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Tipping point: what happens when our landfills are full?

As space in Britain's landfills runs out, the race is on to find environmentally friendly alternatives



I am standing on a manmade mountain, a 260ft monument to human detritus. Below, on terraces carved into the hillside, trucks rumble in and out, laden with fresh waste, and a squadron of diggers charges back and forth, spreading, crushing and covering.

On it goes, layer upon layer, over and over again. Eventually, it will be capped with an impermeable liner, made of clay or plastic, then a little soil, before being grassed over. Within a few years it will blend in with the rest of this strange landscape, to become uneven tufty grassland. One would never guess what lies beneath.

This is Packington, just outside Birmingham, one of Britain's biggest landfill sites. It covers about 380 acres and contains more than 18.5 million tons of waste.



Today it takes rubbish from Birmingham and Warwickshire, though in the past waste has come here from as far away as London, Bristol and Manchester. Opened during Harold Wilson's first term as prime minister, it has since grown into a hill the height of a skyscraper where there was once flat land. In industry parlance this is 'land raise' rather than landfill, but the purpose is the same.

The waste does not lie idle. About 14 miles of pipework sucks up the methane-rich gas the rubbish produces via 300 extraction points, after which it is used for electricity generation. (Methane has 21 times more impact as a greenhouse gas than carbon dioxide, so burning it to create CO₂ is beneficial.)

Sita, the French multinational that owns the site (and 23 others in the UK), says its landfills are responsible for generating three per cent of the nation's green energy. It is not only methane that is collected: waste wood is turned into wood chip to be burnt, and the nasty rainwater runoff – known as leachate – is collected and processed.

The common perception of landfill is of a blight on our landscape; this place, however, is a monument to mankind's ingenuity. But for all its innovation, I am staring at the past. In two years' time Packington will be full. The pipes will keep sucking methane for another 30 years but the trucks will stop arriving and the site will reopen within 10 years as a country park.

My guide, Sita's technical director Stuart Hayward-Higham, explains that since the 1990s the number of working landfill sites in Britain has fallen from 1,500 to below 250 – Sita has lost three dozen sites in the past few years, some of them full and others replaced with newer technologies.

In his view, it is right to move on, but he feels that landfill never got a fair hearing. 'I think it's always struggled to represent itself – most people have an expectation of odour, flies and seagulls. When you take them up here they say, "Where are the flies?" The development of a fly from egg to maggot to fly is 10 days. The tip bay is organised so that we put fresh waste over old waste before those 10 days are up.'

It is not only Packington that is filling up. In 2007 the Local Government Association reported that in Britain a combined area the size of Warwick was taken up with landfill. In July last year it warned that the country will run out of space for its rubbish by 2018 unless new sites are found.

The real nail in the coffin is the European Union's landfill directive (first issued in 1999 but ramped up over the years with increasingly ambitious targets), which will impose fines of up to £1 million a day if we send more than 50 per cent of our waste to landfill by 2013 or 35 per cent by 2020 (currently we send 48 per cent to landfill).

As a result, disposing in landfill in the UK is subject to an escalating tax – in April this year the tax rose to £56 a ton and it is set to hit £80 a ton in 2014. The UK produces about 280 million tons of waste a year. Only Spain, Greece and Ireland send more to



landfill per head of population. Forty per cent of our household waste is recycled or composted and 12 per cent incinerated for electricity, with the rest – 680lb per capita each year – going to landfill. The EU average is 415lb; Germany's rate is 7lb. (Germany sends the least amount of waste to landfill in Europe, and has high rates of recycling, but it has achieved this by moving to 35 per cent incineration.)

Waste has always been a conundrum for urban society. The Victorians brought in sewers and the first bins for ash from domestic fires. But it was decades before the rag and bone man was driven out by dustbins and large-scale landfill sites, the latter seen as a logical use for empty quarries. Our waste binge didn't begin in earnest until the 1970s, with cheap materials such as plastic becoming widespread; the trend accelerated and continued until the introduction of the first mass recycling programmes of the mid-1990s. In the new century we have learnt about carbon footprints and how to reduce them, and a growing number of campaigners have vocalised our concerns about how much 'stuff' we consume and what happens when we have finished with it.

Until a few years ago, there was only one significant alternative to landfill: incineration. The big five waste companies – Veolia, Sita, Viridor, WRG and Biffa – are all fond of incineration, though the word itself makes them jumpy. (They prefer the euphemism 'energy from waste'.) Incineration is highly effective – you can generate a lot of power from huge loads of rubbish and don't need to do much work sorting it all out in advance. Moreover, incinerators are cleaner and more efficient than they used to be.

For the big players, incineration is the main replacement for landfill. Hayward-Higham says that if the UK is to meet its EU targets, we will need to add more than 20 million tons of 'thermal capacity', the equivalent of 35 mega incinerators like the Belvedere plant in south-east London. This will be one of the biggest incinerators in the country when it becomes operational, expected at the end of 2012.

