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When Waste Disappears, or More Waste Please!

This paper considers the unintended consequences of well-intentioned environmental propositions or principles that on closer examination turn out to be partial views and/or isolated from broader structural constraints. In particular, I examine what happens if we take three core environmental propositions, which have almost become truisms or principles of our time, and consider them in conjunction. Baldly stated, these are the propositions: First, the world produces too much waste; we therefore need to reduce waste. Second, primary resources are being extracted beyond the point of sustainability or replenishment; we therefore need to reduce resource extraction, particularly carbon-based fuels. Third, energy demands are increasing, particularly in developing economies; we need to expand energy production, but we also need to reduce carbon emissions.

These are, of course, closely related. Energy is required to treat waste and extract resources; it can also be generated from both. Recycling, which again uses energy, replaces or delays primary resource extraction.

There is a fourth proposition, which we might call a secondary or recursive proposition, since it both addresses how we deal with these problems and is derived from all three principles. This is commonly known as the proximity principle. Enshrined in EU guidance (EU 2008, Article 16), the proximity principle suggests that material operations should minimize distance traveled. Thus if waste is to be disposed of, treated, or recycled, the proximity principle promotes these activities happening as close to the point of waste generation as possible. The rationale is formed by principles two and three outlined above: local recycling means less energy and fewer resources (fuel) are consumed in transportation.

An ideal, virtuous scenario might therefore be imagined as a closed loop, where materials circle through different stages of assembly, consumption, and post-consumption disassembly before the circle starts again. Since some of these stages can release and others consume energy, the closed loop requires no energy input.

Whether or not any system can be fully closed is a moot point.

This article is, in part, a provocation: carefully adhering to all these excellent principles produces unexpected results, one of which is that the apparent reduction or indeed elimination of waste in fact requires *more* waste. One might say therefore that this provocation is a *reductio ad absurdum*, but one that is regularly promoted and enacted, if in not so many terms. What this paper is therefore exploring is why ideas of closed loops are inevitably tripped up in their translation to practice (Alexander and Reno 2012).

The context is contemporary Britain and attempts to respond to the 1999 EU Landfill Directive (EU 1999) to reduce biodegradable waste going to landfill. Vast amounts of public money have been directed towards new technologies to treat waste and then treat the inevitable by-products, large-scale commercial contracts to manage municipal waste streams, and massive media communications to the public to recycle and segregate their rubbish at home. These new social, political, engineering, and financial technologies invariably do not stand alone, despite often being presented as such, but require some kind of pre- or post-activity process, or indeed something as simple, and problematic, as a physical connection to the National Electricity Grid or local housing in order to realize technological and financial promises (Alexander and Reno 2014).

Tracing the logic of how less produces more, we need to think about three key factors that immediately complicate the abstraction of a closed loop. In the first instance, *uneven geographies* underlie each of the three main propositions. The production, consumption, and disposal of waste, resources, and energy occur at different rates and at different scales whether within cities or regions, or globally (Moore 2012; Bakker and Bridge 2006). Arguably, keeping material operations local in a globalized material economy demands active disconnection and can be as hard to sustain as many local exchange trading schemes (Aldridge and Patterson 2003). Second, *technical constraints* on most waste treatment technologies affect what goes in and out of them. Not all technologies can cope with all materials, and often choices have to be made as to which element is to be maximized: energy generated or waste treated. Third, *sociotechnical constraints* are central to this provocation in terms of how materials and processes are classified and what those classifications enable or inhibit. Similarly, the financial devices that frame and drive these processes often determine how they operate: economies of scale and shareholder imperatives undermining a moral/environmentally-framed prescript of reduction and local operations. These three considerations are often occluded when considering resource and energy management. The remainder of this paper discusses these technical and sociotechnical constraints within a context of uneven material, social, and financial geographies.

Energy, Waste, Resources—and Proximity

Technical Constraints

There are roughly three modes of waste treatment and disposal, some of which are only appropriate for organic waste. These are: rotting (composting or anaerobic digestion [AD] for organic waste); burying (landfill); and burning (incineration and more sophisticated forms such as pyrolysis and gasification that partly char material and produce a synthetic gas called syngas). We could add here "containing" or "storing" as a subcategory of burying where decisions about what to do with waste—typically toxic waste such as nuclear waste—are postponed or temporally displaced. This has not always been a successful strategy; containment technologies do not necessarily weather well and can leak into the present (Gille 2007; Brown 2013).

All technologies (other than postponement) take waste in and produce some form of energy: biogas from AD, methane from landfill, and heat or syngas from incineration. All of them, except landfill, require some kind of technological treatment for the waste *before* the technology and sometimes *afterwards* if by-products are to be usable; for example, autoclaving digestate to be spread on fields to ensure persistent organic pollutants and heavy metals have been eradicated. Most treatments produce one or more by-products, which in turn require "treatment" to render them safe, compact, saleable, recyclable, etc. As materials process through this efflorescence of treatments, their capacity for value extraction, in the broadest sense, is steadily reduced until finally the landfill receives the compressed husks of char, ash, and fiber. After nine recycling iterations, for example, the best quality wool is nothing but dust.

