Methane: from Pollution to Solution

In the People's Republic of China, an experimental project to capture methane gas from coal mines and burn it for fuel is reducing greenhouse gas emissions and providing a low-cost, high-quality fuel to the people of Jincheng.

Jincheng, People's Republic of China - Wei Jiusheng drives a methane-powered taxi and earns about CNY3,000 a month, substantially more than most drivers in his city.

When Wei drove on gasoline, he said, filling the fuel tank was so costly, he was barely able to support his wife and child. When he learned that he could save money by using methane gas, Wei, 27, converted his old car.

To reduce air pollution and promote the use of methane gas, the municipal government later made it mandatory for all taxis and buses in Jincheng to be converted to bi-fueled vehicles, with gasoline to be used only as a backup fuel.

Many owners of private vehicles have also switched to bi-fueled cars because this cuts their fuel expenses in half.

Transforming Methane

The People's Republic of China (PRC) is the largest coal producer and consumer in the world, getting more than 70% of its energy from coal. Coal is the dirtiest fossil fuel and a major cause of methane gas emissions, a greenhouse gas 21 times more potent than carbon dioxide.

In the PRC, more than 13 billion cubic meters of methane are released into the atmosphere each year. As a result, about 60% of cities do not meet minimum standards for air quality, and acid rain falls on about a third of the country.

Methane gas is found naturally in coal beds. But it is highly explosive: every year at least 5,000 miners die from mining accidents in the PRC, mainly caused by methane explosions. To keep working conditions safe, methane needs to be drained during, and sometimes before, underground coal mining operations.

When captured, methane is a clean energy source: its use does not produce soot or lead to acid rain; it has the highest energy content of all fossil fuels; it is the main constituent of natural gas, one of the cleaner energy sources; and its use can replace the burning of coal, wood fuel, synthetic waste gas (a low-energy mixture of coal and biomass or municipal waste), and petroleum-based fuels.

The removal of methane from coal mines increases coal mine safety and efficiency, reduces greenhouse gas emissions, and improves air quality.

Using Methane Efficiently

To meet the government's commitment to address climate change by developing clean and renewable energy as an alternative to coal, the country's Eleventh Five-Year Plan (2006-2010) aims to cut pollution by 10% and reduce energy intensity by 20%.

But the question is: what will be the most efficient way to do so?

In 2004, the Asian Development Bank (ADB) approved a US$117.4 million loan for the Coal Mine Methane Development Project in Jincheng to demonstrate how new technologies can increase the production and use of methane.

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Merlita Pajarillo, energy specialist, Energy Division, East Asia Department, ADB
released through bore holes drilled from the surface into underground coal seams.

The ADB-supported project captures and produces CMM for a 120-megawatt power plant - the world's largest methane power plant, which transmits and distributes CMM to residential, commercial, and industrial consumers in Jincheng. Coal bed methane is produced mostly for transport fuel supply.

By capturing methane, the project will reduce methane emissions by 265 million cubic meters, which is equivalent to 4.4 million tons of carbon dioxide emissions, and will save over 430,000 tons of coal per year, experts say.

The project will benefit from the sale of carbon credits under the Clean Development Mechanism - an agreement under the Kyoto Protocol that allows industrialized countries with a greenhouse gas reduction commitment to invest in ventures that reduce emissions in developing countries as an alternative to more expensive emission reductions in their own countries. The sale of carbon credits under this mechanism will bring in an estimated total revenue of over US$100 million by 2012, which can offset the cost of the power plant.

Consistent, Even Supply

Jincheng East Glassware Company, one of the industrial users which benefits from the project, upgraded their four furnaces in 2008 from coal to methane gas. Each furnace saves the company about CNY1,000 (US$147.05) per day, compared to the cost of burning coal.

"More importantly, the production quality has improved as the temperature of furnaces has stabilized with consistent gas supply," said Li Yuqing, general manager of the company.

The temperature of the methane gas-fueled furnaces fluctuates by only 10-degrees celsius, while coal-fueled ovens fluctuate much more. As a result, said Li, methane gas ensures that the glass melts evenly, without creating imperfections, such as bubbles, in the glass. Also, due to the even burning of the methane gas, Jincheng East Glassware Company uses its raw materials 20% more efficiently, wasting less in the glassmaking process.

In addition, switching from coal to gas has improved air quality in the workshops, greatly reducing the incidence of respiratory disease.

The three-star Grant Guesthouse on the main street of Jincheng has replaced its coal-burning boiler for heating and cooling with a gas-fueled boiler. It upgraded its kitchen equipment at the same time. These changes reduced costs, increased efficiency, and improved working conditions. Also, because they are better able to control temperatures, chefs do not have to worry about over- or under-cooking their dishes.

According to Wang Keping, director of Jincheng Finance Bureau, CMM has been distributed to 80% of Jincheng households since the end of 2008.

The average annual cost for gas supply is CNY350 per family, instead of CNY2,000 for coal. "It not only reduced households' expenses, but also liberated women from time-consuming cooking," Wang said.

Energy Impact: Taking the First Steps

According to the China Coal Information Institute, a government think tank, 4.3 billion cubic meters of methane were captured by coal mines in the PRC in 2007. Government incentives helped bring about this 26% annual increase in capture.

The jincheng municipal government plans to cover the whole city with CMM distribution pipelines to supply over 60,000 households with gas for heating and cooking by 2011. It will also provide compressed gas products to other places as far away as Shenzhen in southern PRC and Hong Kong, China.

"The success of this project in Jincheng will not only have significant impact on climate change and improvement of miners' safety and energy security, but demonstrates the great effort of the central and local governments along with corporate partnership to work effectively together toward a common goal," said Merlita Pajarillo, energy specialist in ADB's Energy Division, East Asia Department.

This effort is only the first step. It will establish a model for thousands of coal mines across the country, leading to cleaner air and a better environment for the people.
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