Unsurprisingly, environmental groups aren't fans of incineration. According to Friends of the Earth, incinerators are considerably worse on carbon efficiency than even coal-fired power stations. It seems perverse that developed economies – so keen in other ways to kill CO₂-belching industries – are looking to incineration as an alternative to landfill.

To be viable, incinerators need to be big, which means waste must be brought in from far away. And once built, regardless of changing circumstances, the contracts that local authorities have signed with the waste firms mean that you have to keep feeding the monster. The Liberal Democrat shadow environment secretary Norman Baker argued eight years ago that recycling rates were depressed in areas with incinerators. The issue came to a head in Stoke-on-Trent last year when the incinerator operator Hanford Waste Services warned the council that it was in danger of breaching the terms of its contract. In effect, the council's new recycling strategy had been too successful, and there was not enough waste being burnt.

Amid the theorising it is easy to forget the day-to-day reality: we put things in the bin and expect them to be taken away. Where it all goes few of us know, or care. In



Bournemouth, it goes to New Earth Solutions' mechanical biological treatment plant on the edge of town. Bournemouth is not typical: the council recycles half of its waste, 10 per cent more than the national average. Three per cent of it goes to metal recycling, three per cent to plastic recycling, 23 per cent is turned into compost, 20 per cent sent to incineration. Only 21 per cent goes to landfill – much less than half the national average.

The council ignored the big waste firms in favour of New Earth Solutions, a small but growing company that specialises in composting. The council refuse wagons tip their waste into a mechanical sorting shed at New Earth's Dorset facility (it has nine others around the country), where it is whisked up on to a conveyor belt and cleverly sorted. With its flashing lights, overhead walkways, platforms and conveyor belts, the process is like something out of Fritz Lang's *Metropolis*, only with a whiff of latrines.

Organic material, such as food scraps, falls through holes in the mesh and goes for composting. Then via a series of devices such as magnets and wind sifters, the ferrous waste, aluminium, recyclable polymers and card are respectively removed for recycling. What you are left with – plastic bags and other non-recyclable waste – is either sent to landfill or burnt in cement kilns.

New Earth's compost shed has an altogether different ambience – and a rich, sweet aroma, redolent of tobacco. Beneath a dull orange glow the waste is laid out in four long rows of decaying material. I can see scraps of paper and plastic, but Peter Mills, the operations director, says that most of this will break down over the six weeks it remains in the shed.

'It's exactly the same as the compost heap at the end of the garden, but a more managed environment – we add air, irrigation and agitation,' he explains. The agitation is done by a turning machine, a powerful vehicle that resembles a combine harvester. All this microbial activity creates heat. Long probes relay the temperature inside the compost heap to the control room – at this point in the cycle it is between 60 and 70C. The emissions from the composting are carbon dioxide and water vapour.

We wander through to the next-door shed where six-week-old compost is being sorted to remove any remaining paper and plastic. The end product is a mulchy, leafy substance the colour of coffee. I am wowed by the naturalness of it all. The trouble is that no one makes much money out of compost from household waste. Under current legislation it can't be used in production of food crops, only for forestry, transport or spreading. Its value lies in the cost of landfill tax avoided, but it has no more than a minor supporting role in replacing landfill.

A debate that never seems to go away is over recycling, especially as it means councils are changing the way they collect domestic waste. Research by *The Sunday Telegraph* in August showed that three out of five councils now operate fortnightly rounds, affecting more than 50 per cent of all households, a consequence of councils boosting their recycling schemes to divert rubbish from landfill. Recycling campaigners bemoan the



fact that traditionalists are hung up on the idea of defending the weekly rubbish collection instead of focusing on the real issues.

For the Campaign for Real Recycling, the issue is that by allowing councils to collect recycling all mixed up – 'commingling' in the jargon – Britain is breaking EU law. Andy Moore, the group's co-ordinator, says it is only when you collect materials separately that they have real value, which may explain why so much of our recycling is exported to China or the Philippines and why better-quality recyclate must be imported.

The consensus is that something needs to be done, and soon. If Packington is the past, an industrial estate outside Swindon could be the future. Advanced Plasma Power is, as the sci-fi name suggests, aiming at a brave new world.

Plasma technology is about superheating waste that might otherwise go to landfill in an oxygen-deprived environment, producing a clean synthesis gas that can be used to power engines and create electricity. Unlike incineration, the process leaves behind little ash, instead producing a lava that cools to form a black glass-like substance known as Plasmarok. Earlier this year, APP's then CEO, Simon Merriweather, previously the managing director of EDF's power stations, gave me a tour. The technology can handle nearly all waste, he explained, is more energy-efficient than incineration, produces no dioxins and very little ash; Plasmarok is considered a building material rather than waste.

