WATER & WASTE MANAGEMENT

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Legislation is not the only route

Plastic shock: a polluted river in India that used to supply drinking water to Bangalore Getty

Industry is increasingly taking the initiative out of self-interest, says **Sarah Murray**

At times, the world's water and waste problems seem insurmountable. In developing countries, population growth and rising incomes are putting pressure on water supplies and generating more waste. The rapid growth of mega-cities is creating headaches for the companies and authorities trying to meet demand for water and manage municipal and industrial waste water.

By 2030, if no efficiency gains are made, global water requirements could exceed current accessible, reliable supply by 40 per cent, according to a study published in November by the Water Resources Group, whose members include McKinsey, the International Finance Corporation – part of the World Bank – and a consortium of companies.

Meanwhile, the Great Pacific Garbage Patch – an expanse of floating debris twice the size of Texas – is an indication that the world's waste is becoming unmanageable, with serious implications for the environment.

But while the Pacific Trash Vortex consists mainly of plastic rubbish, the world's waste also consists of less visible refuse, such as agricultural run-off and nuclear waste.

And if much pollution from waste is invisible, awareness is also growing of the volumes of hidden water that go to make many consumer products. According to Waterwise, a UK non-profit organisation, it takes 2,400 litres of water on average to produce one hamburger, while a cotton T-shirt consumes about 4,100 and pair of leather shoes some 8,000 litres.

Legislation will play a role in both water efficiency and waste management. Companies already pay a high price in many places for polluting rivers and lakes. In some cities, local administrations charge fees for water and are tightening rules on how waste water is managed.

Many think more could be done through legislation to encourage greater efficiency in the use of water. The case for pricing has often been made, with many arguing that establishing a fair price for water would help secure adequate supplies for the world's poorest people and create more powerful incentives for business to conserve it.

However, water pricing has proved politically sensitive. In Bolivia, protests erupted in the city of Cochabamba in 2000 in response to privatisation of the city's water supply.

More recently, some have argued that a cap-and-trade system similar to Europe's emissions trading scheme could be introduced, granting businesses a quota of water rights. Companies that use more than their allocation, such as agricultural businesses, would have to buy extra rights from other members of the trading system.

> Incentives include preserving profitability and reputation management

Water trading could prove challenging, however, as – unlike emissions, which are traded virtually – water is heavy and difficult to transport over great distances. And access is closely tied to land ownership.

When it comes to waste, legal restrictions are also tightening, particularly in Europe. The European Union landfill directive, for example, puts governments under pressure to increase markets for recycling and implement large-scale composting.

In addition, the Waste Electrical and Electronic Equipment (WEEE) regulations place responsibility on producers and retailers to retrieve and recycle their products at the end of their lives (*see page 4*).

While legislation may be a catalyst for clean-ups, industry will need to play an active role in conserving water and cutting waste.

In the UK, for example, business and the construction sector account for more than half of the 330m tonnes of waste produced annually, according to the UK Environment Agency.

Businesses have a variety of incentives to act on water and waste – business continuity, preservation of profitability and reputation management. For mining companies, for example, the danger is reputational, if they release toxic substances into communities.

And with industry highly dependent on water, some companies are taking the security of their supply seriously. Coca-Cola includes water scarcity among the material risks it highlights

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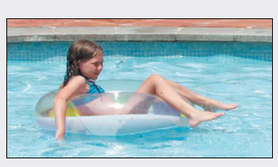

Industry starts to take the initiative

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in its annual filing to the US Security and Exchange Commission.

Tools are available to help companies assess their water risk and implement conservation measures. The Global Environmental Management Initiative's online tool helps companies assess their dependence on water, identify potential risks, and design strategies to manage their consumption.

However, the role companies play in reducing water consumption and waste generation also extends to the way consumers use their products.

Unilever, for example, has developed more concentrated laundry detergents that require up to 20 per cent less packaging per wash. In India, its Surf Excel Quick Wash detergent saves up to two buckets of water per wash because it produces less lather and so needs less water for rinsing. The company says this offers potential water savings in India of about 14bn litres a year.

Reducing waste and increasing the recycling of water also present companies with opportunities to cut costs. The UK construction industry, for example, could cut its waste disposal costs by 40 per cent by reducing waste by 20 per cent, according to Envirowise, the UK government-backed consultancy.

Technology will help with water use, and the first step is introducing systems to track and manage consumption. In Malta, as part of a €70m smart grid scheme being implemented by a consortium led by IBM, metering will be integrated into the network, enabling water use as well as energy to be monitored and managed more efficiently.

Water-saving technologies do not have to be costly or complex. Global Easy Water Products has developed a low-cost drip irrigation system for farmers in India that generates water savings of up to 50 per cent while increasing yields by 30 to 70 per cent.

New technologies are helping cities replace failing water infrastructure. Piping systems allow polymer-based materials to be inserted into old pipes to repair faults and reduce leaks without having to dig up and lay new pipes.

When it comes to managing waste water, new systems are emerging, such as Advanced Immobilised Cell Reactor technology, which uses a system based on the immobilisation of bacteria, reducing the power and land area needed for conventional waste water treatment systems.

And companies have realised that much can be achieved by re-examining their products at the development stage. By designing items that can be more easily picked apart and that use fewer different materials in their construction, companies can increase the recyclable content of what they produce, cutting waste and generating cost-savings by being able to re-use parts and materials (*see page 3*).

