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# ASH **at work**

Applications, Science, and Sustainability of Coal Ash

## CCP Supply 2.0:

Infrastructure and Logistics Address Shifting Markets

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# CCP MARKETING

## Unique Industry Depends on Private Investment and Sensible Public Policy for Growth

By John N. Ward

For nearly 20 years, I've had the privilege of visiting Washington DC frequently to educate policymakers and regulators regarding coal combustion products beneficial use. "Coal ash recycling" – the simpler, but technically incorrect descriptor of the industry—is a more complicated enterprise than people assume when they are first exposed to it. To accurately describe the industry and how it works, I find a handful of phrases frequently enter the conversation:

- "This is not your father's commodity business."
- "Ash is like children..."
- "It's all about the logistics."
- "You don't just wake up one morning and decide to recycle coal ash."
- "Public policy matters."

The complexity of the industry is reflected in its very name. Coal ash is defined as the non-combustible mineral portion of coal. (Ash content is one of the characteristics that is specified by coal consumers before they ever buy, much less burn it.) But several distinct types of coal ash are produced when coal is consumed for generating electricity. Fly ash, bottom ash, and boiler slag all have varying characteristics that make them useful for different things. Furthermore, some of the solid materials produced by coal-fueled electricity generation aren't ash at all. Flue gas desulphurization material also known as FGD or synthetic gypsum is produced by power plant emissions control equipment and doesn't originate in the coal. But it is another coal combustion product that can be put to good use.

Coal combustion product uses are even more varied than the types of coal combustion products (refer to Fig. 1). Furthermore, the use of these products is not technically "recycling." Recycling involves taking materials that have already been used and reprocessing them for another use. Coal combustion products have never been used before. What's happening in this industry is the beneficial use of a recovered material.

### "THIS IS NOT YOUR FATHER'S COMMODITY BUSINESS."

Consider fly ash – one of the most widely used coal combustion products. It's a powder, like cement. It's sold by the ton, like cement. It's moved and stored like cement. It's used in making concrete, usually replacing a portion of the cement. Must be a commodity like cement, right?

Wrong. Commodities are products that are manufactured (or, in the case of agricultural products, grown) to meet certain specifications. A ton of cement manufactured to a specification on the East Coast is interchangeable with a ton

of cement manufactured to the same specification on the West Coast.

Fly ash is not manufactured to a specification. (Specifications for fly ash do exist to guide its use in various products, but power plant operators are in the business of generating electricity, not manufacturing fly ash.) Fly ash characteristics and performance can vary depending on the type of coal that is used, the age and size of the power plant that produces it, and even the operating conditions at individual power plants. As a result, fly ash produced at one power plant may perform differently from the fly ash produced at another power plant just 50 miles away (refer to Fig. 2).

### "ASH IS LIKE CHILDREN..."

"...There is no bad ash, just some you need to love a little more than others." The first question most people ask when they find out fly ash is classified as Class C or F is: "Which one is better?" The answer is neither. They simply perform differently, just as fly ash sources within each of those classifications can perform differently based on the factors listed previously.

All fly ashes are capable of producing performance benefits such as improved strength and durability in concrete. Fly ash users adapt to the materials that are available in their area. What ash users need is a supply that is consistent and reliable. How an ash compares to another ash source is less important than whether the ash source being used performs the same this week as it did last week.

In the quest for consistency and reliability, the ash marketing industry has developed a robust array of beneficiation technologies. These technologies can remove excess carbon from fly ash, passivate the effects of carbon that remains in ash, and mitigate the effects of power plant emissions control technologies on the ash. Ash marketers are also increasingly deploying strategies such as blending ashes and other pozzolanic materials in order to create consistent, reliable supplies in various markets.

### "IT'S ALL ABOUT THE LOGISTICS."

The fact that coal combustion products are recovered, not manufactured, means the best way to think about the beneficial use industry is as an exercise in logistics, which the dictionary defines as "the detailed coordination of a complex operation involving many people, facilities, or supplies."

On the supply side of beneficial use markets, logistics are complex because the entities making coal combustion products (electric utilities) typically outsource the management of their