Shifting the emphasis from waste treatment and disposal to energy changes the picture. Incineration produces heat directly through combustion. Other waste-to-energy technologies produce heat and combustible fuel (methane) that can be converted to electricity or heat. Technologies are being improved all the time. However, most operate better with a constant volume of inflowing material. The need for steady flows is accentuated in non-mechanical treatments where microorganisms require the right substrate conditions to multiply and digest waste. Starting up an AD plant requires a degree of care. Sudden shifts in volume or shutting down and starting up again is not easy to do.

The extent and quality of the gas produced depends on the volume and composition of the waste feedstock technology. Quality refers to first, how clean it is—hydrogen sulfide, siloxanes, and carbon dioxide have to be removed in order to upgrade the biogas—and second, how much energy it contains. The greater the calorific content going in, the better quality gas produced. Optimum feedstock is organic in origin (e.g., paper, wood, food, crops) and preferably has not been through any processes that have already extracted some energy. Slurry, therefore, while the most common reason for farms having AD plants on site, releases relatively little and poor quality biogas, as the organic matter that went into the cow has already had much of the energy removed by the cow's own digestive processes. Arguably, a cow is a living anaerobic digester.

Farmers therefore have to consider whether their AD plant's primary purpose is to contain and treat on-site slurry for intensive farming, or to generate energy. If the latter, the output is improved by the addition or co-digestion of other organic material such as maize or crops rejected by supermarkets as aesthetically imperfect. At the other extreme, of course, high-calorific crops are grown exclusively to produce energy, raising questions about trade-offs between food and energy security.

Energy via biogas is not the only output. AD also produces digestate, which is akin to a fertilizer and a fibrous matter for which many ideas have been suggested but none as yet commercially implemented. This is therefore a residual by-product currently landfilled.

Research is underway to team pyrolysis with anaerobic digestion, to "disappear" that last bit of waste and, it is claimed, produce more energy, but the syngas produced by feeding fibrous residue from AD plants into pyrolysis plants is negligible in terms of energy quality. This means that if incinerators or indeed syngas technologies are only fed residual waste, after extensive recycling of paper products and diversion of organic wastes to AD and composting plants, then the energy they produce is of lower calorific content. A further nuance is that "burning" technologies operate more efficiently and effectively with dry feedstock.

If waste treatment technologies are to produce energy, they therefore need high calorific inputs. Arguably, this works against recycling paper and reducing organic waste *tout court*. One way forward here is to develop the technologies that use these fuels so they require less energy for their own operation, thus releasing more surplus energy. Or to recast those principles of reducing waste and increasing energy production as a balancing act or a question of choice, rather than an unproblematic, beneficial solution, where one is elided with the other.

However, there are other kinds of technologies that are locking in place particular approaches to those opening propositions: legal restrictions and penalties on the one hand and financing mechanisms on the other. It is these sociotechnical obstacles that, added to the technological requirements for high calorific composition and volume, start to alter the picture of energy from waste as a straightforward win-win response to those opening axioms.

Sociotechnical Constraints (1): Classification

Considerable work is required to transform byproducts of waste treatment technologies to "goods": they have to shift categories from "waste" to "commodity." Waste is typically hedged about with restrictions on handling, movement, and transferability. Commodities are mobile; they can be moved, sold, and bought. Classifications do things. In order for this to happen with new by-products, as AD was getting off the ground in Britain for example, there had to be quality protocols and certificates and then effectively the manufacture of a green energy market via government subsidies, "renewable offset certificates" (Reno 2011b). Still, the British government's resistance to underwriting these ventures and the cost of connecting to the grid, rather than simply establishing a plant, has slowed progress in developing AD plants—unlike Germany where state support is stronger (Weiland 2000).

Sociotechnical Constraints (2): Financing

The British government's response to the 1999 EU Landfill Directive (EU 1999) was first to pass to local authorities both the responsibility for responding to the directive and potential penalties for failure to meet targets. Having said it was up to local authorities to find ways of reducing biodegradable waste going to landfill, the government's second move was to make billions of pounds available for them to spend on private finance initiatives (PFIs) for municipal waste management.

PFIs began in the UK as "public-private partnerships" in 1992. They are a way of creating large public projects with private capital, effectively outsourcing risk to the private sector and enabling a cash-strapped government to continue investing in infrastructure (Froud 2003). They are grounded on the assumption, not always correct, that the private sector is *ipso facto* more efficient and effective at delivering and running assets and services. They have also been described as a public accounting trick, simply hiding public debt "off balance sheets." They have created considerable controversy as services have not only not improved but have sometimes had to return in-house after massive failures or costs have mounted to keep profit margins steady. Nevertheless, they continue and have indeed expanded (Campbell et al. 2012). PFI contracts are long-term; waste management contracts, in particular, are often at least 25 years in duration to enable huge capital investment in infrastructure to be recouped. This encourages inflexible technological lock-in.

