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# Heat recovery potential of mine water treatment systems in Great Britain

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## Abstract

Treatment of pollution from abandoned coal mines often requires significant inputs of electrical power, particularly at sites where long-term pumping of mine water is required. Given the large fossil fuel generation element of the UK electricity supply network, this has a direct impact on carbon emissions. The potential for recovery of low enthalpy heat at mine water treatment sites in Great Britain, such that they could become net sources of energy during operation, rather than consumers, was explored using data from April 2014 to March 2015. To do this, an inventory of coal mine water treatment systems across England, Scotland and Wales was first collated, including key variables for each site. The heat energy which could potentially be recovered was then assessed against the energy consumption of each site and reviewed at a national scale. It was found that 47.5MW of thermal energy was available for recovery from mine waters, compared to 2.3MW of electrical power already committed for pumping and treatment of these waters. Recovery of thermal energy might be achievable by the use of heat pumps for space heating of nearby properties. Yet, because of the high carbon cost of UK grid electricity required to power heat pumps, this approach would offer only very modest CO<sub>2</sub> savings over domestic gas central heating. Calculations made in this paper suggests that just 0.33kt CO<sub>2</sub> savings are achievable using this approach, compared to existing emissions of 10.8kt CO<sub>2</sub> entailed by the pumping and treatment sites themselves.

## Keywords

renewable energy, mine water treatment, geothermal, ground source heat, acid mine drainage

## 1 Introduction

Widespread closure of coal mines in Great Britain occurred in the latter part of the 20<sup>th</sup> Century. The subsequent flooding of mine workings, and recovery of mine water levels, gave rise to polluting surface discharges in the vicinity of many abandoned mines (Younger, 1997; Henton, 1981). Elsewhere, monitoring identified that rising water levels were at risk of causing outbreaks at the surface or pollution of groundwater in overlying aquifers (e.g. Neymeyer et al., 2007; Younger, 1993). The Coal Authority, an organisation statutorily responsible for managing the legacy of abandoned coal mines in Great Britain, currently operates 64 pumping stations or treatment systems to tackle this issue. Research efforts have largely focused on improving treatment technologies and lowering operating costs in order that this legacy can be effectively managed with a lesser financial burden on the taxpayer.

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