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Could technology open doors to a cleaner-burning future for coal?

Clean Coal Technologies and the University of Wyoming are collaborating on a cleaner, more efficient way for the US and the world to produce and consume coal

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The term ‘clean coal' has taken on various definitions over the years and has grown to encapsulate several ideas to better coal's environmental impact. At the heart of all of these solutions is the desire to reduce coal pollution, typically by recapturing carbon released as the product is utilised, or similar. For many, the idea of coal as a dirty word is changing.

Schmidt

While coal is here to stay for the foreseeable future, its future role in electricity generation rests largely on having the right environmentally friendly technology at hand. Imagine, then, the ability to take one of the lowest calorific value and lowest sulphur coals in the US - from the prolific Powder River Basin (PRB) region, which according to Clean Coal Technologies (CCTC) provides an estimated 30% of bituminous coal to the nation - and to use technology to raise the Btu (British thermal unit) content, thus allowing it to burn better and more efficiently. Imagine, too, if this technology could also be scaled for use globally.

It seems that image could soon become reality due to the work of New York-based CCTC, which has compiled many diligent years of work into a test facility that has raised enough attention from the industry that the majority of its funding needs have now been met. In April, the company announced it had selected a site near Gillette, Wyoming, to construct the plant and, with the help of its partner, the University of Wyoming, it is anxious to put the process on display and continue its scaling efforts.

As pointed out by CCTC's CEO Robin Eves, when the group first started looking at the history of clean coal technology, what it primarily found was a series of failed promises. Without proper scaling, a lack of expertise by some, missing stabilisation, and a focus only on financial elements, past projects went by the wayside. In fact, skepticism is what took CCTC as long as it did to hit its financial goals; with bad experiences suffered by some potential backers in the past, there was at first a natural hesitation.

What has set the development of CCTC's Pristine technology apart, aside from the company's tenacity, has been the design itself. Setting out with the targets of minimising the carbon footprint along with eliminating moisture and reducing transportation costs, the company conceived a way to extract volatiles, in a liquid form, from coals that are generally lower ranking in content, and, as a result, significantly more expensive to utilise.

This method thus mitigated the historical problems of typical coal dehydration. Consider a wet sponge: when it is squeezed, some or all of the water is removed, leaving empty pockets of air (and in the case of coal, introducing volatility).

With the innovation of Pristine, what's happening in the transformation involves only what's in the coal itself and there are no third-party materials introduced. The process also does more than just remove moisture, thus reducing the use

limitations, transport (of a now dust-free product) and environmental impact of a higher-quality coal.

"Once the moisture is removed from the targeted coal, the liquid volatiles are used through an 'absorption' process to fill the pores of the coal that has been dehydrated," CFO Aiden Neary says of the process. "Additional liquid volatiles are used through an adsorption process to coat the coal.

The result is a dramatic improvement in the coal ranking through increased caloric value (Btus), and a stable low-moisture dust-free feedstock for power generation."

The dryer, devolitiser and stabiliser (left to right) of the test plant facility

Work has not stopped with the site selection; in fact, it seems it is just beginning. Plans are in progress to look at byproduct extraction and methods to further enhance the product by continuing to increase Btu. CCTC is certainly in the perfect place for it, with PRB coal lending itself well to lower overall mining costs, though Neary stresses that the key is for the technology to be scalable to all coals, domestic and international.

It has had no shortage of interest from those wanting to visit the modular facility, once it has been completed at the University of Wyoming site, and test their own coal, including groups from the other side of the world.

"Everyone wants to see it working for themselves," Eves says, adding that two countries of the many which have turned their attention to the Pristine technology - some include India, China, South Korea, Japan and Taiwan - have already shown serious interest in having their own models of the plant.

In some cases internationally, the countries cannot continue to take on lower-quality coal, yet power plant numbers in those countries are rising. In addition to upgrading their own coals for more efficient use, the opportunity could also be

there for PRB coal to be exported to those destinations.

The modular design of the plant, Eves confirms, is less expensive and also quicker to scale, as the modules can be added to whatever capacity is required.

"Eventually modules will be very quickly and efficiently manufactured, whereas if you build a one-million-ton facility (2-3 years), there is not only the engineering and financial risk but also performance. If anything is wrong, you are stuck with it, whereas [with] modular you just repair or replace the faulty module," he explains.

"In addition, if you build a one-million-ton facility and then you need more capacity, you are committed to building another two- to three-year project to get to two million tons; you could be looking at 5-6 years."

CCTC and the university are aiming for the end of this year to have a fully operational second-generation pilot plant operation, or ready to come online, and testing PRB and foreign coals in preparation for the construction of plants on a commercial level.

The company has retained Kiewit to assist in some elements of executing the design plan. With the potential to turn a 30% moisture coal to 10% and simultaneously increasing its Btu by 35-40%, these efforts are worth the result and the impact the technology could have on the future of coal mining and use.

"This did not happen overnight," Neary says. "We want to help facilitate the need for coal, but in a positive manner." He also stresses that the US, at least, needs to realise that coal is not only a useful asset but also integral to the future. While data has shown coal's piece of the proverbial energy pie is falling, the amount being used is either steady or rising.

"Coal is abundant and relatively inexpensive ... most of its obstacles faced have been overcome at this point. Let's use it, responsibly, because it will continue to be used. We just want to help it be used better," Eves said.

University of Wyoming professor Richard Horner concurs; the institution's School of Engineering Resources has a commitment to supporting future technologies, in particular those for the state's vast coal resources, making the past year since inking a pact with CCTC an investment in the PRB and what's to come for clean coal and the environment.

"We're not only giving better value to current users, but we can also penetrate markets where higher Btu value coals exist and they don't purchase [those] lower Btu coals," he says, adding that plants are often designed for a certain type of coal, all in quite different markets, and may be able to seize an opportunity that could negate a need for upgrades.

