RESPONSE TO ENERGY FROM WASTE

I read the excellent article *Recycling Household Waste* (*Ingenia* 62) with interest. As a former director of Manchester Waste (Viridor Laing), whose mechanical biological treatment plant was featured, there were a few background points not in the article which might interest your readers.

To start with, the recycling rate in the UK, at just over 40%, is poor compared with the rest of the EU. Germany, for instance, achieves over 70% with virtually zero landfill, and the UK is only mid-range in its recycling success compared with other EU countries. What Germany does with the remaining 30% is to put it through its energy from waste (EfW) plants – modern, well-designed incinerators with a heat-recovery element. This is an important component of an integrated approach to waste processing: just to consider recycling is only to take in part of the picture.

A decision as to whether to invest in EfW depends on the various fuel streams available and their calorific value (the amount of heat released by a substance during combustion). I recently visited an EfW plant in Lausanne, Switzerland, which operates in the middle of the town with no emission problems. I was surprised to see no materials recovery at the energy from waste plant, but only until I realised how high the calorific value of the waste was. It's a very complex model: by recovering the maximum heat from the waste they heat a large section of the town and therefore save fossil fuels; however, by not recovering more materials, they cause more manufacture of new products which uses energy to do so! The average calorific value of such rubbish is around 12,000 KJ/kg and they use that potential energy to district-heat the centre of the town. Landfill is virtually nothing as a result.

However, this approach would not work everywhere; in China, for instance, even after substantial economic growth, the average calorific value of rubbish across the whole country is only around 4,000 KJ/kg.

That then leads to the debate about whether more recycling saves the cost of virgin materials manufacture; more incineration might produce heat but increases the need to make more virgin materials. In the Manchester Waste project, the largest in Europe, both options were embraced to give a fully integrated solution, and the targets for that project are a 60% recycling rate by 2025, 90% landfill diversion by 2020 and zero landfill in the longer term. So far, they are on schedule to meet those.

Another important consideration for the UK is food waste. Although household food waste has been reduced by an estimated one million tonnes since 2006, we are still not processing around seven million tonnes a year generated by households. Furthermore, an estimated 90 million tonnes a year of animal waste from farms could be dealt with by anaerobic digestion, producing heat and power estimated at 3-5 TWh (1 TWh per year = 114 MW) of electricity – reducing greenhouse emissions.

In short, we have some way to go. One major holdup will be funding; the Manchester project cost £650 million and was financed largely by a private finance initiative (PFI) deal. If we are to make progress in the short term, the arguments against PFI or similar arrangements would have to be overcome.

Eur Ing Richard Groome
CEng FIChemE FRSPH

LETTERS

RESPONSE TO ENERGY FROM WASTE

I read the excellent article *Recycling Household Waste* (*Ingenia* 62) with interest. As a former director of Manchester Waste (Viridor Laing), whose mechanical biological treatment plant was featured, there were a few background points not in the article which might interest your readers.

To start with, the recycling rate in the UK, at just over 40%, is poor compared with the rest of the EU. Germany, for instance, achieves over 70% with virtually zero landfill, and the UK is only mid-range in its recycling success compared with other EU countries. What Germany does with the remaining 30% is to put it through its energy from waste (EfW) plants – modern, well-designed incinerators with a heat-recovery element. This is an important component of an integrated approach to waste processing: just to consider recycling is only to take in part of the picture.

A decision as to whether to invest in EfW depends on the various fuel streams available and their calorific value (the amount of heat released by a substance during combustion). I recently visited an EfW plant in Lausanne, Switzerland, which operates in the middle of the town with no emission problems. I was surprised to see no materials recovery at the energy from waste plant, but only until I realised how high the calorific value of the waste was. It's a very complex model: by recovering the maximum heat from the waste they heat a large section of the town and therefore save fossil fuels; however, by not recovering more materials, they cause more manufacture of new products which uses energy to do so! The average calorific value of such rubbish is around 12,000 KJ/kg and they use that potential energy to district-heat the centre of the town. Landfill is virtually nothing as a result.