However, much remains to be done. In the UK alone, businesses are failing to make collective savings of up to £10m a day through water efficiency, according to Envirowise, which has found that two-thirds of UK businesses do not measure or monitor their water use and 85 per cent have set no reduction targets.

Moreover, market mechanisms alone may not be sufficient to tackle the rising volumes of global waste. Prices achieved by recycled rubbish tend to mirror those of original commodities such as plastic and metal, so any fall in prices for those materials makes recycling less profitable too.

However, failing to act will not only accelerate environmental degradation but also – particularly as regards water – lead to vastly increased costs

According to the Water Resources Group report, if demand and supply measures are implemented, the costs of meeting projected demand in 2030 will be $50bn-$60bn, compared with $200bn if only traditional supply-side measures are taken – double what is now spent on water provision.

Stream of solutions for husbanding liquid assets

Resource management

Mike Scott considers developments in treatment and supply

Despite its fundamental importance to life, water is often taken for granted, particularly as a business issue. Yet the availability and quality of water is crucial for companies in an increasing number of sectors.

The United Nations forecasts that by 2030 almost half the world's population will live in areas facing water stress or water scarcity. Less than 1 per cent of the world's supplies is easily accessible fresh water and "the effects of climate change, increasing population, urbanisation, per capita demand, and pollution damage to supplies will put even greater pressure on these limited resources," says Marcus Norton of the Carbon Disclosure Project.

The CDP, which collects details of businesses' carbon emissions, so that investors can assess their exposure to climate change issues, has just launched a Water Disclosure initiative to do the same thing with water.

Water scarcity is a growing problem in many parts of the world, says Mr Norton. "At present, however, business awareness of the issues, risks and opportunities is limited and investor understanding of the threats and opportunities is even less developed."

Recently, the issue of water has been overshadowed by climate change, but the first impact on businesses of climate change may well be a decline in water quality and availability. While agriculture is responsible for 70 per cent of water use, the CDP highlights a whole range of economic activity that will be affected, from heavy industries to high-tech areas such as pharma and semiconductors.

The food and beverage sector will be one of the most affected, but Andy Wales, head of sustainability at global brewer SABMiller, points out that "we do not need to see this as an alarmist story. There are solutions. If we are water-smart, we can manage the challenge in a way that will not affect growth."

Certainly, water is a sector that investors like, attracted by its strongly-regulated nature and the breadth of opportunities.

According to a report by Marc-Olivier Buffle, analyst at SAM, the sustainable investment specialist, the development of the water market is being shaped by four big trends: explosive population growth; the need to replace infrastructure in developed countries; higher standards of water quality; and climate change, which will change rainfall patterns, cause glaciers to melt and bring other disruptions to supplies.

"This situation opens up opportunities to all businesses offering products and services for the treatment, supply or use of water," says Mr Buffle.

SAM identifies four main segments of the market: distribution and management; advanced water treatment; demand-side efficiency; and water and food.

The sector provides opportunities right across the value chain, says Bruce Jenkyn-Jones, investment director at Impax Asset Management, investment managers for the environmental sector. These range from metering to irrigation.

> 'Much of what you can do to cut water use is not about water, it is to do with improving farming practices'

One area that is attracting interest is water recycling, which has become much more viable because of a fall in the price of the technology that filters pollutants from waste water.

Few regions go to the lengths of Singapore, which collects its waste water, treats it and re-uses it for industrial applications.

NEWater – the name given by the Singaporean Public Utilities Board to its fully recycled waste water – is pure enough to be drunk from the tap. Singapore has built a strong water treatment sector. However, elsewhere there remains widespread cultural resistance to recycled water and indeed, many countries ban the re-use of water, says Mr Jenkyn-Jones.

A more palatable, but much more energy-intensive, solution is desalination, which is attracting a lot of attention in the Middle East. Desalinated water supply was 9.8bn cubic meters in 2000 and is set to reach 54bn cu m by 2020, according to Lux Research. Companies looking to exploit the demand include Modern Water, which has commissioned a plant in the Gulf state of Oman, while a start-up company called Subsea Infrastructure is developing a floating desalination plant.

Another promising area is information about usage, which furnishes some of the simplest solutions for managing water resources, Lux says. Water information technology is a $530m market, but is set to grow, the group says, providing opportunities for companies such as Dercteto, which offers technology for reducing energy usage.

When SABMiller analysed its water usage, it discovered that the biggest proportion went on growing the crops used in its beer, so it focuses on lower tech solutions such as working with farmers to improve water use. "Much of what you can do to cut water use is not about water at all, it is to do with improving farming practices."

In Africa, it is increasing its use of indigenous crops, cassava and sorghum, as feedstocks for its beers, because they are more robust than barley. "When you take a water lens to your value chain, you find opportunities that you would not have otherwise considered," says Mr Wales.

Broad sweep: bigger is not always better when it comes to sustainable practices Alamy

Multinationals are learning lessons from peasant farmers

Agriculture

Big companies are rethinking their techniques, says **Rowenna Davis**

Josephine Kavita farms the slopes just outside the town of Kola, about 40 miles south-east of Nairobi, the Kenyan capital. Her plot might be only a few acres, but her environmental credentials outstrip those of many agribusiness giants.

While many large monocrop fields leach pesticides, chemical fertilisers and topsoil into local water supplies, her neat terraces keep nutrients efficiently in their place. Organic fertiliser from her goats prevents chemical contamination; extensive cover cropping prevents soil erosion; and her border plants put a stop to water run-off.

