Ash Fuel Reburn and Beneficiation at We Energies

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We Energies has developed coal ash beneficiation processes for carbon and ammonia removal. These new processes have been demonstrated at various We Energies coal fired-power plants located in Michigan and Wisconsin. The processes take advantage of utilizing residual energy in high carbon fly ash and bottom ash; while also producing high quality fly ash for use as a supplementary cementing material for the concrete industry. These beneficiation processes are also designed to remove residual ammonia contained in the fly ash from advanced NOx reduction systems. These new ash beneficiation processes are designed as stand alone systems or potential additions to existing power plants. In some cases it may be advantageous to reburn high carbon coal ash from one power plant by transporting it to another where more complete combustion normally occurs.

These patented and patent pending ash beneficiation processes are described along with the conditions required to make their application successful. Benefits include improved concrete quality fly ash with reduced alkalis, reduced carbon, additional supplies of “green” materials for construction, landfill space conservation and preservation of virgin materials that would otherwise be excavated or quarried. Utilizing fly ash as a cementing material can also reduce the need for new portland cement kilns and their associated air emissions. Sustainable development is becoming an important consideration in manufacturing and construction. Making use of existing coal combustion products (CCPs) while preserving natural raw materials for future generations makes good economic and environmental sense.

Ash Reburn Process

Either fly ash or bottom ash or a mixture of both is added in a fine particle condition to the furnace of a pulverized coal boiler in a small proportion to the pulverized coal fed to the furnace. The ash is burned with the pulverized coal. The proportion of coal ash is preferably in the range of 1% to 3.5%, by weight, of the pulverized coal.

The relatively course bottom ash may be introduced with the coal upstream of the pulverizers, while the finer fly ash can be introduced with the pulverized coal stream before the stream enters classifiers, or with the pulverized coal stream fed to each burner, or with a secondary air flow stream entering the furnace adjacent to the coal diffusers of each burner, or through independent injection ports located above or adjacent to the coal stream burners.

High LOI coal ash is reduced to an overall LOI of 1% to 2% or less. The fuel value that remained in the high carbon coal ash is utilized for heat and steam generation, and the ash is transformed from a material that must be landfilled to one that can be sold and utilized.

Ash Recovery Process

Significant volumes of CCPs have been deposited in landfills over the years, particularly in regions where electricity was or is generated by burning bituminous coal. Coal ash produced from boilers with greenhouse gas emission technologies, such as low NOx burners, has a tendency to have increased LOI and therefore be unusable. Landfill space is rapidly dwindling in many regions and the construction of new landfills is very costly and, in some regions, is not even an option because of the scarcity of potential landfill sites.

Accordingly, there is a need for a process that can recover coal combustion products from a landfill in order to free up landfill space and that can cost effectively produce commercially usable products to make the process economically attractive. CCPs can be removed from the disposal site and used as an aggregate for construction projects or reburned in the furnace with the pulverzied coal as described in the ash fuel process described earlier. In the most preferred version of this process, landfilled CCPs which have a high LOI (and therefore, unrecognized commercial value) are reburned to produce a low LOI coal ash having a commercial value. As a result, this most preferred version of this process provides a number of key advantages. For instance, the process (1) frees up landfill space; (2) transforms CCPs with no commercial value into coal ash with significant commercial value; (3) recovers otherwise lost energy remaining in the coal ash; and (4) removes potential future environmental risk associated with leaching from non-state-of-the-art landfills and ash storage ponds and impoundments.

Advantages include:

- Removal, recovery, and characterization of landfilled CCPs so that recovered CCPs may be put to beneficial use. Characterization includes energy content, sulphur content, moisture, and trace metals content for energy and air emissions analyses.
- Preservation of licensed landfill space.
- Reduced need for new gravel pits, stone quarries and landfill sites.
- Recovery and reburning of high LOI landfilled CCPs to render a commercially valuable fly ash and bottom ash having very low loss on ignition.
- Preservation of coal reserves by recovering heat from reclaimed CCPs.
- Production of low LOI coal ash that may be substituted for portland cement thereby reducing the need for portland cement and reducing air emissions from the its production process.

The need for new, simple, practical and economical CCP beneficiation processes is now. NOx reduction systems are being employed to make reductions in greenhouse gas emissions, and are severely impacting CCPs with additional carbon and ammonia contamination. The landfill option is becoming increasingly less desirable due to higher landfill development and disposal costs, greater difficulty in siting landfills, and the associated long-term liabilities. Growing demand for these valuable mineral resources also makes it imperative that the electric utility industry continue providing the quality coal combustion products that the construction industry have come to expect.