

## ASH AND SLAG HANDLING

## 3.7. Analytics

## 3.7.28. Fly Ash Utilization in China

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## ABSTRACT

The paper presents an overview of fly ash utilization in China, starting from 1950 till now, including history of fly ash utilization, government statistics on fly ash output/utilization since 2005 to 2012, current status of fly ash, its applications. The development of fly ash utilization policies is also highlighted. The paper contains information about key stakeholders and engagement strategy suggestions relating to fly ash.

## CHINA FLY ASH UTILIZATION OVERVIEW

In 1950s China begins utilizing fly ash, mainly in the construction sector as concrete admixture, and particularly in the construction of hydropower stations. In 1960-70s China begins utilizing fly ash as walling material, including blocks, wallboard, baked bricks, and ceramsite. In 1980s the government starts rolling out a series of incentive policies for fly ash utilization in various sectors such as building materials, construction, backfill, agriculture, etc. In 1991 the State Development and Planning Commission (*SDPC was the predecessor of the National Development and Reform Commission - NDRC*) releases the “China Fly Ash Utilization Technology Policy and Implementation Roadmap”. In 1994 “Administrative Measures of Fly Ash Utilization” is released by State Economic and Trade Commission, Ministry of Electric Power Industry, Ministry of Construction, Ministry of Finance, Ministry of Transportation, and State Administration of Taxation. In 2002 Government publishes the “Law on Promotion of Cleaner Production”. In 2003 Government publishes the “Regulation on Levy and Use of Pollutant Charges”. In 2004 Government publishes the “Law of Prevention and Control of Environmental Pollution by Solid Waste”. In 2006 NDRC, Ministry of Finance, and State Administration of Taxation releases the “Administrative Measures of the Recognition and Registration of Resources Comprehensive Utilization Project Encouraged by the Central Government”. In 2007 NDRC releases the “Clean Production Performance Ranking and Indexes System of Thermal Power Industry”. In 2008 Government publishes the “Law of Circular Economy Promotion.” NDRC starts preparing to revise the 1994 version of “Administrative Measures of Fly Ash Utilization”. In 2010 NDRC, MOST (Ministry of Science and Technology), MOHURD (Ministry of Housing and Urban-Rural Development), MIIT (Ministry of Industry and Information Technology), MOLAR (Ministry of Land and Resources) and MOFCOM (Ministry of Commerce) released the “Technical Policy Outlines for Comprehensive Utilization of Resources in China”.

Government statistics on fly ash output and utilization is given in table 1.

Table 1. Statistics on fly ash output and utilisation

Year	Fly ash output (million tons)	Fly ash utilisation (million tons)	Utilisation ratio
2005	302	199	66
2006	352	232	66
2007	388	260	67
2008	395	265	67
2009	405	271	67
2010	417	280	67
2011	428	287	67
2012	440	294	67

In Fig.1 dynamics of fly ash production and utilisation since 2005 to 2012 can be found.

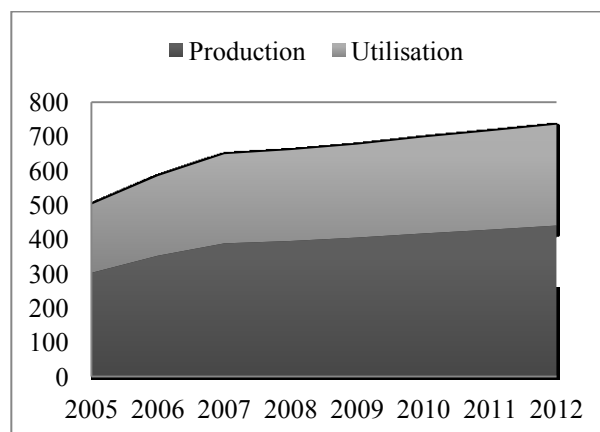


Fig.1. Fly ash production and utilisation in China

In 2009, China’s installed thermal power capacity and the electricity generated by thermal power stations both increased about 7-8%. Although coal consumption has been reduced by introducing high-efficient generators, fly ash output has still maintained its rising momentum.

