



FOSSIL ENERGY RESEARCH BENEFITS

Coal Combustion Products

Coal combustion products (CCPs) are solid materials produced when coal is burned to generate electricity. Since coal provides the largest segment of U.S. electricity generation (45 percent in 2010), finding a **sustainable solution** for CCPs is an important environmental challenge.

When properly managed, CCPs offer society environmental and economic benefits without harm to public health and safety. Research supported by the U.S. Department of Energy's (DOE) **Office of Fossil Energy (FE)** has made an important contribution in this regard.



The Ft. Mandan Visitor Center in North Dakota is a showcase for incorporating CCPs, including wallboard from synthetic gypsum, flex-crete blocks, carpet, ceramic tile, acoustical ceiling tile, shingles, wall stucco, mortar, paint, cultured stone, and 70 percent fly ash replacement in concrete. Photo: Western Region Ash Group.

CCPs include:

- **Fly ash:** A fine powdery substance that “flies up” from a coal boiler and is captured by emissions controls, such as precipitators and baghouses.
- **Bottom ash:** Particles that are too large to be carried by emissions and which collect on furnace walls or fall into an ash hopper.
- **Boiler slag:** Material originating as molten bottom ash that, once cooled, is made up of hard, black, angular particles that have a smooth, glassy appearance.
- **Flue Gas Desulfurization Gypsum:** Material produced by flue gas desulfurization (FGD) emissions control systems (scrubbers) that remove sulfur and oxides from power plant flue or stack gas.

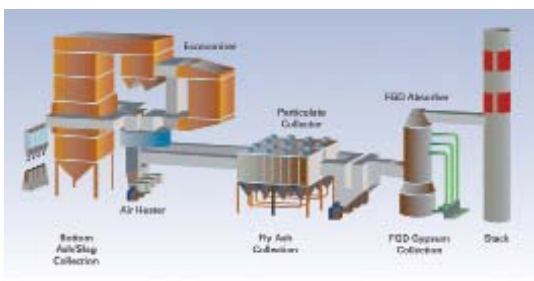
At the time the CBRC was launched in 1998, about 28 percent of CCPs were recycled; by 2009, this number increased to 41 percent.

During the tenure (1998–2008) of the **Combustion Byproducts Recycling Consortium (CBRC)**, a collaborative effort funded by FE's **National Energy Technology Laboratory (NETL)**, technologies to help recycle coal combustion materials were developed and demonstrated.

Encouraged by the CBRC, a multibillion dollar **CCP recycling industry** today exists, incorporating the products into a wide array of building and composite materials, as well as for agricultural use.

Major uses include: substituting for traditional cement and in composite materials (fly ash); replacing aggregate in road applications and other uses (bottom ash); adding to asphalt applications and for snow and ice traction control

Typical power plant layout showing fly ash and bottom ash collection (Electric Power Research Institute).



Facts About CCPs

- ✓ Some **130.2 million tons** of CCPs were produced by U.S. coal-using utilities in 2010; **55.3 million tons** were recycled. (Source: American Coal Ash Association, 2010 Coal Combustion Product Production & Use Survey)
- ✓ More than half of the **concrete** produced in the U.S. uses fly ash in some quantity as a substitute for traditional cement.
- ✓ CBRC projects helped **develop and demonstrate** several technologies that are now commercial or have proven potential, including: CCP use for road base and sub-base; stabilization of gravel roads or highway or pavement construction recycled materials; fired bricks containing up to 30–40 percent fly ash; CCP-based transmission poles and construct on materials; agricultural use of FGD gypsum; and the environmentally acceptable use of fly ash in large fills, such as airport runway extensions.