Waste management contracts are typically premised on the following income streams: energy produced and waste diverted from landfill and treated, including recycling or selling collected materials for recycling elsewhere. The central block of many such contracts is a large-volume energy-from-waste incineration plant. Indeed the word "waste" has all but disappeared. Instead, a common sight are lorries emblazoned with "green energy" trundling through cities and "Green Energy Plant" or "Renewable Energy Plant" signing the way to landscaped gardens and ponds surrounding architect-designed, low environmental/aesthetic impact buildings where energy is produced, usually by incineration, sometimes by biomass conversion. Waste, it might seem, has all but disappeared. It has become a feedstock to create low-carbon energy, thus reducing reliance on carbon resources. Certainly, from the promotional literature of much energy-from-waste companies, it would seem that the challenges outlined in the opening propositions have been happily met.

Looking more closely at the contracts themselves complicates this assumption. These contracts are usually based on certain minimum quantities of waste being treated. Effectively then, the municipality is contracted to produce a given amount of waste. A second key income stream is from energy generated. Noting that volume and quality of energy outputs depends on feedstock composition, there is little or no incentive here to reduce organic waste. Indeed, interviews with one city council generated some confusion when they were asked about their strategy for increasing recycling rates: their answer had been to land a large PFI contract, financed by the government, centered on an incinerator that was in turn linked to a local heating system.

Indeed, to be sure of making the investment pay off, the catchment area has grown in some cases. Waste has been brought in from much further afield to keep levels up, and slowly contracts are being modified to include merchant or commercial waste alongside municipal, typically household waste (Alexander and Reno 2014). This is not only the case with incineration: organic waste can be brought in to anaerobic digestion plants (ibid.; Reno 2011a) and it is not only the case in Britain. Municipal waste is increasingly being shipped to Denmark and Germany to provide profitable waste disposal and energy feedstock. “Recycling” often translates into selling source-segregated materials on the open market for further disassembly and reassembly elsewhere (Alexander 2012). Thus the proximity principle goes out of the window in order to allow these investments to be profitable for the operator.

Conclusion

What then happens to those opening four principles? By recasting waste as a feedstock for energy plants and emphasizing energy outputs, waste is both “disappeared” and becomes essential. Indeed, as energy-from-waste plants grow in size and capacity (larger and larger incineration plants are being built in Britain) and more waste is brought in to feed the hungry plants, we might indeed say that we are on track towards an energy economy that demands more waste to be produced.

Bibliography

Aldridge, T., and Alan Patterson. 2003. "LETS Get Real: Constraints on the Development of Local Exchange Trading Schemes." *Area* 34 (4): 37–81.

Alexander, Catherine. 2009. "Illusions of Freedom: Polanyi and the Third Sector." In *Market and Society: The Great Transformation Today*, edited by Chris Hann and Keith Hart, 221–39. Cambridge: Cambridge University Press.

———. 2012. "Economic Valuations and Environmental Policy." In *A Handbook of Economic Anthropology, Second Edition*, edited by James G. Carrier, 451–68. New York: Edward Elgar Publishing.

Alexander, Catherine, and Joshua Reno. 2012. *Economies of Recycling: The Global Transformation of Materials, Values and Social Relations*. London and New York: Zed Books.

———. 2014. "From Biopower to Energopolitics in England's Modern Waste Technology." In "Energopower and Biopower in Transition," special issue, *Anthropological Quarterly* 87 (2): 335–58.

Bakker, Karen, and Gavin Bridge. 2006. "Material Worlds? Resource Geographies and the 'Matter of Nature.'" *Progress in Human Geography* 30 (1): 5–27.

Brown, Kate. 2013. *Plutopia: Nuclear Families, Atomic Cities, and the Great Soviet and American Plutonium Disasters*. Oxford: Oxford University Press.

Campbell, Denis, James Ball, and Simon Rodgers. 2012. "PFI Will Ultimately Cost £300bn." *The Guardian*, 5 July. http://www.theguardian.com/politics/2012/jul/05/pfi-cost-300bn.

EU. 1999. Council Directive 1999/31/EC (Landfill Directive), 26 April.

EU. 2008. Directive 2008/98/EC (Waste Framework Directive), 19 November.

Froud, Julie. 2003. "The Private Finance Initiative: Risk, Uncertainty and the State." *Accounting, Organizations and Society* 28 (6): 567–89.

Gille, Zsuzsa. 2007. *From the Cult of Waste to the Trash Heap of History: The Politics of Waste in Socialist and Postsocialist Hungary*. Bloomington: Indiana University Press.

Moore, Sarah. 2012. "Garbage Matters: Concepts in New Geographies of Waste." *Progress in Human Geography* 36 (6): 780–99

Reno, Joshua. 2011a. "Managing the Experience of Evidence: England's Experimental Waste Technologies and Their (Im)modest Witnesses." *Science, Technology and Human Values* 36 (6): 842–63

———. 2011b. "Motivated Markets: Instruments and Ideologies of Clean Energy in the United Kingdom." *Cultural Anthropology* 26 (3): 391–415.

Weiland, Peter. 2000. "Anaerobic Waste Digestion in Germany: Status and Recent Developments." *Biodegradation* 11 (6): 415–21.