issues where change is needed in society to achieve a better balance in the resources it consumes and the waste it creates. John is a research assistant at the University of Hertfordshire, where he is currently working on developing environmental auditing and management systems for agriculture and assessing the environmental impacts of agricultural policy.

Sustainable waste management entails complex technological, environmental, social, cultural and economic issues. Waste management is an ancient issue as archaeological evidence often proves. Sustainability is a political ideal that has numerous definitions on paper, yet has failed to be defined in the real world. To address this issue there are many aspects to consider, starting with waste itself.

Waste is a material that is discarded because it has become obsolete and has little or no value to the individual who discards it. To reduce the environmental damage that arises from the management of this waste, the simple solution seems to be to avoid this obsolescence and minimise waste. In the *Utopian* ideal of zero waste, no environmental damage can arise from its management. However, it is impossible to evolve overnight to a situation of zero waste. Hence, other waste management options have to be considered, such as re-use, recovery, recycling, incineration and landfill.

DESIGNER WASTES

There is an inherent link between the design of products and the design of waste management options. Waste management is the final phase of a life cycle of a population of products, processes and materials. A life cycle that starts with the extraction of raw materials, transport to production, the processes of production, transport to retail, use, and finally disposal. It is the environmentally damaging impacts of this life cycle that need to be sustainable. In the past, life-cycle assessments (LCAs) have been undertaken for individual products or for waste management options. The question that must be asked is, does pursuing waste management options with less damaging impacts reduce the overall impact, or is the pursuit of products with a reduced overall impact a

better option? Products need to take account of their overall environmental damage, including when they become waste, and evolve their design so that the damage being caused is sustainable. Waste management options and facilities need to adapt their design in response to the evolution of products in order to cope with changing amounts and composition of waste.

Disposal to landfill or incineration, recycling and re-use, and minimisation are all dependent on the design of products and consequently the design of waste. Thus we are faced with decisions such as will the design changes necessary to increase recycling or waste minimisation reduce the overall impact of the life cycle. For example, the production of a more durable product may reduce the waste that arises through worn out products. However, would this product require materials and energy that would give rise to a far more damaging impact than if a less durable product were used and the increased waste managed? It is also important to take this perspective when comparing different waste management options, such as recycling versus incineration with energy recovery. Is recycling paper less damaging than burning it and recovering the energy? Has the pursuit to recycle more and more paper had a damaging economic impact on environmentally sustainable forms of forestry such as coppice? It is important to ask these questions if we are to become truly environmentally sustainable.

UNDERSTANDING IMPACTS

When considering the impacts of different products and waste management options, it is important to understand what an impact is and what is sustainable. It is also important to make use of the most current knowledge about environmental processes to answer questions like: What is a threat to human health? What is the

carrying capacity of the environment? From what level of pollution can it recover? What level of damage is sustainable? Over what time scale? Science is capable of achieving this task and it is the closest we can get to an objective view of the world. This view provides the material for decision making so its certainty is constantly questioned. Thus there are often calls for the disclosure and debate about the scientific certainty of our knowledge about the environment. Uncertainties should be openly debated, but in the context of an uncertain world in which decisions need to be made. It is important to remember that nothing is absolutely certain, be it about environmental damage or risks to health. Thus, we should not immediately take the precautionary stance whenever uncertainty is mentioned.

There are, however, other aspects of sustainability to take into account that can diminish any scientific view. These include cultural, social and economic considerations.

A VIEW OF THE WORLD

The world is open to interpretation by individuals who construct values, interests and priorities and these will differ between individuals. Thus, there are a range of perceptions through which the world is viewed. This perception spectrum is otherwise known as subjectivity. This means that what might be viewed as damage by one individual may not be viewed as damage by another. This is only to be expected when we all have different interests. Scientists and experts are not free from this subjectivity even though they constantly try to maintain an objective perspective. What emerges is a scale of environmental value. It is important to understand what value people place on the environment as it will affect their behaviour. Individual behaviour is critical with regard to impacts that are the cumulative

result of individual actions, such as waste. Thus, it is important in waste management to identify what will motivate people to change their behaviour. What will encourage people to buy less environmentally damaging products, to minimise their waste, to sort their waste and take it to an appropriate facility? Economics is often viewed as an indicator of motivation.

THE ECONOMIC PERSPECTIVE

How much are people willing to pay to protect the environment? This is a commonly asked question as we try to cope with the environment in the conventional economic framework. However, this often fails as the value of the environment transcends this convention. For example, can you put a price on a healthy environment, biodiversity or landscape? It is the evolution of these values that are key influences on the evolution of culture and the behaviour of individuals. Thus it is essential for sustainability that the value of the environment is increased.

