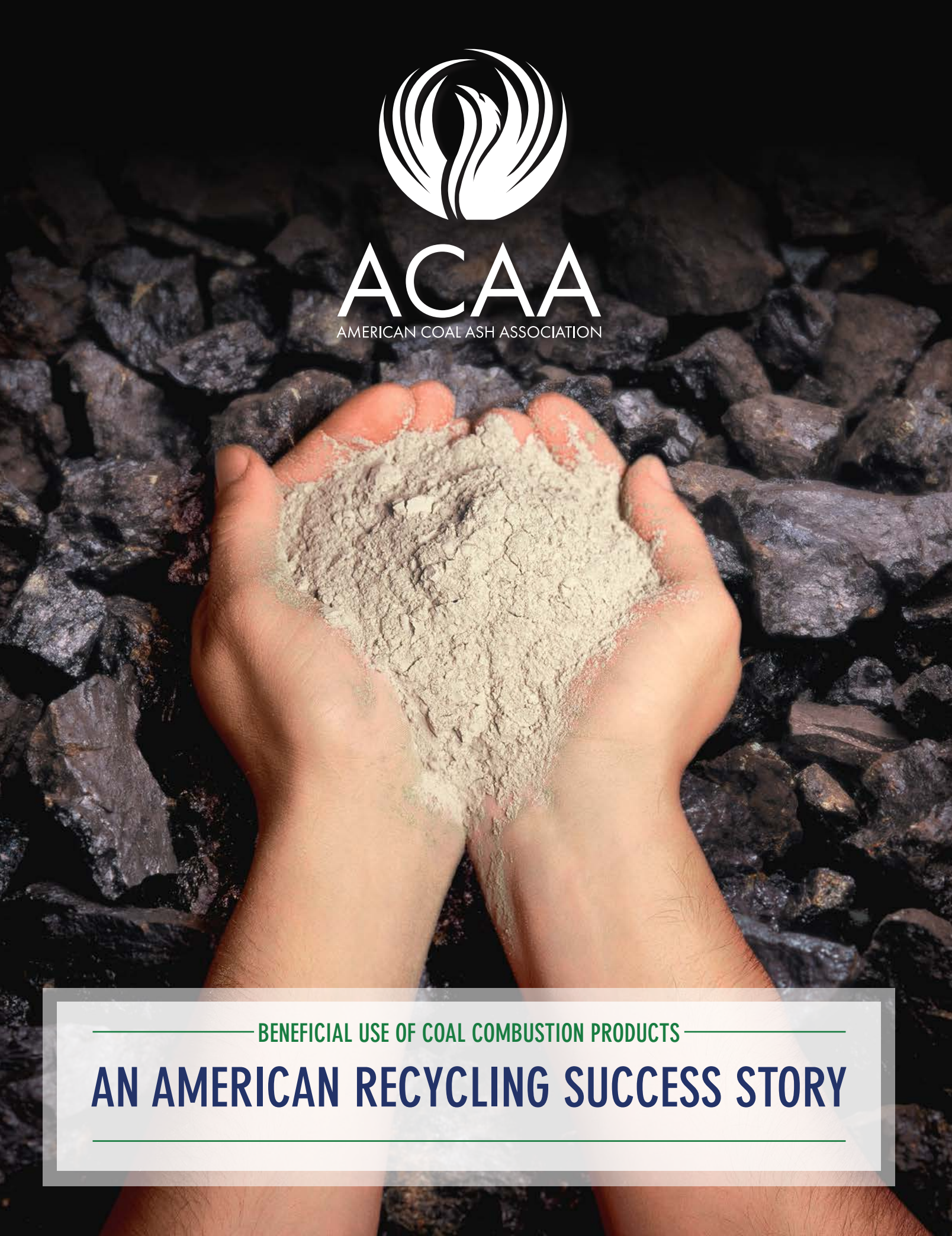


BENEFICIAL USE OF COAL COMBUSTION PRODUCTS

AN AMERICAN RECYCLING SUCCESS STORY

ACAA
AMERICAN COAL ASH ASSOCIATION

The American Coal Ash Association *was established in 1968 as a trade organization devoted to recycling the materials created when we burn coal to generate electricity. Our members comprise the world's foremost experts on coal ash (fly ash and bottom ash), and boiler slag, flue gas desulfurization gypsum or "synthetic" gypsum, and other "FGD" materials captured by emissions controls. While other organizations focus on disposal issues, ACAA's mission is to advance the management and use of coal combustion products in ways that are: environmentally responsible; technically sound; commercially competitive; and supportive of a sustainable global community.*