Plasma technology is in use around the world to clean up dangerous emissions from industrial processes. But nowhere else are gasifiers and plasma being used in tandem, as they are in Swindon. The gasifier is a 42ft cylindrical box that heats the waste to 850C. It is only once this process has vaporised the waste that the full might of the 23ft plasma converter is unleashed. 'The converter is a swirling gas field containing an arc of lightning that's at a temperature of between 5,000 and 8,000C,' Merriweather explained. 'That intense heat together with ultraviolet light breaks down what are called long-chain carbon products that are proven or indicated to cause asthma and cancer.' In layman's terms it destroys all the bad chemicals and produces a gas rich in hydrogen and carbon monoxide that is perfect for combustion.

'We're taking waste that would otherwise be put in the ground and producing enough energy for about 15,000 homes,' he told me. Unlike an incinerator, everything is small-scale and can sit close to a town. The whole plant is the size of a small supermarket and the exhaust is a maximum of 33ft high, compared with the 200-260ft chimneys of most incinerators.

The only trouble is that Swindon is a demonstration plant. Nobody has yet committed to buying the full-scale version. Councils, it seems, are lukewarm about the idea of gasification, and the big waste firms remain unconvinced. 'APP are very nice people and have got a neat technology proven at small scale,' Stuart Hayward-Higham says. Merriweather recently left APP, but his successor, Rolf Stein, remains bullish about the technology and believes that the first wave of commercial APP plants will begin



construction next year. 'Looking ahead there will be APP plants in edge-of-town business parks around the world,' he says.

Sceptics should pay a visit to Belgium, the nation that leads the world in waste policy. Flanders, the Dutch-speaking north, is especially advanced with recycling rates of over 70 per cent – and unlike the Germans and Austrians they don't massage their statistics with incinerator ash. In the north-eastern corner of Flanders, Group Machiels, a large family firm, is pioneering one of the most revolutionary ideas to hit landfill in years. The plan (a public-private partnership) is to dig up decades' worth of rubbish from Flanders's biggest landfill site, recycle the precious materials and generate energy from what is left using APP's plasma technology.

The Remo landfill near the city of Hasselt is a mix of woods and rolling grassland, home to grazing sheep and the odd deer. Under this sprawling site lie 16 million tons of waste, dating back as far as 1976. Truckloads of rubbish still arrive, but today it is only industrial – it is illegal in Belgium to bury household waste. It goes into pits 33ft deep and the length and width of two football pitches.

In a portable building on the site, I meet the company's CEO, Emiel Philipsen. 'Look at the potential in materials and energy that is stored in the landfill. This is our own oil,' he says. 'We don't have to go and get it, it's here.' Group Machiels estimates that after extraction costs, the energy in the ground at Remo is equivalent to a year's petrol imports to Belgium.

The company, once Flanders' government has approved the plans, aims to mine 200,000 tons a year, Patrick Laevers, the chief operating officer, says. About half of the mined material will be recycled, the other half will go into an APP gas plasma plant, producing energy, Plasmarok and heat for greenhouses that will grow vegetables. Only about five per cent of what is dug up will be unsuitable for recycling or gasification; this will be stored again until a suitable technology emerges.

But can such an endeavour really work? It will need new laws for a start. Flanders' environment minister, Joke Schauvliege, says she supports the idea in principle, but wants to see the results of an environmental study by the end of the year.

And how do the locals feel about it? After years of having an ever-growing dump on their doorstep, which is finally grassed over, the same firm wants to start taking the waste out. Laevers says that after initial opposition in the local village of Houthalen-Helchteren there is now almost universal support. The site is protected by trees, the nearest house is 1,000ft away and there won't be any noticeable difference in traffic. In any case, once they have removed the waste they won't be filling it up again. The land will return to its level before it was a waste dump. He is enthusiastic about APP's gas plasma technology, which he says is less intrusive for the community than incineration and more environmentally sound. And then there is local pride. Hasselt will be the first place in the world to try landfill mining on a serious scale. Other nations have tried it in the past, notably Japan, which has extracted valuable metals such as gold and



electrical circuitry from the earth, but the Flanders model is much more radical. Rather than merely cherrypicking precious bits from an old landfill site, in Flanders they will take everything out of the dump.

The Remo project will cost €250 million and employ 800 workers over its 20-year duration – another reason for local support. The profit margin on Remo will be a solid but unspectacular 15 per cent, Laevers says. 'This is the first project. We want to generate the technology and master it so as to duplicate it in other sites. Imagine what the energy and material prices will be in 20 years' time.'

So how big could landfill mining be? Laevers estimates that there are 1,600 similar landfills in Europe. Group Machiels is already in discussions with the authorities in Antofagasta, Chile's fourth biggest city, to dig up its landfill site. And during the Shanghai Expo last May, a Chinese public-private partnership expressed an interest in the Machiels model. 'In the end, every substantial landfill will make use of this technology or a derivative, to achieve energy generation and land recuperation,' Philipsen predicts.

Landfill is dying. But if Flanders – with a little help from Swindon – can succeed, our old garbage could set off a new gold rush.