As fly ash volume steadily increases, the government’s 60% fly ash utilization regulation has always been considered an impossible goal by some industry analysts; most recently in September 2010, Greenpeace released a report which publicly criticized government statistics: “The biggest misconception is the belief that 60% or more of China’s coal ash is reused—in reality it’s less than 30 percent” (a conclusion of Greenpeace based on its independent eight-month survey of 14 thermal power stations across China).

The uneven growth of the various regions of China creates an imbalanced fly ash utilization rates.

In the developed coastal regions, especially the Yangtze and Pearl River Delta, as well as the Bohai

Rim, the utilization ratio of fly ash could be as high as above 100%: the downstream players most likely compete to secure a fly ash supply, import fly ash from other regions, or use prior fly ash storage.

Meanwhile, in the underdeveloped middle and western part of China, the fly ash utilization ratio could be as low as 30% or below, although, there might be fly ash shortage as well in certain months because of the nature of the building material and cement business.



Fly ash is currently used in China for:

- Building materials: such as baked brick and ceramsite, gas ash concrete and cement admixture (or blended material), etc.
- Road engineering: such as roadbed layer materials, side slope and bituminous concrete admixture.
- Construction projects: concrete and mortar admixture.
- Agribusiness: used as fertilizer or used to improve soil quality
- Backfill: engineering or mine backfill.
- Others: such as extraction of Aluminum, etc.

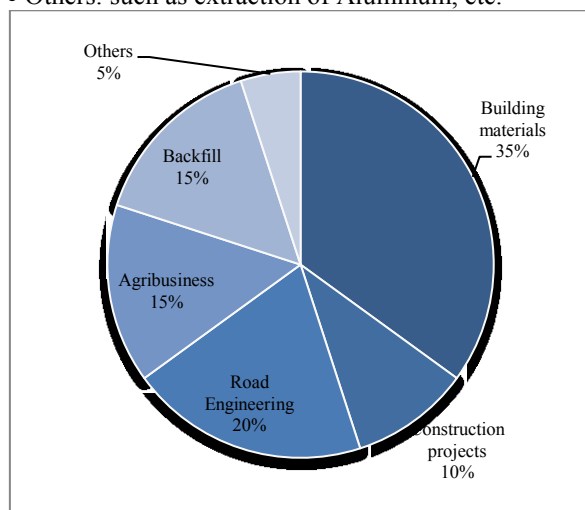


Fig.2. Fly ash applications

Main challenges fly ash utilization in China are the following:

1. Imbalanced Utilization
  - Uneven development of fly ash utilization in the coastal and inland areas.

- Uneven utilization ratio of various grade of fly ash (short supply of high quality fly ash and low utilization of low grade ones).
2. Dynamic of fly ash quality
    - Mixed discharge equipment in power stations (wet vs. dry).
    - Increasing desulfurization and denitration and its impact on fly ash characteristics and quality.
  3. Limited application fields and value added
    - Fly ash utilization is still largely concentrated in the building materials and construction sector.
    - The products are mainly low value-added.
  4. Limited government incentives and weak law enforcement
    - “Administrative Measures of Fly Ash Utilization” need to be updated and revised
    - Taxation and financing incentives need to be improved.
    - Law enforcement needs to be enhanced to control fly ash discharge.

### DRIVERS OF FLY ASH UTILIZATION

Economic growth will still rely on coal

- While the increases in China's population, economy, and energy usage has prompted the Chinese government to encourage the development of other energy resources, coal is still expected to play the most significant role in the nation's energy future.
- Nearly 75% of China's installed capacity in 2010 is from thermal power generators, and an even further 81.81% of the electricity generated in 2010 was from thermal power plants.
- Although the government plans to reduce thermal power generators to 69.1% in China's installed capacity mix within the next 5 years, the actual total thermal power capacity could further increase about 56%, from 599GW to 933GW, according to the national development plan.

