COAL COMMINUTION WITH WATERJETS FOR DIESEL ENGINE POWER GENERATION

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In near term of the next few decades, coal will likely remain fundamental to supplying significant quantities of affordable electrical energy while other alternatives are developed. 50% of the U.S. domestic electricity is supplied by coal and that number is expected to increase as the U.S. has the world's largest reserves of coal. However, burning coal is not without drawbacks as its contribution smog, acid rain, and other air quality issues are well documented. By tapping the multi-disciplinary expertise at Missouri University of Science and Technology, certain technologies and equipment are coming to light that could be employed for mining and coal preparation to create a more valuable and cleaner product. Thus far, researchers at Missouri University of Science and Technology have evolved an efficient and compact method for rapid coal size reduction to the sub-micron level. In fact, the fine coal slurry has proved to be substitute diesel fuel in field trials.

The utilization of coal as a fuel for compression combustion engines has been a goal since diesel engines were invented by Rudolf Diesel. General Motors Corp. engineers began exploring the possibility of developing a coal powered engine in the late 1970's, when petroleum prices were skyrocketing. The use of powdered coal as a transportation fuel only became possible in the early 1970's with advanced milling techniques that produced much finer powders, reducing the size of the average coal particle from 57 microns to about 3 microns.

Coal comminution with waterjets to sizes below 1 micron has been successfully demonstrated at the Missouri University of Science and Technology laboratories. This improved method of comminution is promising for producing liquid fuel for compression combustion engines.

Coal preparation involves both comminution and contaminant removal with the one dependant, to a degree, on the other. Technologies for coal preparation differ as the particle sizes change. As the high density coal slurry is produced by introduction of coal into the cavitation chamber, inorganic mineral constituents are liberated along the grain boundaries of coal. This leads to a more straightforward separation process and can potentially lower the level of ash content, mercury, cadmium, arsenic and other toxic metals.

It is anticipated that the new diesel fuel derived from coal could be used to drive large diesel engines for power generation in stationary application. This would ease problems associated with fuel delivery and storage, emission control, and other infrastructure required to support commercial deployment of the technology.

Current research concerns optimum cavitation conditions required for coal comminution to sub-micron size. Future studies will include evaluation of environmental and economic benefits of alcohols and biofuels derived from the aqueous cavitation media with added the anticipation to leverage nanomaterials science research.