



**Ash Development
Association of Australia**

Ash Development Association of Australia

Annual Production and Utilisation Survey Report

January - December 2023

Prepared by
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Membership Survey Results: Jan to Dec 2023

Summary

The beneficial use of coal combustion products (CCPs) during 2023 resulted in 4.8 million tonnes or 48% being beneficially used, resulting in the conservation of; energy; finite natural resources, the reduction of carbon emissions through the recovery of CCPs being mineral by-product resources.

The survey results for CCP production and end uses for the period January to December 2023 discussed in this report are shown in Table 1. Over the survey period more than 74 million tonnes of thermal coal was consumed to generate vital energy to support the Australian economy. Some 10.2 million tonnes of all CCPs were produced with 48% being effectively utilised¹ within various civil and construction applications throughout Australia.

Total CCPs produced reduced slightly over the reporting period, with the longer-term trend continuing to decrease as planned closures out top 2050 come into effect. This decline is consistent with ongoing closures of coal fired power stations and reduced demand for thermal coal as an energy source, coupled with ongoing energy reforms, renewable energy targets (RET) and state government privatisation agenda for electricity over the past several years. For example since 2006 total megawatt available generation capacity has reduced 22% from 30,159 MW to 23,434 MW, with a further 10% reduction of generation capacity planned to occur in the next 3 years.

Methodology

Annually members and non-members are surveyed for CCPs generated, stored and sold during the reporting period January to December 2023. Information provided by members² and non-members³ is collated, compared with other data sources for verification purposes and then aggregated into national data set. The import and export of CCPs were included, however sources and destinations are not identified.

Discussion of results

Total CCPs generation for the period decreased from 10.6 (2022 adjusted) million tonnes to 10.24 (2023) million tonnes. Over the period CCPs used also decreased from 6.5 million tonnes (2022) to 4.8 million tonnes during 2023. Large scale projects offering some beneficial use (e.g. on-site mine remediation, local haul roads etc.) reduced significantly over the period, but continued demand within the supply chains for construction materials (e.g. cement and concrete manufacture) are steady.

High value utilisation end uses in Category 1 continue to be attributable to 'graded' (See AS 3582.1 and AS 2758) materials used in cement and concrete manufacture at 2.5 million tonnes. The largest decreases occurred in structural/civil, mining and mine site remediation in Category 2 and 3. 'Harvesting' of CCPs continues to increase in internationally, particularly

¹ "Effective utilisation" is the sale or utilisation of recoverable mineral resources into a value added construction application that provides both commercial returns [revenue] return on investment or an economic profit [avoided expense], and use is consistent with the criteria of ecologically sustainable development (EDS) principles.

² <http://www.adaa.asn.au/membership.htm>.

³ Power stations.

within well-established markets such as the USA where access to CCPs has become restricted due the station closures.

Ongoing regulatory reform advocated by the Ash Development Association of Australia continues its focus on new end use market opportunities for 'ungraded' material applications, when coupled with changes to AS3582.1 and AS 2758, these end-use applications are expected to grow.

The use of CCPs, in particular fly ash has been proven to significantly contribute to further reducing the carbon footprint of the cement and concrete sector⁴, however additional processing capacity to produce 'graded' fly ash to meet growing demand, coupled with supply chain inventory capacity are essential.

Further research will commence with support from the NSW Government under the NSW Carbon Recycling and Abatement Fund to investigate harvesting the large volumes of 'homogenously' stored materials within ash dams to buffer natural material supply chain demands. Ongoing monitoring of cumulative storage with ash repositories estimates there is more than 700 million tonnes of CCPs stored nationally. For example, at current consumption rates of fly ash in the cement and concrete sectors the Association estimates there are more than 250 years of recoverable material.

Demand for fine and coarse aggregate use in structural/civil applications is closely tied to consumption or growth in the future development of infrastructure in both urban and regional Australia – estimated to be more than 200 million tonnes annually of natural virgin material. Extractive resources are generally widespread and remain in adequate supply nationally, however, shortages in important large-scale markets (Sydney, Melbourne and Brisbane) have emerged, requiring additional logistics and associated handling costs not historically incurred. These are mainly attributed to unsuitable geology, conflicting or incompatible land uses and environmental problems caused by high rates of urban expansion. Natural sand and gravel resources are also being depleted leading to opportunities for substitution by ungraded CCPs.

Considerable interest from extractive industries to supplement natural sand and gravel resources with recovered resources such as CCPs continues to grow, which is an area of considerable focus.

⁴ Heidrich, C., I. Hinczak, et al. (2005). Case study: CCP's potential to lower Greenhouse Gas emissions for Australia. World of Coal Ash 2005, Lexington, Kentucky, USA, American Coal Ash Association & University of Kentucky.

Key results of survey

The survey results include all generators⁵, marketers⁶ and users for the total production and resulting sales by each end use. Where required, data was supplemented with importation data and other secondary data⁷ sources for accuracy purposes.

- Approximately 10.2 Mt (million tonnes) of CCPs were produced within Australasia. On a per capita basis, this equates to approx 390kg/person. (10.2Mt/26M population)
- Some 4.8 Mt or 48% of CCPs produced have been effectively utilised in various value-added products or to some beneficial end over the period. On a per capita basis, this equates to approx 190kg/person recycled or reused. (4.8Mt/26M population)
- Approximately 2.5 Mt or 52% of fine grade fly ash was used beneficially in high value-added applications such as cementitious binders, concrete manufacture or mineral fillers.
- About 0.086Mt or 2% of CCPS was used in non-cementitious applications such as flowable fills, structural fills, road bases, coarse/fine aggregates.
- Some 2.2Mt was used in projects offering some beneficial use (e.g. on site remediation, local haul roads etc.). These uses typically generate no economic return, that is, cost avoidance or recovery only.
- 5.1 Mt were placed into onsite storage ponds awaiting some future use opportunity where material would be harvested for economic use.
- More than 62.5Mt of CCPs [fly ash] have been used in cementitious applications or concrete manufacture from 1975 to 2023 [48 years].