Big names in global agribusiness, increasingly anxious about global water supplies, have recently started paying more attention to such practices.

SABMiller, one of the world's biggest brewers and owner of such brands as Grolsch and Pilsner Urquell, has formed a partnership with the worldwide fund for nature (WWF), focusing on traditional ways of reducing run-off.

The partnership's first project aims to clean up the company's sugar cane production in Honduras. Run-off from fields finds its way into rivers, contaminating water supplies and damaging ecosystems.

In Honduras, the Meso-American Reef (MAR) is particularly vulnerable to such pollution. Eutrophication – the process by which leaching fertiliser causes increased plant growth in rivers, starving water wildlife of vital oxygen supplies – also occurs in the region.

SABMiller has agreed to replace its toxic pesticides with *metarhizium anisopliae*, a fungus that attacks the notorious froghopper that plagues sugar cane plantations. This fungus kills the pests, without harming ecosystems.

Other solutions include precision farming – a technique used to give crops exactly the right amount of water and fertiliser and no more – and to invest in weather forecasting systems, to insure that agricultural treatments are applied when the chance of run-off from rainfall is lowest.

Meanwhile, cover and border cropping – as used by Ms Kavita in Kenya – are being introduced in the company's plantations in Latin America. Traditional commonsense approaches to reducing agricultural pollution, it seems, are prevailing over gimmicks and gadgetry.

Sasha Koo-Oshima, water quality and environment officer at the Food and Agricultural Organisation of the United Nations (FAO) believes that many multinational agricultural companies can learn lessons from traditional practices.

She points out: "Big agricultural models are often misapplied in developing countries, where they may result in huge landscape changes and run-off. Smaller traditional systems often make agricultural and environmental policy sit better together."

The problem with some more traditional agricultural methods is that they work out more expensive. Mixed cropping may prevent topsoil loss, but it makes the mechanised ploughing – on which modern agriculture depends – very difficult. Biological pest management may be an option, but is unlikely to work better than chemical alternatives in every case. Leaving strips of land fallow may prevent ecological damage, but cuts output.

One study, from the UK Environment Agency, estimated that leaving three metre fallow strips between rows of crops reduces production between 2 and 6 per cent.

In such a context, agricultural businesses may choose to continue passing costs on to others, and moving when the problem starts to affect production. Such problems help explain why the private sector is so reluctant to change.

> The problem with more traditional agricultural methods is that they work out more expensive

However, there are cases of companies reducing pollution out of self-interest. Vittel, the drinks company, pays French farmers $250 (£150) for every hectare that reduces contaminated run-off into its water supplies for example. Unfortunately, they remain rare.

Even SABMiller, seen as a "leader in water sustainability" by the World Water Council is working with the WWF in only six of the 31 countries in which it does business.

Other companies noted for their good work on water scarcity had almost no information to offer on the subject of water quality. For instance, Nestlé said it was the business of its sub-contractors.

According to the FAO, more hopeful results are seen when companies have an opportunity to profit from their environmental activities.

In Scandinavia, the shellfish industry is feeding mussels and clams on the algae that result from agricultural run-off.

This is not just an efficient way of doing business; it also prevents eutrophication.

In the Netherlands, a new accounting system for nitrates has given farmers the tools they need to use fertilisers more efficiently, saving them money on input costs.

In the US, a new "safe salmon" certification has become available for farmers who reduce their run-off, allowing them to charge premium prices for their produce.

Robin Farrington, Water Policy Adviser at the WWF, says the private sector is set to do more to tackle agricultural pollution.

"Increasing water scarcity will give companies the incentives they need to call for greater regulation, not just on their own sites, but across the board," he says.

He adds: "It is important that businesses do what they can on their individual sites, but without action to improve the governance of the wider basin, they'll still be exposed to water-related risks."

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Traditional remedies are back in vogue

Pharmaceuticals

The industry is returning to its roots, reports **Andrew Jack**

When India's Andhra Pradesh region suffered a drought in the middle of the decade, GlaxoSmithKline came up with an unusual form of help. It filled the tankers that deliver milk to its Rajahmundry factory to help make Horlicks with clean, recycled water, and sent them back to the struggling local villages for drinking and irrigation.

The plant is one of several operated by the company in drought-prone areas, including Australia. They have been at the forefront of the UK-based pharmaceutical group's efforts to recycle water as part of a broader strategy to reduce waste of all sorts.

GSK, which has set the global objective of cutting waste water in its manufacturing operations by 3 per cent a year, had already introduced systems at the Indian facility to reduce the volume of water used in production, and to recycle the amounts consumed.

It cleans the water – producing methane then used for cooking in its staff canteen – and combines it with collected rainwater to irrigate gardens that grow food for its employees.

Similar initiatives are taking place across the pharmaceutical sector, as it faces the twin pressures of good corporate citizenship and improved efficiency.

"It was the idea of sustainability that drove the idea," says Jim Hagan, GSK's vice-president for environmental health and safety. "You improve the environment and cut costs."

Marc Jones, vice-president of global operations at AstraZeneca, says manufacturing was for years the "fat and happy" part of the industry. With production such a tiny proportion of the cost of researching, developing and marketing medicines, it was long neglected. Ensuring constant, high-quality product was all that mattered.

