

Ultra-clean coal – Could the price now be right to help fight climate change?

March 13 2006

A new chemical process for removing unwanted minerals from coal could lead to reductions in carbon dioxide emissions from coal-fired power stations.

There is already a way of burning coal in a cleaner, more efficient fashion that would reduce carbon dioxide emissions: this is where the coal is turned into a gas and used to drive a turbine. However, problems with cleaning the coal before it is burnt have made generating electricity in this way very expensive. This new chemical process could make it more commercially viable.

Under development by a University of Nottingham team with EPSRC funding, the new approach involves using chemicals to dissolve unwanted minerals in the coal and then regenerating the chemicals again for re-use. This avoids the expense of using fresh chemicals each time, as well as the need to dispose of them, which can have an environmental impact. By removing unwanted minerals before the coal enters the power plant the new process helps protect the turbines from corrosive particles.

The aim is to cut unwanted minerals in coal from around 10% to below 0.05%, making the coal 'ultra clean'. Removing these minerals before using the coal to generate power prevents the formation of harmful particles during electricity production. To do this, the team is using specific chemicals to react with the minerals to form soluble products which can be separated from the coal by filtration. This process is known as 'leaching'. Hydrofluoric acid is the main chemical being tested.

The chemicals not only dissolve the minerals but are also easy to regenerate from the reaction products, so they are constantly recycled. It is this aspect that has largely been overlooked in past research, but is virtually essential if chemical coal-cleaning is to be environmentally and commercially viable.

Dr Karen Steel of the School of Chemical, Environmental and Mining Engineering is leading the project. "A lot of research took place in the 1970s and 1980s to see if coal-cleaning was viable," she says. "The conclusion was that it was too expensive. With the environment high on the global agenda and coal certain to remain a key energy source for decades, it makes sense to see if the perception is still justified today."

If it proves technically viable and economically competitive, the new process could help ensure that world coal reserves are harnessed with less impact on climate change.

The new process could also help ensure commercial take-up of high-efficiency "combined cycle" power technologies, which have potential to deliver significant carbon dioxide reductions. A combined cycle uses both gas and steam turbines to produce electricity, with the waste heat from the gas turbines used to heat the steam turbines. By increasing generating efficiency, this reduces both the amount of fuel required and the emissions produced per unit of electricity generated.

In combined cycles where coal is gasified ('coal gasification'), mineral matter in mined coal gives rise to corrosive particles in the gas, causing severe damage to the turbine that generates electricity. There are two ways of protecting the turbine – removing the particles from the gas before it reaches the turbine, or removing unwanted minerals before the coal enters the power plant. The new process focuses on the second option.

Coal gasification involves the use of steam to turn coal into the gases carbon monoxide and hydrogen. These are then combusted in a gas turbine, offering efficiency gains that reduce the amount of carbon dioxide produced by 30-50%, compared with conventional coal combustion.

Potential uses for ultra-clean coal, apart from power generation, include production of heavy fuel oil, graphite and carbon fibres. Dr Steel's research has further benefits. As the chemicals are being regenerated, valuable additional products are made, e.g. pure silica – a raw material used in the manufacture of a huge range of products such as silicon chips and solar cells. The ultra-clean coal itself also has non-fuel uses. As a raw material for manufacturing high purity carbon-based products, e.g. electrodes for the aluminium industry, it could act as a substitute for oil.

Source: Engineering and Physical Sciences Research Council

Citation: Ultra-clean coal – Could the price now be right to help fight climate change? (2006, March 13) retrieved 10 April 2024 from <https://phys.org/news/2006-03-ultra-clean-coal-price-climate.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--