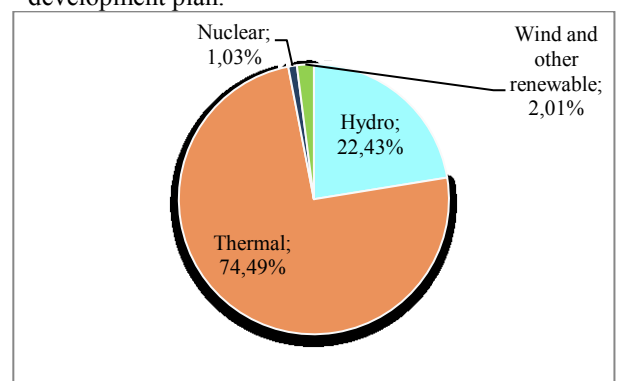


Fig.3. Installed capacity in 2010

Data on the installed capacity and fly ash output are presented in table 2.

Table 2. Fly ash output vs installed capacity

Year	Installed capacity (GW)	Fly ash output (million ton)
2006	622	352
2010	900	405
2015 (projection)	1,350	562.5

Fly ash utilization in China is driven through the

pull and the push factors.

The pull factors are:

- Promotion of circular economy and comprehensive utilization of resources
- Due to the continuous expansion of infrastructure in China, there is an increasing market demand for fly ash for construction projects and building materials
- Rising prices of fly ash in the market
- Financial incentives such as government subsidies and tax break policies

The push factors are:

- Increasing fly ash output
- Cleaner production policies and regulations
- Prevention and control of environmental pollution due to solid waste
- Punishment for solid waste discharge

## DEVELOPMENT OF FLY ASH UTILIZATION POLICIES

China's regulatory framework creates numerous laws and regulations to restrict solid waste discharge and promote a "circular economy".

There are three main laws in China related to fly ash utilization:

- Law on Promotion of Clean Production (2002);
- Law of Prevention and Control of Environmental Pollution by Solid Waste (2004);
- Circular Economy Promotion Law (2008).

Law on Promotion of Clean Production (2002) defines means of clean production and sets forth incentives for clean production in the forms of tax cuts and subsidies.

Law of Prevention and Control of Environmental Pollution by Solid Waste (2004) comprehensively revises the original version (1996) by introducing the "Producer Responsibility System"; expands producer responsibility, and calls for the establishment of a mandatory recycling system.

Circular Economy Promotion Law (2008) provides a legal framework for developing the economy, raising energy efficiency, protecting the environment and realizing sustainable development based on the 3R (reduction, reuse and recycle) principles.

Administrative Measures of Fly Ash Utilization:

- Released in 1994, and currently under revision by NDRC and MIIT.
- New power station projects need fly ash utilization solutions in advance for approval; existing power stations need to upgrade their systems for fly ash utilization.
- Ban any new solid clay bricks and tiles projects near power stations, ask existing plants as well as new construction projects to use fly ash as mixture.
- Impose penalties on construction projects which could not meet the set target of fly ash utilization.
- Ask power stations to provide subsidies to large scale direct users of their raw ash; power stations could only sell fly ash after processing it in line with national standards, and prices should be in the buyers favor and based on actual processing cost and quality.

- Ask power stations and end users to submit their statistics of fly ash discharge, utilization and storage status to government agencies on a regular basis.
- Call for incentive financial and taxation arrangement for fly ash utilization.
- After the central government released the administrative measures of fly ash utilization, the surrogates at the provincial and municipal level started to release their local regulations.

For example in Shanghai, the municipal government decided to levy a special R&D fee (0.4 RMB per ton of fly ash output) on power stations in order to support the research of fly ash utilization in Shanghai.