Now, efforts to boost savings have reached into the factories too. AstraZeneca, like a number of its peers, has spent considerable effort ensuring newer medicines are produced more efficiently, using fewer steps requiring less energy and raw materials. "Our supply processes are a hidden gem," says Mr Jones.

Novo Nordisk of Denmark, which drew up its first environmental policy a quarter of a century ago, issues regular progress reports, which show carbon dioxide emissions as a proportion of sales have fallen by two-fifths in the past five years, and overall waste has reduced even further.

More efficient use of ingredients is central to cutting waste. Medicines used to be made from plants, but a shift took place from the middle of the last century to more intensive resource-consuming synthetic chemical production.

Mr Hagan at GSK says there is significantly less waste in the production of drugs than of industrial chemicals. Nonetheless, the complex, multi-step processes required mean that 100 kilograms of waste materials are typically generated for a single kilogram of final medicinal product.

His company has set targets to cut that level to less than 50 kilograms on its new products by the end of next year, and as low as 30 kilograms by 2015. That involves changing the chemical approaches used and modifying processes – notably switching from wasteful stop-and-start production in small batches to continuous manufacturing.

The company says it imposes similar demands on its contract manufacturers, auditing their environmental controls alongside health and safety, risk management and human rights issues.

The launch of biological medicines, and the broader use of processes such as fermentation even for smaller molecule, chemically-based drugs, is tilting the balance to more sustainable forms of production.

> 'Adopting fermentation techniques can cut waste by 90 per cent and halve costs'

Stefan Doboczky, president of anti-infectives at DSM, the Dutch manufacturer that provides the active ingredients for many pharmaceuticals, says that since the start of the decade his company has switched three-quarters of products to "white biotechnology".

Of China, he says: "The waste is humungous, with solvents ending up in the air or water. I have seen rivers that don't look as though they carry water any more."

By moving from organic chemical production that requires large quantities of solvents to fermentation techniques, he reckons waste can be cut by 90 per cent, and costs halved.

Difficulties include delays by regulators in authorising new approaches to manufacturing products. Mr Doboczky says this means some countries with less well established controls such as China may be able to leapfrog EU and US authorities by approving greener approaches more swiftly.

But while the "middle" of the production process controlled by the pharmaceutical groups may be making progress, the "ends" lag behind.

GSK concedes it has yet to impose its own targets on suppliers of raw and intermediate materials. And judging by the hefty packaging of its products, such as the weight-loss drug Alli, there is scope for considerable slimming.

Let sustainability in at the ground floor

Design

Products should be devised so as to cut waste, reports **Stephen Pritchard**

Purveying a product that is environmentally friendly wins plaudits. Designing one in such a way that its manufacture minimises environmental impact often goes unnoticed.

According to AMR Research, which specialises in manufacturing and the supply chain, more than 70 per cent of a product's cost is committed at the design phase. So it is worth designing a product so it can be made efficiently.

Designing to reduce waste should be an inherent part of good business practice, and go hand-in-hand with lean manufacturing, which sets out to ensure that businesses only use the minimum of materials and energy to produce an item.

But the trend to outsourcing and global manufacturing can undermine this: stories abound of companies that moved manufacturing to lower cost markets, including south-east Asia and China, only to find that inadequate quality control and manufacturing techniques led to large quantities of substandard products or sharp rises in waste.

Sometimes these shortcomings only became apparent when the brand owner audited the supplier, because the supplier accepted more waste, and re-manufacturing, as an acceptable cost of doing business.

Quality control and environmental standards have improved over the past few years especially in low-cost manufacturing centres, and western companies have become more proactive in ensuring that their ethical and environmental standards are observed by contractors and sub-contractors.

Better supply chain technologies have also made it easier for manufacturers to monitor how their materials and components are made.

But companies have also come to realise that making a greener product is not enough if the manufacturing process harms the environment. The focus is turning to reducing waste, cutting energy use, and using less harmful materials, such as glues, solvents and packaging.

This can bring dual benefits. With materials that are less damaging, the product is easier to break down at the end of its life.

James Dyson, the UK designer, (*see case study on the Dyson Airblade*), for example, strongly believes that good design and environmental responsibility go hand in hand, and should help determine how a product looks and works.

"We design our machines to minimise their size and weight, so we use fewer materials, but the machines offer strength, durability and ease of use," he says. "Slimmer components also require fewer materials and less energy in the manufacturing process. Green design is not just about using recycled materials which in some cases consume as much energy as new materials."

In the US, Nike and Timberland, the clothing and footwear manufacturers, have moved to water-based adhesives because they mean greener manufacture and a greener end-product.

Businesses that make their designs more efficient should see environmental benefits. Focusing on the environmental impact leads to cheaper or more efficient manufacturing techniques. A close liaison between design and production, makes it possible to reduce the cost of materials, and cut down consumables and waste.

> Offering a greener product is not enough, if making it harms the environment

According to AMR, Wal-Mart is asking its suppliers to label products, explaining the environmental impact of ingredients.

"A significant part of the benefit of measuring the environmental impact of a manufacturing process is that it helps focus minds on where resources are being consumed," says Mike Barber, partner for corporate responsibility services at Deloitte, the professional services firm. "It identifies areas where process improvement may have a significant benefit."

Some of these changes -- such as switching to water-based glues – do mean radical departures from conventional manufacturing techniques and materials.

The mobile phone industry is rapidly adopting new materials to reduce the environmental impact of its products. With more than 3bn devices in use worldwide, even small changes will have a significant environmental impact. But changes have to be balanced against functionality, durability and consumer appeal.

