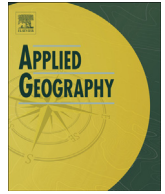




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# Examining the influence of settlement morphology and separation zones policies on the availability of shallow coal resources in the United Kingdom<sup>☆</sup>

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## ABSTRACT

In 2013, demand for coal in the UK was 60 million tonnes. Of this, 12.7 million tonnes (21%) came from indigenous sources; the majority of which was from surface mining (8.6 million tonnes). Many planning applications for surface mining of coal and the coal extraction that follows, are often a source of conflict with the communities who live within shallow coalfield areas. Policies which enforce a gap, or 'separation zone', between communities and surface coal mining operations exist in Wales and Scotland, but do not exist in England. This paper examines the effect of applying separation zones on the availability of shallow coal resources within two study areas; one within the South Wales Coalfield, the other within the Midlands Coalfield (comprising the Yorkshire, Nottinghamshire and North Derbyshire Coalfield areas). Density profiles and a shape-index algorithm are used to compare and contrast settlement morphology (i.e. shape or footprint) and distribution to determine whether they have a bearing on the areal extent of any potential separation zone applied. The implications on the availability of shallow coal resources of applying different separation zone distances around settlements within these two areas are explored. Results reveal that although the settlement morphology is important in determining the area of the separation zone, and has greatest influence in the South Wales Coalfield, the area of coal resource sterilised by the application of separation zones is greatest in the Midlands Coalfield due to it having a higher proportion of urban development situated on the surface extent of the shallow coal resource.

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## 1. Introduction

### 1.1. Coal production in the UK

The UK has a long history of coal production, reaching a peak of 287 million tonnes in 1913. Thereafter output declined, due in part to loss of export markets during, and subsequent to, the First World War. Despite this decline, coal remained the UK's most important

primary fuel until 1971, when it was overtaken by petroleum (Chapman et al., 2006). The UK remained a net exporter of coal until early 1983 (British Geological Survey, 2010). After that date, mine closures caused output to fall and imports rose rapidly. This decline was accelerated in the 1990's due to the 'dash for gas' which resulted out of concerns about carbon emissions and climate change, as well the exhaustion of reserves in older pits and the lack of (capital) investment to develop new ones during a period of environmental and policy uncertainty (UK Minerals Forum, 2014a). In 2001, imports exceeded indigenous production for the first time; a trend that has continued to date (Fig. 1).

In 2008, the British Government introduced the Climate Change Act which set a legally binding target of reducing the nation's CO<sub>2</sub> emissions to at least 80% of the 1990 baseline by 2050 (British Parliament, 2008). The Energy Act 2013 introduced a switch in the main sources of electricity generation away from dependence on fossil fuels to lower carbon generation (TSO, 2013). This means that any future long term use of coal for energy production would, therefore, need to be tied to Carbon Capture and Storage (CCS)

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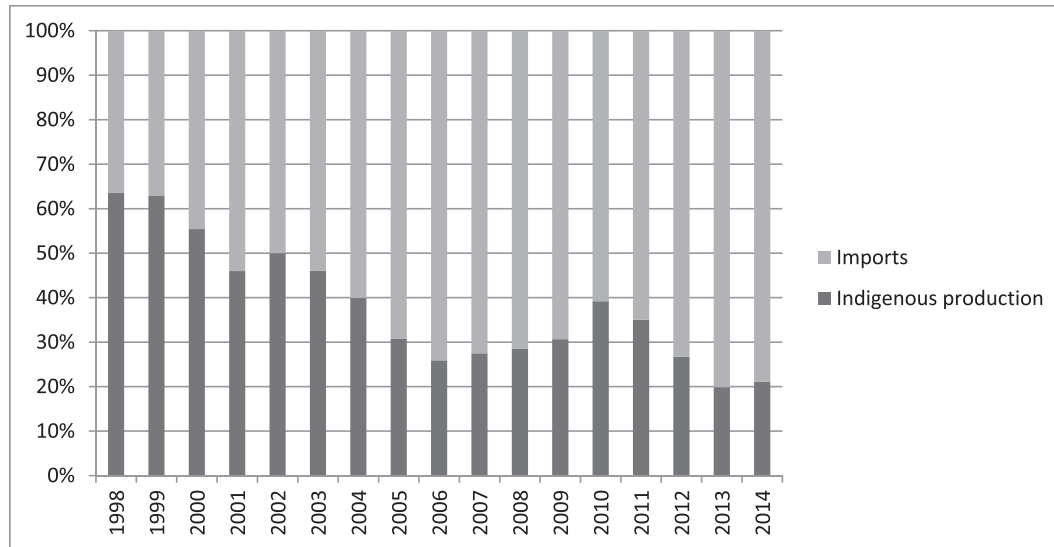