American Coal Ash Association 38800 Country Club Drive Farmington Hills, MI 48331 Email: info@acaa-usa.org			Phone: 720-870-7897 Fax: 720-870-7889 Internet: www.ACAA-USA.org			2015 Coal Combustion Product (CCP) Production & Use Survey Report			
Beneficial Utilization versus Production Totals (Short Tons)									
2015 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	44,365,587	12,010,425	2,228,205	32,661,536	11,313,960	1,311,947	206,314	13,191,460	117,289,432
Total CCPs Used by Category	24,062,786	4,819,205	1,866,912	17,058,178	1,249,438	252,849	20,697	11,723,843	61,053,908
1. Concrete/Concrete Products /Grout	15,737,238	570,092	33,290	409,134	0	0	0	0	16,749,754
2. Blended Cement/ Feed for Clinker	3,629,151	1,130,802	0	1,649,934	0	0	0	0	6,409,887
3. Flowable Fill	107,263	9,106	0	0	0	0	0	0	116,369
4. Structural Fills/Embankments	1,277,356	1,561,531	305,770	1,221,865	100,940	0	0	0	4,467,462
5. Road Base/Sub-base	178,281	311,779	21	0	0	0	0	0	490,081
6. Soil Modification/Stabilization	216,483	66,253	0	8,053	0	0	0	0	290,789
7. Mineral Filler in Asphalt	52,784	0	14,176	0	0	0	11,479	0	78,440
8. Snow and Ice Control	0	527,695	77,935	0	0	0	0	0	605,630
9. Blasting Grit/Roofing Granules	0	184,712	1,400,455	173	0	0	0	0	1,585,340
10. Mining Applications	1,128,682	73,416	0	807,280	0	215,974	0	11,593,760	13,819,113
11. Gypsum Panel Products (formerly Wallboard)	0	28,378	0	11,322,016	973,785	0	0	0	12,324,178
12. Waste Stabilization/Solidification	1,138,078	242	0	0	0	0	9,218	130,083	1,277,621
13. Agriculture	2,409	1,788	0	1,392,693	174,713	0	0	0	1,571,602
14. Aggregate	0	173,472	0	0	0	0	0	0	173,472
15. Oil/Gas Field Services	181,907	0	0	0	0	36,875	0	0	218,782
16. Miscellaneous/Other	413,152	179,940	35,265	247,030	0	0	0	0	875,387
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	24,062,786	4,819,205	1,866,912	17,058,178	1,249,438	252,849	20,697	11,723,843	61,053,908
Category Use to Production Rate (%)	54.24%	40.13%	83.79%	52.23%	11.04%	19.27%	10.03%	88.87%	52.05%
2015 Cenospheres Sold (Pounds)	948,787	Data in this survey represents 182 GWs of Name Plate rating of the total industry wide approximate 291 GW capacity based on EIA's July 2016 Electric Power Monthly.							

Notes:  
 These are estimates for entire U.S. utility and IPP sectors calculated by dividing the survey respondents' data by the portion of the overall industry's coal burn they represent, as reported in the July 2016 EIA Electric Power Monthly (57%).

**Fig. 1: Coal Combustion Products 2015 Production and Use Survey** SOURCE: American Coal Ash Association



**Fig. 2: Fly ash samples from different power plants.**

SOURCE: American Coal Ash Association

material to ash marketers who specialize in developing and supplying coal combustion products users. This has the advantage of placing beneficial use in the hands of entities that approach the activity as their primary mission. But those ash marketers have little control over the volume or initial quality of materials the utilities produce.

Supply side logistics are further complicated by geographic and seasonal dislocations in ash production. Coal combustion products are produced at electricity generating stations that tend to be remote from urban markets where most the products are ultimately used.

Coal combustion products are also made year-round, while demand for the product tends to be seasonal following construction cycles. The true measurement of ash supply, therefore, is not necessarily how much ash is produced in a year. A more accurate measure of supply is how much can be provided to users on the busiest construction day of the summer.

Demand side logistics also can be complex. For instance, concrete producers are major users of fly ash. But the amount of fly ash that they use is heavily influenced by specifiers – engineers, architects, and government agencies who may never purchase a ton of fly ash directly, but who have enormous influence over how (and how much) fly ash is used in concrete mixtures.

## “YOU DON’T JUST WAKE UP ONE MORNING AND DECIDE TO RECYCLE COAL ASH.”

Matching supply to demand in such a complex market doesn’t happen without significant planning and financial investment. Storage facilities may be needed to collect coal combustion products made in the winter for use in busier summer months. Trucks and trains are needed to move coal combustion products from where they are made

to where they are used. Distribution terminals may be needed to stage adequate supplies for individual markets. Beneficiation technologies may be needed to ensure consistent product quality.

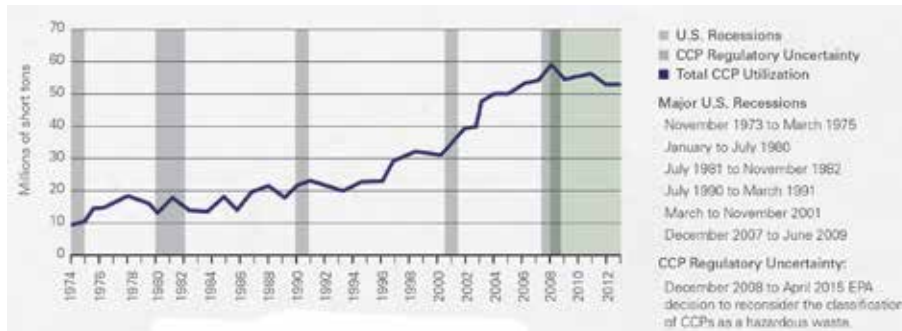
The deployment of these investments must be balanced against activities to develop market demand. For instance, if a local market has too little distribution capacity, ash users may be reluctant to increase their use of the resource. (Concrete mix designs are often developed and tested months in advance. Concrete designers are reluctant to commit to higher levels of ash utilization if they are uncertain about ash availability during the time that the resource will be needed.) On the other hand, if ash marketers build too much distribution capacity, markets can become unprofitable and jeopardize the marketers’ ability to invest in other places.