"There is always a trade-off," says Mitti Storckovius, sustainability director for the devices division of Nokia, the Finnish mobile telephony group.

"We are very strict about product quality. So, for example, with bioplastics [plastics based on organic materials that bio-degrade] we have to ensure with strict testing that it performs as well. If it is not as high quality, the customer is disappointed, and it hurts our brand."

Reducing packaging can make significant savings in a product's lifetime carbon footprint. Nokia has significantly reduced the size of its packaging, especially for its high volume, lower-end phones. This saves both costs and materials, but the new packaging was not immediately popular, Ms Storckovius admits.

Sony, the Japanese electronics group, has developed a technique for recycling old CDs into polycarbonate product casings, and has programmes to reduce energy and water use and gas emissions at its sites.

But sometimes, it is small commonsense steps rather than big changes that bring the most practical benefits.

For example, Sony now ships its TVs without their stands attached, for the buyer to assemble at home. This approach means 215, rather than 100, 50-inch TVs can fit on a truck.

As Deloitte's, Mike Barber points out: "If you have a good handle on the true cost of manufacture, including energy and wastage, you do not need separately to account for environmental impact."

Dyson's Airblade: slimmer components require fewer raw materials and less energy

Airblade dryer team takes a long-term view

Dyson, the British manufacturer of domestic appliances, is known for reinventing the simple vacuum cleaner. Its machines work without a bag, so as not to lose suction, and put much of their innards on display, turning the workings into a design feature.

The Airblade, the company's revolutionary hand dryer, was an accidental spin-off. In 2002, engineers had come up with the concept of an "air knife" – a thin, powerful blade of air – for use in another project. The design team realised it could provide an alternative to inefficient, and sometimes not very hygienic, conventional hand driers in public or office washrooms.

Much of the appeal of the Airblade, apart from being effective in drying hands, lies in its low running costs. The company calculates the Airblade uses up to 80 per cent less energy than conventional, warm-air hand dryers. But a product that sells at least partially because of its environmental credentials has to be designed so it can be made in an efficient, and environmentally friendly, way.

The design had to meet a number of criteria, according to John Churchill, senior design manager on the project. It had to be hygienic in use in the public washroom environment. This meant designing the casing with as few seams as possible.

It had to be robust, as equipment in public places can be subject to rough treatment, and even abuse. The Airblade needed to be easy to maintain and repair, for the same reasons, and also had to accommodate Dyson's own digital motor. This motor was developed to last twice as long as a conventional, brushed motor. As a result, the rest of the Airblade also needed to be designed for a long working life.

Originally, Dyson's designers intended to make the main casing for the Airblade out of die-cast aluminium, because of its durability, and the fact that the metal is easy to recycle. The Airblade 01 model is now made from the material, but the design team calculated that a plastic model could be developed for less demanding environments, despite plastics' poor environmental reputation.

"Not all bathrooms need the same level of robustness, and not everyone was as tough on the Airblade as we expected," says Mr Churchill. "So to make it more efficient, as aluminium is energy-intensive to process, we turned to plastic. We have good knowledge of plastics from our vacuum cleaners. We didn't want a cheap plastic that breaks, so we used PC-ABS. That material makes a casing for the Airblade that is OK for an office environment, and which doesn't use the high amount of energy required to produce the aluminium version."

Another consideration, and one that is not always to the fore in product design, is where the Airblade could be made. Dyson makes its motors in Singapore, so to reduce transport costs and carbon dioxide emissions, the Airblade is made in Malaysia.

"We could make the motors more cheaply elsewhere, but the trade-off is not worth it," says Mr Churchill. "They are assembled in a clean room, more like a lab than a production line. We don't want to compromise by using a cheaper and dirtier location."

Perhaps surprisingly for a "green" product, recycled materials and end-of-life recycling were not top priorities. The company would not use a recycled material, in order to appear "green", if the result was a less effective product. At the same time, efficient and environmentally responsible manufacturing should go hand-in-hand on a well-designed product.

"We do measure the amount of plastic used in the product, and in its bill of materials," Mr Churchill says. "Recycling is considered, but in the design hierarchy, making the Airblade last as long as possible and making it efficient, is more important than making it easy to take apart."

Stephen Pritchard

Local authorities are crucial in tackling a global problem

Legislation

Charles Batchelor on progress in national and regional regulations

It would be easy to imagine that legislation to govern the treatment of water and the handling of waste was of recent vintage. Governments have been prolific in recent decades, creating and refining the regulations required to keep their citizens safe and, more recently, save the planet.

Yet concern for such matters precedes by millennia the arrival of the industrial society and the growth of large cities. More than 2,500 years ago, officials in Athens opened a municipal landfill site and decreed that waste should be carried at least a mile from the city gates.

German cities in the Middle Ages required wagons bringing in produce to take out waste when they left, while in 1515 Shakespeare's father was fined for "depositing filth in a public street".

Local authorities around the world still play an important role in devising by-laws and implementing legislation to manage water and waste, although the main responsibility has moved to national and supra-national bodies such as the European Union.

Regulation of waste in much of Europe is driven by the EU's Waste Framework Directive of 1975, revised in 2008. This sets a target for member states to recycle and re-use 50 per cent of household waste by 2020.