Fig. 1. Percentage supply of coal from imports versus indigenous production in the UK from 1998 to 2014. Source: DECC (2015a).

technology (UK Minerals Forum, 2014b; Hammond & Spargo, 2014). Furthermore, the effects of the Large Combustion Plant Directive (LCPD) (2001/80/EC) issued by the European Parliament in 2001, which requires member states to legislatively limit emissions of sulphur dioxide, nitrogen oxides and dust from combustion plants with a thermal capacity of 50 MW or greater, are now coming in to force. Under the terms of the LCPD, combustion plants licensed before 1st July 1987 can either opt to comply with the emissions limits or 'opt out' and close by the end of 2015. The remaining plants are subject to the LCPD and must comply with specific emissions limits (DEFRA, 2010). In the UK, several core coal-fired power stations have 'opted out' of the LCPD. The 'opt out' option was the preferred option for many power plant operators, where the investment required to meet the new emissions limits was not considered to be viable.

In 2013, demand for coal in the UK was 60 million tonnes. Of this, 12.7 million tonnes (21%) came from indigenous sources; the majority of which was from surface mining (8.6 million tonnes) (DECC 2014a; 2014b). During 2013 a number of deep mines closed (including the Daw Mill Colliery in Warwickshire after a major fire) and some surface mines went into liquidation. In 2014, electricity generation from coal in the UK fell by 36%, as several plants closed or switched to predominantly burn biomass (DECC, 2015b). The closure of three other deep coal mines in 2015: Hatfield (June 2015); Thoresby (July 2015); and Kellingley (December 2015) means that the UK no longer mines deep coal.

Despite these closures, increasing demand for electricity is likely to mean there will remain a market (albeit declining) for coal for power generation in the UK for at least the next 20 years (UK Minerals Forum, 2014a). In particular coal produced at surface, remains an important part of the energy mix in the UK today (Figs. 2 and 3). The UK remains heavily reliant on coal, in particular, to meet its energy needs during the winter months where 44% of electricity generated is from coal (UK Minerals Forum, 2014a).

Extensive resources of coal, both near surface and underground, still exist within the coalfield areas of the UK (Fig. 4). However it is unlikely that any new deep mines would be economically viable in the immediate future; therefore interest in coal extraction will be mainly confined to shallow coal resources that can be worked by surface mining methods (British Geological Survey, 2010).

## 1.2. Separating communities from coal working

Although several developed countries around the world utilise policies which seek to protect mineral resources from incompatible development (Wrighton, Bee, & Mankelov, 2014;; Wagner, Tiess, Solar, & Nielsen, 2006) it is not apparent that many have introduced planning policies which enforce gaps, or 'separation zones', between surface mining and residential settlements. Western Australia (WA) provides a rare example outside of the UK where separation zones (or in this case Special Control Areas) for the extraction of 'basic raw materials' have been implemented (Western Australian Planning Commission, Department of Planning, 2016). Although not specifically related to surface mining, Queensland, Australia also provides an example of where separation zones (or buffer areas) are applied through policy to separate 'good quality agricultural land' from encroachment by residential activity in a similar manner to the adoption of mineral safeguarding in the UK. (Department of Natural Resources, Queensland, 1997).

Within the UK, actual separation zones have been recommended by the Welsh Assembly Government through Minerals Technical Advice Note (MTAN) 2: Coal (2009) and by the Scottish Government in Scottish Planning Policy (SPP, 2014) to help protect communities from the impacts of surface coal working. The Welsh MTAN (2009) specifically states that "coal working will generally not be acceptable within 500 m (m) of settlements". Whilst in SPP (2010) "Surface coal extraction is unlikely to be environmentally acceptable if proposed site boundaries are within 500 m of the edge of a community". Whilst the SPP and MTAN do not preclude coal working within a separation zone, given the wording of the respective policies, obtaining permission for coal working within these areas will be more difficult. Although there is no equivalent coal separation zone policy in England to date, a Private Members' Bill - Planning (Open-cast Mining Separation Zones), was introduced to the House of Commons on the 30 June 2010 proposing a 500 m separation zone in England. Its second reading occurred on 11 February 2011 (House of Commons, 2011a, 2011b). The Bill failed to complete its passage through Parliament before the end of session and therefore made no further progress, meaning that there is no equivalent 'enforced' separation zone policy in England.

Despite the limited examples of separation zone policies being

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