AN AMERICAN RECYCLING SUCCESS STORY

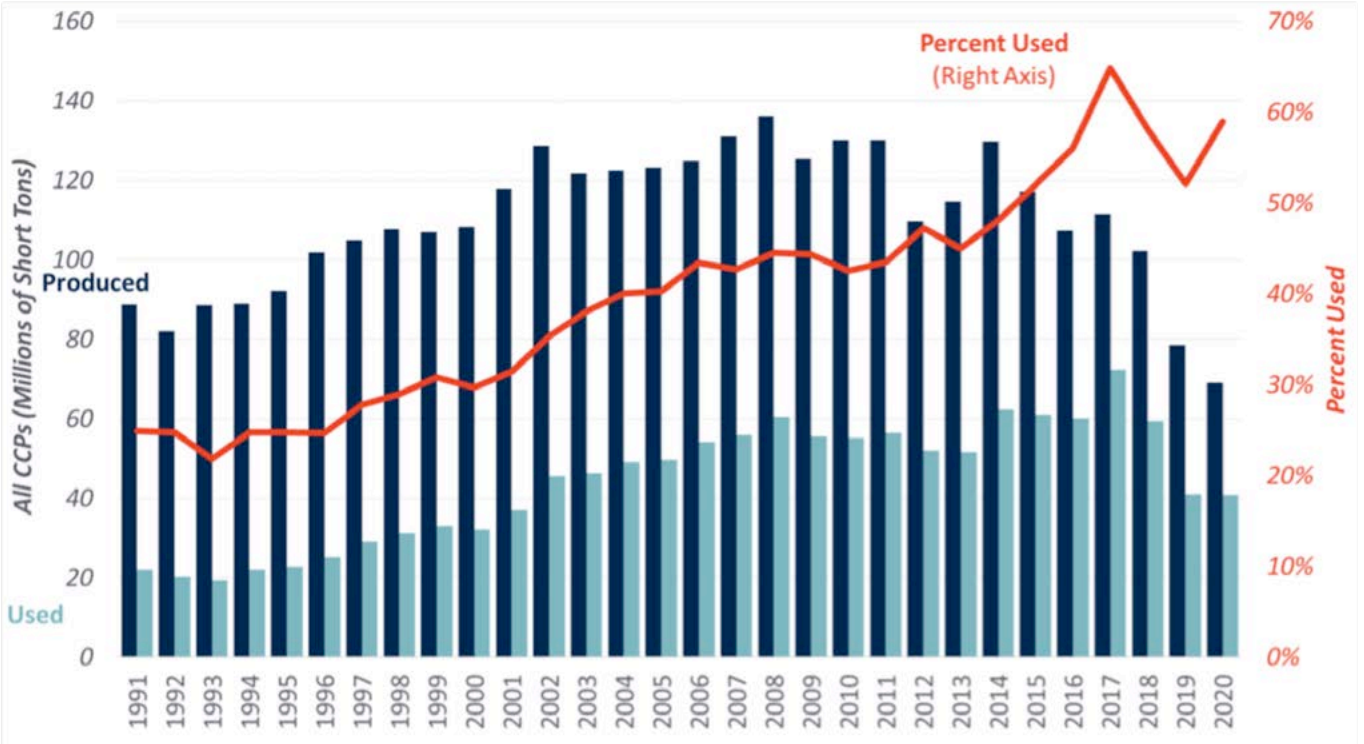
Coal combustion products – often referred to as "coal ash"– are solid materials produced when coal is burned to generate electricity. There are many good reasons to view coal ash as a resource, rather than a waste. Using it conserves natural resources and saves energy. In many cases, products made with coal ash perform better than products made without it.

As coal continues to produce approximately one-quarter of the electricity generation in the United States, significant volumes of coal ash are produced. Since 1968, the American Coal Ash Association has tracked the production and use of all types of coal ash. These surveys are intended to show broad utilization patterns and ACAA's data have been accepted by industry and numerous government agencies as the best available metrics of beneficial use practices.

Fifty-nine percent of the coal ash produced during 2020 was recycled –increasing from 52 percent in 2019 and marking the sixth consecutive year that more than half of the coal ash produced in the United States was beneficially used rather than disposed. The overall recycling rate had declined over the previous two years from its high of 64 percent in 2017.