This directive created a five-tier hierarchy for dealing with waste, explains Mike Webster of Waste Watch, a UK environmental charity. It requires waste management to start with preventing or minimising waste – such as packaging – in the first place; re-using or refurbishing goods; recycling materials such as scrap metal; recovering energy from incineration; and, finally, disposing of what is left.

Water, meanwhile, is covered by the Water Framework Directive of 2000, which requires governments to identify the river basins in their territory and produce management plans that provide pricing incentives to ensure water is used efficiently. However, these policies, which should have been in place at the start of this year, may prove difficult to implement in some southern European states with extensive irrigated agriculture.

The US is not without its federal regulation. The Environmental Protection Agency (EPA) was called into being by the Nixon administration in 1970, while a cornerstone law governing the disposal of solid and hazardous waste, the Resource Conservation and Recovery Act, dates from 1976.

However, the individual states have often made the running and sometimes even challenged the EPA to do better. In 2005, nine states sued the agency for being too easy on mercury emissions from power plants and several brought in their own controls.

> 'In the US, legislation is dealt with mostly by the individual states not by the federal government'

"In the US, legislation is dealt with mostly by the individual states not by the federal government," says Jacques Labre, vice-president for institutional relations at Suez Environnement, a French environmental management company active in many countries.

"California is very active," he continues. "In the US, there is still a big proportion of solid waste that goes to landfill. Incineration is only done in the densely urbanised parts of the country. Western Europe is ahead."

Australia is closer to European practice than to the US, with a high level of environmental awareness. In November, Australian state governments agreed a national waste policy to cover the period to 2020.

The first comprehensive approach to this issue was adopted in 1992, but waste generation has continued to increase. Actions to be taken include waste avoidance, reduction of landfill and three-yearly reviews of progress.

China has been progressing fast in terms of awareness of waste and water management, driven in part by recent incidents of river pollution and serious declines in air quality in large cities. Water quality was so poor in China's 28 largest lakes that almost 40 per cent was rated level 6, the lowest ranking and unfit even for farm irrigation, according to a recent survey.

Legislation by governments and cross-border agencies such as the European Commission is one approach to dealing with waste and water. Another often more wide-reaching mechanism is the international convention, which can be agreed by states around the world.

One such is the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, which took effect in 1992. Trade in hazardous waste had grown steeply in the two previous decades, driven – perversely – by tighter environmental controls in developed countries, the globalisation of shipping and a desperate search for revenues by poorer countries.

The convention was prompted by scandals during the 1980s, including the dumping of incinerator ash from Philadelphia on a Haitian beach and the shipping of 8,000 barrels of hazardous waste from Italy to Nigeria. Similar incidents still occur, but are less frequent than before the convention. It has been bolstered by a number of supporting treaties.

International conventions can help achieve global consensus on how to deal with the issues thrown up by the need to manage waste and water.

But in recent years most progress has been achieved by regulation at a national and regional level. This may not always look tidy, but it reflects local priorities and differing stages of economic development.

Disposal programmes are in need of some fine-tuning

Electronics

Recycling schemes are being refined, writes **Mike Scott**

One obvious sign of "progress" in the past 30 years is the increase in the amount of consumer electronics in the house of today compared with its 1979 counterpart.

As well as multiple television sets, DVD players, a microwave, tumble dryers and fridge-freezer, today's home will have a range of MP3 players, a desktop computer, maybe a laptop, computer games console, broadband connection and a digital video recorder.

Disposing of all these gadgets, as well as the IT equipment thrown out by businesses as it becomes obsolete, is becoming an increasing problem. The United Nations estimates that up to 50m tonnes of electronic goods are discarded globally each year, while in Europe "e-waste" is increasing at 3-5 per cent a year – three times faster than the total waste stream.

The EU's WEEE (Waste from Electrical and Electronic Equipment) directive aims to ensure that the waste created by consumers buying 9.3m tonnes of electrical gadgets a year does not end up in landfill.

WEEE was a groundbreaking law but it had a troubled development. Agreed in 2004, the directive was subject to long delays in its introduction in many member states and the European Commission said in 2008 that only a third of e-waste was being treated in line with the legislation, with the rest going to landfill or sent abroad.

The directive, which called for EU countries to ensure that 4kg of e-waste per person was collected each year, has been heavily criticised and poorly implemented. The focus on weight has meant that collectors have not concentrated on collecting energy-saving light bulbs, for example, but on bulky, heavy items such as washing machines and refrigerators that are more difficult to transport and have little value.

Another problem is that the 4kg requirement is the same for all EU countries, even though for some newer entrants it is close to 100 per cent of the e-waste they produce, while for some of the older member states it is about one-fifth of the total.

The European Commission is revising the directive, and wants to introduce new collection targets equal to 65 per cent of the average weight of goods placed on the market over the previous two years.

"We have a [new] target that is much more ambitious and reflective of a member state's circumstances," says the Commission. It also wants to increase the responsibility of producers to collect the waste.

> Just 18 per cent of computers and TVs were recycled in the US in 2007 – and only one in 10 cell phones

This will be unworkable, says Dr Kirstie McIntyre, of Hewlett-Packard's EMEA Environmental Compliance department, because so much e-waste is illegally disposed of outside the producer compliance system.

E-waste is not just a European Union problem, of course. Similar regulations are in place in Japan, while China and Korea are among countries looking at introducing their own regulations. A number of US states also have "producer take back" laws. However, just 18 per cent of computers and TVs were recycled in the US in 2007 – and only one in 10 cell phones.