Ash marketers must work closely with ash users and specifiers to coordinate supply issues and plan for careful market expansion.

## “PUBLIC POLICY MATTERS.”

Government policies also play an important role in encouraging (or occasionally inadvertently discouraging) increased beneficial use of coal combustion products.





**Fig. 3: Coal Combustion Products Utilization History**

SOURCE: American Road and Transportation Builders Association analysis of American Coal Ash Association Production and Use Survey data

First of all, government agencies often fill an important role as product specifiers. Federal agencies such as the Federal Highway Administration, Bureau of Reclamation, and Army Corps of Engineers, are influential designers of concrete and other projects that utilize coal combustion products. State highway departments also play key roles in specifying fly ash use in infrastructure projects – one of the largest sectors for coal combustion product beneficial use.

U.S. Environmental Protection Agency policies can also have a major impact on beneficial use – both positive and negative.

For instance, the volume of coal ash utilization stalled between 2009 and 2013 as EPA pursued a protracted rulemaking process that posed the threat of a “hazardous waste” designation for coal ash that is disposed. Even though beneficial use was exempt from the proposed regulation, ash producers, specifiers and users restricted coal ash use in light of the regulatory uncertainty and publicity surrounding EPA’s activities. In 2014, EPA began signaling that the “hazardous waste” designation proposal was off the table and in December 2014 finalized coal ash disposal regulations under the non-hazardous section of federal law. Ash utilization began to increase again once regulatory uncertainty was restored. (refer to Fig. 3, which also demonstrates that the 2009-13 performance was not linked to an economic downturn inasmuch as every previous recession saw ash utilization increase as users sought out more economical materials.)

On a positive note, a program led by EPA was in place during the most rapid expansion of coal combustion products

beneficial use in history. The Coal Combustion Products Partnership (C2P2 program) was a cooperative effort between EPA, American Coal Ash Association, Utility Solid Waste Activities Group, U.S. Department of Energy, Federal Highway Administration, Electric Power Research Institute, and U.S. Department of Agriculture Agricultural Research Service to promote beneficial use of coal ash as an environmentally preferable alternative to disposal. The initiative included a challenge program, various barrier-breaking activities, and development of coal combustion products utilization workshops. In 2000, when EPA issued a Final Regulatory Determination that coal ash should be regulated under “non-hazardous” RCRA Subtitle D and subsequently initiated the C2P2 program, beneficial use volume was 32.1 million tons. Just eight years later, when the C2P2 program was terminated and EPA initiated the aforementioned ash disposal rulemaking, beneficial use volume had nearly doubled to 60.6 million tons.

## THE MORE THINGS CHANGE, THE MORE THEY STAY THE SAME

Much has changed in the nearly two decades I have spent in the coal combustion products beneficial use industry. Ash sources that were once perceived as “unmarketable” are now being productively used thanks to beneficiation technologies. Products are moving longer distances to reach their markets. Ash utilization rates once considered “high volume” are now commonplace. Strategies such as blending and ash reclamation that were once considered unfeasible are now preparing to enter the mainstream.

Although the number of coal-fueled power plants has decreased in response to environmental regulations and competition from other energy resources, it’s worth noting that we continue to dispose of nearly half of the coal combustion products that are produced annually. A 2015 study by the American Road and Transportation Builders Association that found there will be ample supplies of coal combustion products for beneficial use in the future. The report concluded: “Coal will continue to account for a significant percentage of U.S. electric generation during the next two decades... Even under alternative scenarios of accelerated coal-fueled electric generating unit retirements, CCP production is still expected to exceed overall demand.” That means the work of increasing beneficial use is far from complete.

I’m reminded of one of the first visits I made to a concrete producer who used fly ash. I commented on the concrete producer’s low rate of ash use and inquired what I could do to persuade him to use more. He responded: “I would love to use more of your product. But first you need to convince me that you won’t run me out of supply on the hottest day of the year.”

That’s one aspect of the beneficial use industry that will never change. Consumers of coal combustion products need supplies that are consistent and reliable. Building the infrastructure to improve supply volume, consistency and reliability requires public policies that incentivize investment in facilities to grow markets sensibly and sustainably. Providing environmental regulatory certainty and avoiding policies that distort supply and demand characteristics of this unique industry will be critical to the continued growth of this great environmental success story. ♦

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*John N. Ward served as Vice President of Marketing and Government Affairs for coal ash marketer ISG Resources and its successor Headwaters Resources (now part of Boral North America.) Since 2008, he has been an independent consultant to the coal and coal ash industries. He serves as Government Relations Committee Chairman for the American Coal Ash Association.*