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## Monetising the impacts of waste incinerators sited on brownfield land using the hedonic pricing method

Monica Rivas Casado<sup>a</sup>, Jan Serafini<sup>a</sup>, John Glen<sup>b</sup>, Andrew Angus<sup>b,\*</sup>

<sup>a</sup> School of Energy, Environment and Agrifood, Cranfield University, Cranfield MK43 0AL, United Kingdom

<sup>b</sup> School of Management, Cranfield University, Cranfield MK43 0AL, United Kingdom

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## ABSTRACT

In England and Wales planning regulations require local governments to treat waste near its source. This policy principle alongside regional self-sufficiency and the logistical advantages of minimising distances for waste treatment mean that energy from waste incinerators have been built close to, or even within urban conurbations. There is a clear policy and research need to balance the benefits of energy production from waste incinerators against the negative externalities experienced by local residents. However, the monetary costs of nuisance emissions from incinerators are not immediately apparent. This study uses the Hedonic Pricing Method to estimate the monetary value of impacts associated with three incinerators in England. Once operational, the impact of the incinerators on local house prices ranged from approximately 0.4% to 1.3% of the mean house price for the respective areas. Each of the incinerators studied had been sited on previously industrialised land to minimise overall impact. To an extent this was achieved and results support the effectiveness of spatial planning strategies to reduce the impact on residents. However, negative impacts occurred in areas further afield from the incinerator, suggesting that more can be done to minimise the impacts of incinerators. The results also suggest that in some case the incinerator increased the value of houses within a specified distance of incinerators under specific circumstances, which requires further investigation.

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\* Corresponding author.

E-mail address: [a.angus@cranfield.ac.uk](mailto:a.angus@cranfield.ac.uk) (A. Angus).

## 1. Introduction

The waste hierarchy is the rationale that underpins most European waste legislation, such as the European Waste Framework Directive 2008/98/EC (EU, 2008). The hierarchy is based on the principle that prevention of waste is the most desirable form of waste management and disposal of waste in landfill without energy recovery is the least. There are a range of other management options between, such as incineration with energy recovery, also known as Energy from Waste (EfW). When waste avoidance and recycling opportunities are unfeasible EfW is the next best alternative.

In England and Wales compliance with European legislation has driven significant investment in waste management facilities that offer alternatives to landfill (Defra, 2014). In addition to the 30 incinerators currently operating in England and Wales (Defra, 2013), over 100 new incinerators are in the proposal or planning stage (UKWIN, 2015). Two major guiding principles of waste management strategy in England and Wales are that facilities should be located such that: waste is managed or treated as close as possible to its source; and that the environmental or social impacts of a waste management facility should be minimised (DCLG, 2015). These two principles have the potential to conflict, given that those who create waste are those that must be protected from the impacts of waste management.

This conflict has given rise to notable public protests where incinerators have been proposed near residential areas (BBC, 2015, 2013, 2012). This opposition arises partly because of the nuisances and risks associated with waste incineration (COWI, 2000; Eshet et al., 2005; Rabl et al., 2008; Defra, 2013). Incinerators share many of the same negative externalities as landfills including noise, unpleasant odour, windblown litter, dust, vermin, presence of seagulls, flies, traffic, visual intrusion and enhanced perception of health risks among local residents (Havranek et al., 2009). Thus, while the decision to site an incinerator requires a technical and spatial assessment it also remains a highly sensitive issue for local residents.

Considering where to site EfW incinerators requires an analysis of all costs and benefits associated with waste incineration. While the benefits of incineration are largely tangible, such as the monetary value of electricity generated and number of jobs created, many of the disamenities are not. To date, the literature has typically used the Hedonic Pricing Method (HPM) to monetise the negative externalities of waste management. The HPM uses housing market data to estimate the price individuals are willing to pay for a non-marketed quality (Lancaster, 1966), such as distance from a waste management site.

There is a clear policy and research need to balance the benefits of EfW against the negative externalities experienced by local residents in a European context. Such analysis helps policy makers identify instances where EfW offers clear gains in social net present value and others where EfW is unsuitable and alternative waste management options should be considered. To meet this research need, this paper uses the HPM to quantify the impact of three EfW incinerators in England. In particular, the study focuses on the effect that these waste management sites have on property prices at three development stages: planning, construction and operational. The analysis processes over 55,000 transactions over a 20 year period.

To the authors' knowledge this is the first European study on incinerator negative externalities that adopts a HPM approach using such a large volume of data. Although this study focuses on sites in England, the results have relevance to other countries with duties to comply with EU Waste Regulations. This study also has international relevance, offering another comparison measurement of the cost of the negative externalities of incinerators, as

well as an analysis of whether spatial planning provides a useful option for waste management.

## 2. The impacts of EfW incinerators on house prices

Compared with research estimating the negative externalities landfill sites (Braden et al., 2011; Ham et al., 2013; Owusu et al., 2014), the negative externalities of waste incineration have received less attention. The results from many studies that monetise the negative externalities of incineration, such as Kiel and McClain (1995a,b) are based on impacts from relatively less advanced incinerator technology. Emission control technology has improved significantly over the intervening period (HPA, 2009), but less research has been undertaken on the impacts from recently built incinerators. Several other studies (Kohlhase, 1991; Deaton and Hoehnb, 2004; Kiel and Williams, 2007) focus on hazardous waste sites, which, owing to the intrinsic toxic characteristics of the waste are expected to generate stronger negative impacts on local properties relative to municipal and/or industrial waste processing sites (Braden et al., 2011). This study focuses entirely on municipal waste sites, which are more common, and as such the impact of the disposal of toxic waste is outside the scope of this paper.

All European empirical studies that investigate the cost of externalities associated with proximity to incinerators focus on UK sites. Pragnell (2003) used the HPM to assess the monetary impact of proximity to 10 UK EfW incinerators. Their results show that incinerators had a negative effect on house prices up to 1.6 km from the incinerator. Between 0.4 km and 1.6 km the impact on house prices declined with increasing distance from the incinerator, eventually reaching zero at 1.7 km. The results from Pragnell (2003) must be treated with caution. Firstly, the study only considers housing transactions in the fourth quarter of 2002. This is opposed to Kiel and McClain (1995a,b), who use a continuous time series. Furthermore, the study assumes neighbourhood characteristics are homogeneous across different sites. Thus, the research excludes other factors, such as quality of schools or crime rates, which could affect house prices. Finally, the study uses data from the UK Land Registry transaction dataset. This dataset excludes some critical housing characteristics, such as, number of bedrooms and bathrooms, property and garden size, access to parking and garage, which can explain approximately 60% of price variance (Cambridge Econometrics, 2003).

Phillips et al. (2014) provides the most recent research on the impact of UK EfW incinerators on property prices. They investigated three existing facilities that began operations between 2000 and 2004, organising data into five 1 km radius bands from the centre of each site. The analysis adopted an approach similar to the repeat sales method (OECD, 2013), only considering houses that sold twice during the period: once before the facility was operational and once after. The results show that houses around two of three incinerators (Kirklees and Chineham plants) experienced an increase in price after the facility became operative. Property values within 1.2 km from Marchwood incinerator, the largest and most visually intrusive of the facilities examined by the study, were found to be lower after the facility became operative. However, none of these results were statistically significant ( $\alpha = 0.05$ ). Thus, all three incinerators were found to have no effect on local house prices.

Again, these results must be treated with caution. The repeat sales approach has some limitations. Houses that sell twice during a given period could have some intrinsic characteristics that differentiate them from houses that were only sold once (for instance, for refurbishment), leading to a sample selection bias. Secondly, this technique significantly decreases the number of available

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