Globally, the Basel Convention seeks to minimise the movement of waste across international borders. Under the Convention, the export of hazardous waste from rich countries to poor ones is illegal, unless the receiving government has given explicit consent, says Charlotte Steel, of Impax, an investment company. However, it can easily be circumvented by relabelling e-waste as second-hand goods.

E-waste is becoming a problem in African and Asian countries, where it is sent for recycling.

Electronic equipment contains a significant amount of heavy metals that can contaminate groundwater, impair air quality and cause health problems if not dealt with properly.

HP, which collected 1.5m products last year in the EMEA region, has been working on a project in South Africa, looking at ways communities can handle e-waste safely and create employment at the same time.

"We have no control over how this waste ends up in Africa, but it is not good for our products to be dumped in other countries," says Ms McIntyre of HP. "However, there is a demand for e-waste in places such as Ghana, South Africa and Morocco because the raw materials can be used."

She says the company's South African project has shown that with proper training, e-waste recycling can provide good jobs and protect the environment. Some of the company's products, such as printer cartridges, are made entirely from recycled plastic, she says. "Waste will become more important, as commodity prices go up and up."

IBM, which has been recycling e-waste since 1989, says early action on e-waste has created business opportunities. In 2003, it became the first company to have collected more than 1bn lbs of e-waste, says Wayne Balta, vice-president, corporate environmental affairs and product safety. It has a target of sending no more than 3 per cent by weight of its waste to landfill or incineration.

"If you anticipate regulation, you have opportunities instead of having to react," says Mr Balta.

Leftovers offer hope to hungry

Food

There is already enough to feed the world in 2050, reports **Jane Bird**

Those filling their supermarket trolleys for the weekly shop or buying their groceries online are unlikely to ponder how much of their purchases may end up thrown away.

In the US, it could be up to 40 per cent, or 1,400 kilocalories a day for each American, according to research just published by the National Institute of Diabetes and Digestive and Kidney Diseases, in Bethseda, Maryland.

In the UK, 8.3m tonnes of food and drink are wasted each year, of which 5.3m could have been consumed, according to Wrap (Waste & Resources Action Programme), a government funded initiative.

The cost of this waste is at least £12bn, or £480 for each household, and £680 for families with children.

Food waste is so widespread that experts believe if it could be eliminated there is already enough to feed the expected world population of 9bn in 2050. Moreover, there would be huge environmental advantages: a saving of 20m tonnes of carbon dioxide a year in the UK, the equivalent of taking one in four cars off the road.

The main reasons households throw away food is because we cook or prepare too much (£4.8bn a year) or we let food go off (£6.7bn a year). Much of this is due to lifestyle change, says Richard Swannell, Wrap's director for retail and organics.

"You plan a midweek lasagne, then get asked out, or the children have a party and you forget to put the mince in the freezer."

We have also got out of the habit of using leftovers, he says. "A shrivelled apple can go in a crumble or be used to make a smoothie; the remains of a Sunday joint can make sandwiches or shepherd's pie."

"Sell by", "best before" and "use by" dates add to the problem. There is confusion between safety and quality, which means that safe food, which may not be of the best quality, is thrown away, says Frances Buckingham, manager at Sustainability UK, a consultancy. She says: "People rely too much on the labels without using their commonsense," adding that, while supermarkets are convenient, "the model of large weekly shops has an element of wastage built into it".

Sell-out: best before and use by labels can cause confusion and lead to safe food being thrown away Getty

The issue is being taken seriously by food producers, retailers and government. "Buy one, get one free" offers are gradually being replaced with a variety of "half price", "buy one, get one free later", and multi-buy deals that combine different items rather than just offering more of the same.

Supermarkets are starting to print storage information on packaging, for example pointing out that apples keep longer in the fridge and cucumbers can last an extra two weeks if kept in their plastic wrapping.

Packaging is also being used to prolong product life. M&S has replaced the plastic tray in which beef joints were sold with a 'skin pack' film that fits tightly and keeps the meat fresh for four extra days.

Tetra Pak has developed a package with a gabled top for drinks that gives a smooth flow to juice or milk rather than splashing when poured. Resealable packets that help keep food fresh are becoming more common.

Reducing instore waste is another key focus for supermarkets, many of which have committed themselves to stop sending waste to landfill by 2015.

It is inefficient to throw away food that could be sold, says Jack Cunningham, environmental affairs manager at J Sainsbury, which produces 56,000 tonnes of instore food waste a year. "Our store managers are incentivised to minimise waste, and we cut prices as food nears its use by date."

Like many retailers, Sainsbury gives to charities unsold food that is within its use-by date. It also works with suppliers, for instance encouraging potato growers to mash low grade produce for use in ready meals, and avocado farmers to process reject avocados for face masks.

Transport offers further areas for improvement. A Waitrose project with 100 banana growers in the Windward Islands has reduced wastage from shipped fruit from 40 per cent in 2002 to less than 3 per cent in 2008. Northern Foods cut the number of pizzas damaged before being sold by 75 per cent by redesigning packaging so pallets can be stacked more efficiently.

"Waste won't get to zero because there'll always be bones, tea bags, banana skins and eggshells," says Mr Swannell. The answer is food waste collection and technology such as anaerobic digesters that turn it into methane, carbon dioxide and solid fertiliser.

