

Effects of Co-firing Biomass with Coal on Emissions of Air Pollutants

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Executive Summary

Since 2003, University of Iowa Facilities Management has worked to reduce the use of coal as an energy source by replacing it with biomass, a process termed co-firing. By using locally-sourced biomasses, co-firing becomes cost-effective, efficient, and sustainable. Much attention has been paid to reducing fossil fuel use to cut emissions of fossil carbon to the atmosphere. In addition, co-firing also offers significant reductions to other air pollutants and simultaneous improvements to public-health.



Coal

Oat hulls

Burning any fuel releases a cornucopia of substances into the atmosphere. Burning coal releases carbon dioxide, the most significant driver of greenhouse warming; sulfur dioxide and nitrogen oxides that contribute to acid rain and smog; particulate matter that can contribute to cardiovascular and respiratory disease; carcinogens such as polycyclic aromatic hydrocarbons (PAH), and many potentially toxic and/or carcinogenic metals. Emissions tests were undertaken in April-May 2014 to determine how co-firing affects emissions of air pollutants.

Co-firing 50% oat hulls (by weight) was found to significantly reduce a wide range of airborne pollutants. Criteria pollutants showed substantial reductions: carbon dioxide from fossil sources decreased by 39%, sulfur dioxide emissions dropped by 40%, and filterable particulate matter fell by 90%. PAH, defined as hazardous air pollutants, decreased by 41%. Meanwhile, total metals dropped by 51%, with substantial reductions in manganese, copper, nickel, and zinc. Decreases in pollutant emissions are attributed to the lower levels of sulfur and metals in biomass compared to coal and the fact that oat hulls burn rather completely, leaving less unburned carbon behind.

Future research will examine air pollutant emissions when co-firing coal with other locally-sourced biomasses, including wood chips and miscanthus grass.

Reductions in air pollutants when co-firing oat hulls