"The holy grail is to take new market share for customers seeking higher Btu coals here and internationally. It's very promising where we are now, and [the university] is pleased to be collaborating with CCTC as they begin to scale."

About Pristine-M

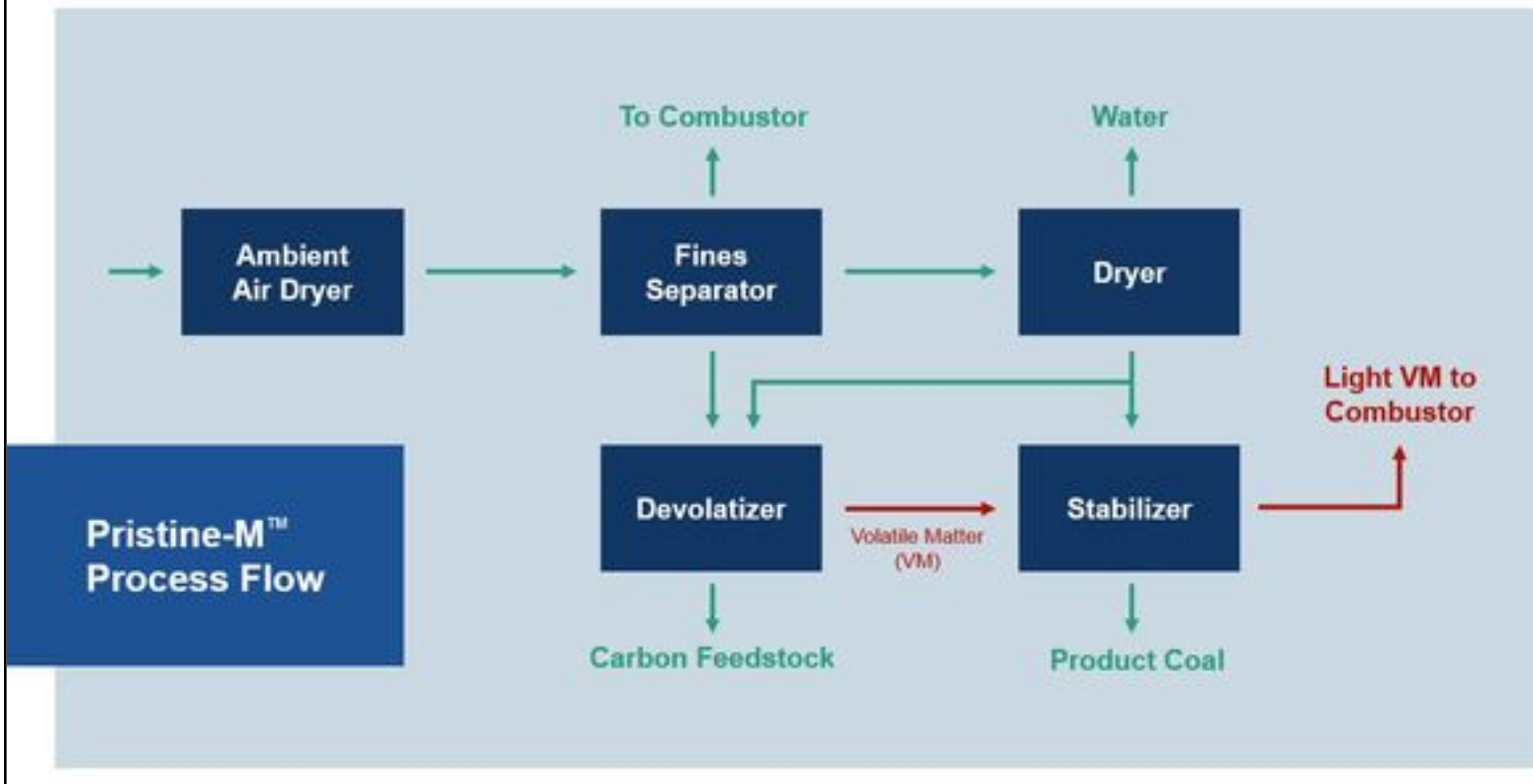
The concept of Pristine-M is to allow mines to generate coal-derived volatile gases from a slip stream of coal, then use those volatiles in CCTC's stabilisation process to render the dry coal structurally stable and hydrophobic with increased Btu content.

The company's technology, called Vapor Phase Deposition, causes the pores of dry coal to adsorb volatile matter, rendering it hydrophobic and boosting its heat value beyond what would be possible with moisture removal alone. At the end of the process, the coal is not only stable but also dust-free.

The pilot plant has a 2- to 3-US-ton-per hour (1.8- to 2.7-tonne-per-hour) capacity, a the commercial-scale module has been designed to handle 30 US tons (27.2t) per hour. Full capacity can be achieved by adding modules up to 1 million tons (907,000 per year, and even more if the client should require it.

The plant's design, which CCTC says is ideal for mine-mouth placement, includes a dryer, devolitiser and stabiliser. The first applies heat to remove surface and interna moisture and expose internal moisture pathways, while a side stream of coal processed into the devolitiser partially drives off volatile vapour; those vapours are preserved and then coated over the coal's outer surface later in the process. Finally at the stabiliser, most devolitised coal is fed into it and volatiles condensed from the devolatised coal; then is used to stabiliae the demoisturised coal (the Vapor Phase Deposition phase). The now stabilised, demoisturised and high-Btu coal is removed from the stabiliser, cooled and stored for later use.

Depending on the source coal, the processing takes between five and seven minute A variety of feed coals can be used, and about 25-45% of feed coal is consumed for the process (subject to the quality of the coal and desired output, according to CCT



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