> 'The model of large weekly shops has an element of wastage built into it'

The UK is learning from best practice in other countries. For example Italy has pioneered door-to-door food waste collections, while Switzerland and Germany are advanced in their use of anaerobic digesters.

The ideal approach seems to be weekly collections of food waste only. This can be processed cost-effectively in anaerobic digesters whereas a mixture of food and garden waste collected fortnightly is less efficient, says Dr Swannell. This approach creates methane in a form that can be used to generate energy or be injected into the gas grid.

At present, 66 local authorities in the UK collect food waste separately (15 per cent) and a further 72 authorities (17 per cent), collect it with garden waste.

If all the 5.8m tonnes of UK municipal food waste were recycled in anaerobic digesters it would generate the energy for up to 164,000 households, or 26 per cent of that generated by wind power in the UK in 2005.

But as Wrap's Dr Swannell says: "The best thing is not to produce it in the first place."

Relax with a clear conscience

Hotels

A raft of improvements is being floated, reports **Charles Batchelor**

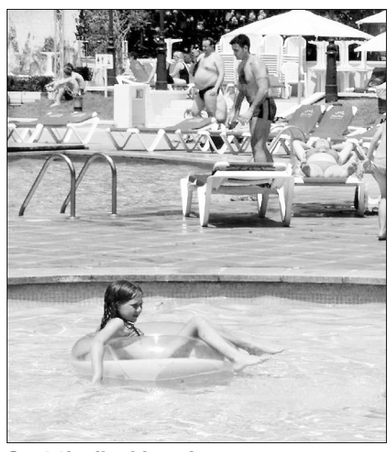
Travellers will be familiar with the request displayed in many hotel bathrooms to re-use towels for the benefit of the environment. They may be less aware of the scale of measures being taken by some hotel chains to improve their green credentials and of the impact such a simple action can have on water use.

InterContinental Hotels calculates that its towel re-use programme saves 199m litres of water a year in the US alone. Marriott International, with 3,200 hotels worldwide, reckons its linen re-use programme saves 11-17 per cent on its water and water treatment costs. As well as urging guests to re-use towels, some hotel chains urge customers not to demand fresh bed linen every day.

Lower water use can have knock-on effects by cutting energy used to power washers and dryers and reducing the quantity of detergents needed. Marriott says that laundry savings at its central European hotels has reduced phosphate discharge into the waste water system by 100,000 kilos.

The attentions of regulators and green activists may have focused on other aspects of the tourism industry – notably aviation – but hotels are well placed to make a contribution to reducing environmental damage. More than 900m international tourists travelled in 2007 and the United Nations World Tourism Organisation forecasts 1.6bn tourists by 2020.

When they reach their destination, travellers are more profligate in their use of water than the local population. A survey of water consumption on the Spanish island of Mallorca in 1994 showed that while a country dweller consumed 140 litres of water a day and a city dweller 250 litres, the average tourist used 440 litres and a luxury golf resort 880 litres for each visitor.


Spot the liquid pool cover Reuters

For hotel managements, water issues can do more than influence their premises' appeal to guests. In extreme cases, they can determine the hotel's very survival. In many developing countries the water infrastructure may not be highly developed. A large hotel may have difficulty obtaining adequate and regular supplies or may only achieve it by depriving the local residents and farmers.

Imagine having to tell your guests that they can only shower every other day, that supplies of bottled water have become hard to obtain and that providing clean laundry has become impossible, suggested Green Hotelier, the magazine of the International Tourism Partnership (ITP), a business group that promotes environmental and social responsibility.

"It is not as unlikely as may seem," the magazine explained. "Puerto Rico and St Lucia experienced dry spells in 1995, resulting in cancellations and hotel guests cutting short their holidays. Some resorts were even forced to close their doors."

Waste water can also pose a serious threat to a hotel business. Stomach upsets, vomiting and ear and skin infections can result from swimming in polluted water. Discharge of improperly treated waste water into the sea can lead to algal outbreaks and damage coral reefs.

Tour operators often check a hotel's fresh and waste water management processes as a part of their contract. Hotels put water to a wide of range of uses, with only 5 per cent estimated to go to drinking and cleaning food. Some goes to guests taking showers and washing; some to irrigating gardens and golf courses; filling swimming pools and jacuzzis; cooling and decorative use such as fountains; and irrigating land used to produce food for tourists. Water accounts for 15 per cent of the total utility bill of many hotels.

"You can install showers if you are building a new hotel," notes Miles Quest of the British Hospitality Association, a trade body. "But people who otherwise would not take a bath often do so when they stay at a hotel."

For many travellers a hotel stay is a luxury experience. They might scrimp at home but they do not want to do so on holiday.

This puts the onus on the hotel operator to take initiatives that will save water without obviously impinging on the pleasure of the stay.

De Vere Venues, the conference arm of the De Vere hotel group, is trialling devices installed in the pipework to showers in its 3,310 rooms to add air to the water. The strength of the flow is maintained but water use is reduced.

It is also introducing "liquid pool covers" in its seven swimming pools. These are unnoticeable to the swimmer but when the water surface is still the molecules form an invisible surface on the pool that retains heat and prevents evaporation.

"We are also in the throes of a water scanning project to detect leaks because a lot our premises are old," says David Greenhill, head of health and safety. "But this involves capital investment and we are progressing slowly, given the current financial climate."

"Water management is a huge issue for the industry," says Stephen Farrant, director of the ITP. "Some of the more enlightened companies have focused on it but there is huge scope to do more."