However, this approach would not work everywhere; in China, for instance, even after substantial economic growth, the average calorific value of rubbish across the whole country is only around 4,000 KJ/kg.

That then leads to the debate about whether more recycling saves the cost of virgin materials manufacture; more incineration might produce heat but increases the need to make more virgin materials. In the Manchester Waste project, the largest in Europe, both options were embraced to give a fully integrated solution, and the targets for that project are a 60% recycling rate by 2025, 90% landfill diversion by 2020 and zero landfill in the longer term. So far, they are on schedule to meet those.

Another important consideration for the UK is food waste. Although household food waste has been reduced by an estimated one million tonnes since 2006, we are still not processing around seven million tonnes a year generated by households. Furthermore, an estimated 90 million tonnes a year of animal waste from farms could be dealt with by anaerobic digestion, producing heat and power estimated at 3-5 TWh (1 TWh per year = 114 MW) of electricity – reducing greenhouse emissions.

In short, we have some way to go. One major holdup will be funding; the Manchester project cost £650 million and was financed largely by a private finance initiative (PFI) deal. If we are to make progress in the short term, the arguments against PFI or similar arrangements would have to be overcome.

Eur Ing Richard Groome
CEng FIChemE FRSPH

If we are to have confidence in the operation of autonomous vehicles, it is imperative that the related issues of software quality and cyber security are properly addressed

SECURITY OF DRIVERLESS CARS

The article *When will cars drive themselves?* (*Ingenia* 61) drew some interesting letters of response in issue 62. Coverage of autonomous vehicles in the mainstream media is at best confusing and sometimes plain misleading. Confusion appears, in part, to originate from a failure to understand what autonomy means in practice.

A simple definition might be that when an autonomous vehicle is provided with a destination and perhaps a required arrival time, it is capable, without further human intervention, of carrying a load, passengers or cargo, to a destination. In fulfilling the task, the autonomous vehicle will have to travel in accordance with the Highway Code in the UK, adhering to speed and other traffic restrictions. In my opinion, a mass-market autonomous vehicle that safely and securely performs the above task is unlikely to be a reality for some considerable time.

In his letter, Christopher Poulin, Research Director at IBM, touched on the security issues. These go significantly beyond the familiar issues of confidentiality, integrity and availability of the data or information. We also need to consider other factors such as authenticity, utility, resilience and possession/control of the vehicle. For example, where the vehicle relies upon data or information from sensors, how does it establish whether the data is genuine? Spoofing of GPS signals can be done, so how would a vehicle handle a sudden shift in location? Would it simply re-plan its route, or would it malfunction, or come to an abrupt stop?

Poulin mentions the significant volume of computer code already present in many modern cars. Some of this resides in the various driver assistance technologies such as adaptive cruise control, anti-lock braking systems and electronic speed control. However, there is a large amount of code in the infotainment system, which is often at the heart of the various networks in the vehicle. The volume of code in this system is likely to grow significantly as vehicle manufacturers add further functionality and connectivity, and such complexity could lead to increased risk of cyber attacks.

If we are to have confidence in the operation of these autonomous vehicles, it is imperative that the related issues of software quality and cyber security are properly addressed. The BSI's PAS 754:2014 entitled *Software trustworthiness – Governance and management – Specification*, led by the Trustworthy Software Initiative, has a documented software governance regime which could, if appropriately implemented, lead to vehicle software being more safe, reliable, available, resilient and secure.

As part of this governance and type approval regime, we also need to give serious consideration to the capture of digital forensics information from modern vehicles in the event of a collision. This may necessitate the fitting of a 'black box' to record system commands and sensor data to assist collision investigators. Without such information, a collision between an autonomous vehicle and a non-autonomous vehicle is likely to turn into a protracted legal dispute.

An appropriate regulatory framework is needed to address all of these issues, and to ensure that engineers design autonomous vehicles with networks and software systems that are secure, joined-up and accountable.

Hugh Boyes CEng FIET
Principal Fellow
Cyber Security Centre, WMG,
University of Warwick