American Coal Ash Association's 2020 "Production and Use Survey" also showed that harvested ash is beginning to play a meaningful role in beneficial use activities. Nearly 4 million tons of previously disposed ash was utilized in a variety of beneficial uses in 2020, including coal ash pond closure activities, for cement kiln raw feed, and for gypsum panel manufacturing.

All CCPs Production and Use with Percent



Fly Ash

Fly ash is a powdery material that is captured by emissions control equipment before it can "fly" up the stack. Mostly comprised of silicas, aluminas and calcium compounds, fly ash has mechanical and chemical properties that make it a valuable ingredient in a wide range of concrete products. Roads, bridges, buildings, concrete blocks and other concrete products commonly contain fly ash.

Concrete made with coal fly ash is stronger and more durable than concrete made with cement alone. By reducing the amount of manufactured cement needed to produce concrete, fly ash accounts for approximately 12 million tons of greenhouse gas emissions reductions each year.

Other major uses for fly ash include constructing structural fills and embankments, waste stabilization and solidification, mine reclamation, and use as raw feed in cement manufacturing.

Fly Ash Production & Use 2000 – 2020

Fly ash ranges in color from gray to buff depending on the type of coal.

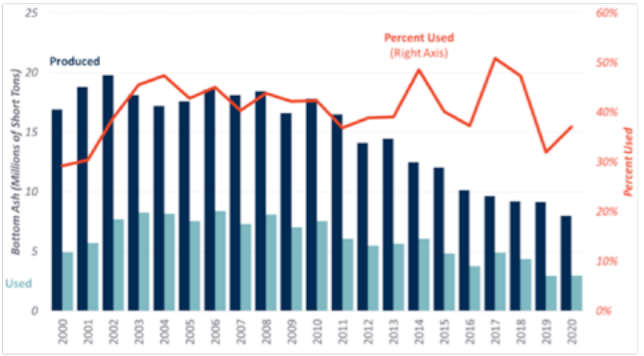
The American Road & Transportation Builders Association estimates coal fly ash use in roads and bridges saves $5.2 billion per year in U.S. construction costs.

Bottom Ash

Bottom ash is a heavier, granular material that is collected from the "bottom" of coal-fueled boilers. Bottom ash is often used as an aggregate, replacing sand and gravel. Bottom ash is often used as an ingredient in manufacturing concrete blocks.

Other major uses for bottom ash include constructing structural fills and embankments, mine reclamation, and use as raw feed in cement manufacturing.

Bottom Ash Production & Use 2000 – 2020



Bottom ash can be used in asphalt paving.

Bottom ash is a granular material suitable for replacing gravel and sand.

Synthetic Gypsum

Power plants equipped with flue gas desulphurization ("FGD") emissions controls, also known as "scrubbers," create byproducts that include synthetic gypsum. Although this material is not technically "ash" because it is not present in the coal, it is managed and regulated as a coal combustion product.

Scrubbers utilize high-calcium sorbents, such as lime or limestone, to absorb sulfur and other elements from flue gases. Depending on the scrubber configuration, the byproducts vary in consistency from wet sludge to dry powdered material.

Synthetic gypsum is used extensively in the manufacturing of wallboard. A rapidly growing use of synthetic gypsum is in agriculture, where it is used to improve soil conditions and prevent runoff of fertilizers and pesticides.

Other major uses for synthetic gypsum include waste stabilization, mine reclamation, and cement manufacturing.

Synthetic Gypsum Production & Use 2002 – 2020

Synthetic gypsum is often more pure than naturally mined gypsum.

More than half of the gypsum wallboard manufactured in the United States utilizes synthetic gypsum from coal-fueled power plants.

Synthetic gypsum applied to farm fields improves soil quality and performance.

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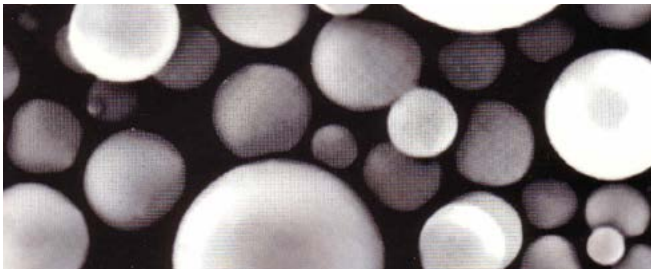
Other Products and Uses

Boiler Slag – is a molten ash collected at the base of older generation boilers that is quenched with water and shatters into black, angular particles having a smooth, glassy appearance. Boiler slag is in high demand for beneficial use as blasting grit and roofing granules, but supplies are decreasing because of the retirement from service of older power plants that produce boiler slag.