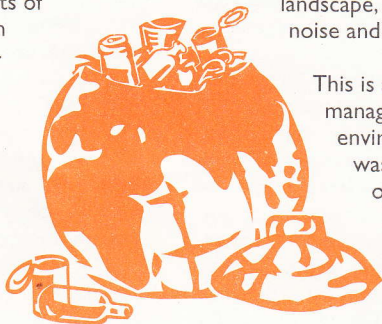
If the values and interests of people, groups or businesses do not evolve to give more consideration to the environment, values can be imposed. One such initiative is the landfill tax. Identified in the national strategy as an undesirable option for waste management, legislation has been passed to impose higher costs of using that option. If this is on the basis of the environmental damage caused, then this is essentially raising the value of the environment. The imposition of such regulation may increase if the population fail to respond to environmental issues. Decision-makers may come under increasing pressure from international sources, such as the European Union, to raise standards and protect the environment. However, it is important that such regulations are practically enforceable. Additionally, they should not have an economic impact that is beyond the ability of businesses and individuals to adapt. This is a key economic aspect of sustainability.

There are also the economic costs of managing waste. Different options have different costs. There are economies of scale to take into account. These are often used in different ways. For example, incineration is often rejected not on grounds of emissions, but on the grounds that it would remove the incentive to reduce waste. The argument being, that a supply of waste is required to maintain the economic viability of the incinerator over its planned life-time. Thus we need to ensure that economic objectives do not conflict with long-term environmental goals.

There are also life cycle implications to take into account. The transport of waste is often viewed as unnecessary and environmentally damaging, hence the evolution of the proximity principle. However, the economics of waste management facilities often dictate that they have a large area to serve. However, is transporting waste further less environmentally damaging? Would transporting waste further to be disposed of at a facility that is less environmentally damaging than a closer facility, be overall more or less damaging taking the transport into account? Economics need not always be in conflict with the environment.

A PLACE FOR WASTE

The location of facilities has other implications for waste management. Commonly values are swayed when an issue arises where people live and work. Waste becomes more of a priority when it is announced that an incinerator or a landfill site is proposed to be built in the local neighbourhood or town. The NIMBY syndrome (Not In My Back Yard) often arises as a result. People are concerned about their local environment because that is where any threat to health and welfare is considered greatest. There are also additional concerns that come into play such as aesthetic impacts on landscape, and issues such as noise and odour.



This is a crucial level for waste management. Even when environmental facts about waste management options are clear, getting the agreement of the local population is incredibly difficult. When the impacts of different options are unclear then this problem is exacerbated. As the uncertainty increases so does the concern over risks. If experts fail in their predictions, with or without consequences, the trust placed in experts by the public diminishes. A lack of consensus among experts can also be a problem. These are recognised communication failures that need to be addressed by all stakeholders including politicians, business, environmental groups and the public and local community. This is an important issue for social sustainability and not just for waste management. If we cannot communicate and debate the issues then we fail to make progress.

CONCLUSIONS

The above discussion, perhaps, raises more questions than it answers. However, it is important to identify these questions and debate them if we are to make any progress toward sustainable waste management. There are though, a number

of issues and principles emerging. They can be split into two parts:

Technological

Firstly, sustainable waste management cannot be assessed in isolation from the full life cycle of products and resources. Technological evolution is necessary towards products that are less environmentally damaging overall (and not just when they become waste).

Waste management technology needs to be adaptable to cope with the evolution of products and the changing composition of waste. At the same time waste management options need to evolve themselves to reduce their damaging impact on the environment.

Socio-economic

Damage is open to interpretation and different people will be more or less concerned about different types of damage. Indeed pollution is difficult to objectively define.

There is a need for continual debate on the values of society and the evolution of a culture around sustainability, of which waste is a crucial component.

The development of instruments which adjust the values of environmental components, such as the landfill tax, are important to bring about change. However, such instruments must be introduced so the economic system can viably evolve, thus meeting the needs of economic sustainability.

All parties in society need to be communicating and made aware of the current state of knowledge about the environment and the uncertainties involved. This includes a debate about risks to health.

Finally, how will we know when waste management has become sustainable? We could set targets according to current scientific understanding of what is considered sustainable, and monitor progress toward those targets. However, it is likely that as time progresses so will knowledge about the environment and targets change. Amongst all this change it is likely that sustainability will arise from the pursuit of evolving targets, rather than from actually meeting them. Such is the nature of dynamic complex systems, be they environmental, economic, social or cultural. It has long been recognised that sustainability is a property that can only emerge from the combination and interaction of these systems.

Contact: John Tzilivakis, Department of Environmental Sciences, University of Hertfordshire, Hatfield Campus, College Lane, Hatfield, Hertfordshire AL10 9AB, UK
Tel: (Intl +44) (0)1707 285259
Fax: (Intl +44) (0)1707 285258
e-mail: J.Tzilivakis@herts.ac.uk