In summary, the use and recovery of CCPs provide positive and significant environmental impacts, including resource conservation, the reduction of greenhouse gas emissions through the conservation of energy and processing emission from conservation of virgin resources through displacement or substitution by CCPs.

The following table provides more detail for individual category sales of CCPs for the 2023 calendar year.

Ash Development Association of Australia Inc
June 2023

⁵ Generator – means a company who generates coal powered electricity, produces CCPs as a by-product and has been admitted as a member. CCPs can be supplied to processors, consumers or value adders.

⁶ Marketers (Value adder) – means a company who processes, mixes, blends, or otherwise incorporates CCPs to produce products for supply to consumers or other value adders.

[A value adder typically incorporates owned intellectual property].

⁷ Company annual reports and other published data sources.

Table 1 - 2023 CCP Sales and Production Survey⁸

Ash Development Association of Australia										
2023 Membership Survey - CCP Production & Use Survey										
SECTION A. Fuel or Coal Used	Tonnes Consumed	Avg % Ash Content	Ash (Auto-Calc)	Ash (Manual-Calc)						
A1: Bituminous (Black Coal)	35,685,747	25%	9,028,485							
A2: Sub-bituminous	6,563,908	6%	385,000							
A3: Lignite (Brown Coal)	32,000,000	2%	798,000							
Total Coal Burned (Auto-calc)	74,249,655	14%	10,211,485							
SECTION B. CCPs Beneficial Use Calculations (Tonnes)	Fly Ash	Furnace Bottom Ash	Cenospheres	Combined 2023	Combined 2022	Combined 2021	Combined 2020	Combined 2019	Combined 2018	Combined 2017
B1. Total Produced (Jan-Dec)	8,742,315	1,132,839	31,307	9,906,462	10,663,170	11,472,562	12,097,938	12,594,827	11,965,085	12,210,944
B2. Total not used [Stored]	4,243,638	839,512	30,363	5,113,514	4,063,854	4,894,673	6,027,131	6,658,193	6,201,286	7,160,328
Total of All Beneficially Used (Auto-Calc)*	4,498,677	293,327	944	4,792,948	6,599,316	6,577,889	6,070,807	5,936,634	5,763,799	5,050,616
SECTION C. CCP Use (Tonnes)	Fly Ash	Furnace Bottom Ash	Cenospheres	Combined (Auto-Calc)	Combined (Auto-Calc)	Combined (Auto-Calc)	Combined (Auto-Calc)	Combined (Auto-Calc)	Combined (Auto-Calc)	Combined (Auto-Calc)
C1. Cement/Concrete Products /Grout	2,361,337	142,354	944	2,504,635	2,516,277	2,251,934	1,939,571	1,912,233	1,816,621	1,736,068
C1. Cement/ Raw Feed for Clinker	-	1,740	-	1,740	2,500	2,750	5,902	21,872	20,778	107,247
C1. Mineral Fillers	-	-	-	-	79,071	49,000	71,175	41,650	39,568	17,845
Category 1	2,361,337	144,094	944	2,506,375	2,597,848	2,303,684	2,016,648	1,975,755	1,876,967	1,861,160
C2. Flowable Fill CLSM	19,371	-	-	19,371	8,860	4,409	4,409	4,409	4,189	92,427
C2. Structural Fills/Embankments	-	-	-	-	-	-	20,000	20,000	19,000	20,000
C2. Road Base/Sub-base	27,690	11,861	-	39,551	42,525	68,100	489,550	293,012	278,361	180,000
C2. Soil Modification/Stabilization	1,000	-	-	1,000	4,562	-	-	-	-	-
C2. Mineral Filler in Asphalt	28	-	-	28	1,028	-	-	-	-	-
C2. Agriculture	-	-	-	-	5,401	-	459	918	4,590	17,676
C2. Aggregate	-	26,125	-	26,125	22,420	19,085	98,000	98,000	88,200	116,423
Category 2	48,089	37,986	-	86,075	84,796	91,594	612,418	416,339	394,340	426,526
C3. Mining Applications (e.g. Backfill)	2,089,251	111,247	-	2,200,498	3,908,369	4,173,308	3,602,257	3,530,660	3,460,047	2,683,930
C3. Waste Stabilization/Solidification	-	-	-	-	-	-	12,925	25,850	24,558	78,000
C3. Miscellaneous/Other	-	-	-	-	8,303	9,303	103,424	8,303	7,888	1,000
Category 3	2,089,251	111,247	-	2,200,498	3,916,672	4,182,611	3,718,606	3,564,813	3,492,492	2,762,930
Total Use (C1, C2, C3)*(Auto-calc)	4,498,677	293,327	944	4,792,948	6,599,316	6,577,889	6,347,672	5,956,907	5,763,799	5,050,616
SECTION D. Summary Results	Fly Ash	Furnace Bottom Ash	Cenospheres	Combined (Auto-Calc)	Combined (Auto-Calc)	Combined (Auto-Calc)	Combined (Auto-Calc)	Combined (Auto-Calc)	Combined (Auto-Calc)	Combined (Auto-Calc)
7. Total of All Beneficially Used (Auto-Calc)*	4,498,677	293,327	944	4,792,948	6,599,316	6,577,889	6,070,807	5,936,634	5,763,799	5,050,616

⁸ Data presented in this table is aggregated based on member and non-member responses. Where appropriate, estimates are given based on published public reports. Coverage of data represents all coal fired power stations currently operating.