Nearly 90 percent of all boiler slag is beneficially used.

Cenospheres – are harvested from fly ash and are comprised of microscopic hollow spheres. Cenospheres are strong and lightweight, making them useful as fillers in a wide variety of materials including concrete, paint, plastics and metal composites.



Because of their high value, cenospheres – seen here in a microscopic view – are measured by the pound rather than by the ton.

FBC Ash – is a category of ash from Fluidized Bed Combustion power plants. These plants reclaim waste coal for fuel and create an ash by-product that is most commonly used to reclaim abandoned surface mines and abate acid mine drainage. Ash from FBC power plants can also be used for waste and soil stabilization.

This regional park was constructed with FBC ash on the site of a former waste coal pile.

New Uses on Horizon

New beneficial uses for coal ash are continually under development. Researchers and ash marketers are currently focusing heavily on the potential for harvesting ash that has already been disposed for potential beneficial use. There is also renewed interest in the potential for extracting strategic rare earth minerals from ash for use in electronics manufacturing.

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2020 Coal Combustion Product (CCP) Production & Use Survey Report

Beneficial Utilization versus Production Totals (Short Tons)

2020 CCP Categories	Fly Ash	Bottom Ash	Boiler Slag	FGD Gypsum	FGD Material Wet Scrubbers	FGD Material Dry Scrubbers	FGD Other	FBC Ash	CCP Production / Utilization Totals
Total CCPs Produced by Category	**26,512,322**	**7,973,554**	**834,131**	**17,677,439**	**6,065,567**	**2,833,942**	**41,364**	**7,217,772**	**69,156,091**
Total CCPs Used by Category	**17,104,493**	**2,955,653**	**369,729**	**13,147,742**	**292,553**	**106,256**	**2,193**	**6,809,788**	**40,788,407**
1. Concrete/Concrete Products /Grout	11,057,713	305,349	0	124,305	0	0	0	0	11,487,367
2. Blended Cement/ Feed for Clinker	2,321,062	862,160	73,727	1,546,731	0	0	0	6,512	4,810,192
3. Flowable Fill	95,272	0	0	0	0	0	0	0	95,272
4. Structural Fills/Embankments	306,379	510,165	0	0	0	0	0	0	816,543
5. Road Base/Sub-base	128,967	83,782	0	0	0	0	0	0	212,749
6. Soil Modification/Stabilization	57,558	80	0	0	0	0	0	0	57,638
7. Mineral Filler in Asphalt	16,195	0	0	0	0	33	2,193	0	18,421
8. Snow and Ice Control	0	35,210	22,454	0	0	0	0	0	57,664
9. Blasting Grit/Roofing Granules	0	9,773	273,548	0	0	0	0	0	283,320
10. Mining Applications	53,930	0	0	0	0	0	0	6,730,060	6,783,990
11. Gypsum Panel Products (formerly Wallboard)	18,308	0	0	9,963,467	0	0	0	0	9,981,776
12. Waste Stabilization/Solidification	1,117,551	43,634	0	118,854	0	13,415	0	73,216	1,366,670
13. Agriculture	0	3,901	0	764,996	0	78,806	0	0	847,704
14. Aggregate	1,550	0	0	0	0	0	0	0	1,550
15. Oil/Gas Field Services	64,163	0	0	0	0	6,816	0	0	70,979
16. CCR Pond Closure Activities	1,558,156	1,026,079	0	537,176	292,553	0	0	0	3,413,964
17. Miscellaneous/Other	307,689	75,520	0	92,212	0	7,186	0	0	482,608

Summary Utilization to Production Rate

CCP Categories	Fly Ash	Bottom Ash	Boiler Slag	FGD Gypsum	FGD Material Wet Scrubbers	FGD Material Dry Scrubbers	FGD Other	FBC Ash	CCP Utilization Total
Totals by CCP Type/Application	17,104,493	2,955,653	369,729	13,147,742	292,553	106,256	2,193	6,809,788	**40,788,407**
Category Use to Production Rate (%)	**64.52%**	**37.07%**	**44.33%**	**74.38%**	**4.82%**	**3.75%**	**5.30%**	**94.35%**	**58.98%**
2020 Cenospheres Sold (Pounds)	0	**Data in this survey represents 121.74122 GVs of Name Plate rating of the total industry wide approximate 222.6244 GV capacity based on EIA's July 2020 Electric Power Monthly.**							