How the legacy of dirty coal could create a clean energy future

January 19 2018, by Amin Al-Habaibeh

Credit: Kelly from Pexels

Energy from coal is now being linked to global warming and pollution on a global level. In fact, it has been estimated that coal contributes to 25% of green house gases.

Coal use has caused severe negative environmental impacts, from its mining and processing, to its transportation and combustion, leading to high levels of pollution. In October 2017, a United Nations weather agency report indicated that levels of carbon dioxide surged at "record-breaking speed" compared to 2016.

Around the world, coal mining contributed historically to the industrial revolution and played an important part in the development of modern society. But many mines have since been closed in the UK and Europe. In the UK, this led to hard financial times and unemployment in many communities, including the miners' strikes of the 1970s and 1980s, an impact recorded in the 1996 movie Brassed Off.

But what happens *inside* the coalmines after their closure? Surprisingly, most disused coalmines start producing methane – known as Coal Mine Methane (CMM) – which can be a clean source of energy. It can be used to generate electricity via gas engines or, with some technical processing, be fed into the gas grid. Over time, however, the mines will begin to fill with water and the methane will almost entirely disappear.

Water, water everywhere

But this will create yet another opportunity. The UK's historic coal mines have an approximate residual void space of a billion cubic metres. When flooded, that's the equivalent of 400,000 Olympic swimming pools of water at a stable temperature. This vast volume of water can be used for efficient heating and cooling applications and reduce carbon emissions.

But how? A recent publication by the team at Nottingham Trent University explains. The water in the coalmines is generally at a stable temperature – normally between 12C and 20C depending on the location – which makes it perfect for warming, or cooling, buildings or industrial processes.

We developed and tested a new technology for several years using two systems, one at Markham Vale and one at the National Coal Mining Museum for England, and found it can use this water to provide green, sustainable energy to homes and businesses in the UK.

Opportunities and challenges

The technology, which is based on using water source heat pumps, is simple and straightforward and works along similar lines to a refrigerator or air-conditioning system. It produces no noise or local air pollution and is also three or four times more efficient than a standard electric heater or gas boiler.

To understand how heat pumps in general work, consider the refrigerator in your kitchen. This extracts the heat from the food and drinks inside it, and diverts it into the surrounding environment via a condenser (which is simply a radiator) on the fridge's exterior. Our technology employs a similar system. In this case, we extract the heat from the coalmine water and use it to warm buildings.

In the UK, coal mining technology programmes already pump nearly 112m megalitres of water for environmental reasons, such as avoiding the pollution of drinking water, springs and rivers. The new technology could use this water, which is being pumped anyway, potentially generating 63 megawatts of heat per year.

But the technology has its own challenges, specifically a lack of investment and "champion" organisations to lead the process. In part, this is because it remains a little-known or understood technology by many investors.

There is also a lack of a clear model to follow in the UK when implementing new technologies such as this, not just commercially, but

contractually and legally as well. Most housing developers in the UK and Europe, for example, prefer to rely on well-established technologies such as gas boilers or electric heaters, even in areas where coalmines are available. If such new, green technologies are to succeed, comprehensive strategies are needed to get developers – and the general public – on board.

Hot topic

On the positive side, the technology can be integrated with other heating technologies, and in many cases existing building infrastructure can be used to implement it. The technology can also reduce carbon emissions and energy use and support compliance with the EU Energy Efficiency Directive and UK ESOS regulations.

We also have excellent, large-scale case studies, showing how effective it can be. In Asturias, north-west Spain, for example, a hospital and a university building are already being heated using coalmine water.

Our research shows this technology could give the world's disused coal mines a new, green, lease of life. What a fitting legacy for the industry that would be.

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