*11<sup>th</sup> Five Year Plan (2006-2010) Guidance of Resources Comprehensive Utilization*

- Released by NDRC in 2006
- Set up a national target of fly ash utilization rate at 75% by 2010
- Ask for financial incentives, tax breaks as well as technical policies for resources comprehensive utilization
- NDRC is currently drafting the 12th Five Year Plan (FYP 2011-2015) which might revise the target and add more incentives
- Meanwhile, MIIT is also drafting a specific 12th FYP for comprehensive utilization of industrial solid waste *Clean Production Performance Ranking and Indexes System for the Thermal Power Industry*
- Released by NDRC in 2007
- Set up a matrix to manage the clean production practice of power plants and define the target and weight of fly ash utilization in the system
- Fly Ash Utilization Rate Target: 100% (coastal region), 60% (central and western region)
- The weight of fly ash utilization rate in the matrix: 10% (other factors includes coal consumption, emission, etc.)

*Regulation on Levy and Use of Pollutant Charges*

- Released in 2003 by NDRC and Environment Protection Authority
- Defines a 30 RMB per ton of fly ash pollutant charge to levy on power stations who could not meet the environment protection standards on fly ash handling and storage

*Regulation on Levy and Use of Special Fund for Promotion of New Walling Materials Application*

- Originally released in 2002, revised in 2007 by NDRC.
- Defines a 10 RMB /m<sup>2</sup> (might be different in various regions with 10 RMB as a cap) special fund for promotion of new walling materials to levy on any new construction projects without application of new walling materials.
- Defines a catalog of new walling materials including all walling materials (bricks, tiles, and etc.) made by fly ash (more than 30% raw materials are fly ash)
- Defines the procedures to apply for financial support from the fund to develop and produce new walling materials.

*Administrative Measures on the Recognition and Regis-*

#### *tration of Resources Comprehensive Utilization*

- Released in 2006 by NDRC and Ministry of Finance and State Administration of Taxation
- Defines a recognition and registration procedure for resource comprehensive utilization projects
- A certificate secured after the recognition and registration procedure is a must for a tax break and government financial support

#### *Technical Policy Outlines for Resources Comprehensive Utilization*

- Newly released in 2010 by NDRC, MOST, MIIT, MOHURD, MOLAR and MOFCOM
- Defines all of the technology supported by government in the resources comprehensive utilization sector including various kind of fly ash utilization technology
- Summarizes the preferential taxation policy for the comprehensive utilization of resources

#### *VAT exemption*

- Released in 2008 by Ministry of Finance and State Administration of Taxation
- Specific building materials such as bricks, tiles, etc., made by fly ash (more than 30% of raw material is fly ash) could enjoy VAT exemption, but the manufacturer needs to secure a certificate from the local DRC to be qualified for the exemption
- NO VAT exemption for direct sales of commercial fly ash or cenospheres, etc.
- Corporate Income Tax Reduction based on the CIT Law released in 2007
- The revenue generated from sales of building materials made by fly ash (more than 70% raw materials must be fly ash) could be reduced by 10% when calculating taxable income
- The revenue generated from direct sales of commercial fly ash or balloon/bead could also be reduced by 10% when calculating taxable income
- If the manufacturer could be qualified as a “New and High-tech Enterprise,” it could enjoy a CIT reduction from 25% to 15%.

At early stages (1950s-2000) the Chinese government started to promote fly ash utilization technologies in 1950 for hydropower projects. Extended utilization of fly ash to the building materials sector took place in 1960s and 70s. In 1980s resource comprehensive utilization policies have been started to introduction. In 1990s incentive policies for fly ash utilization have been started to introduction.

At rapid development stages (2000-2010) sustainable development, energy saving, and emission control became fundamental national policies. The legislative process was sped up by introducing a set of laws related to fly ash utilization. Started to draw up national plan, guidance, recognition and registration administrative measures as well as technical policy outlines. Specific tax incentive policies have been introduced.

Review, improve and intensify enforcement stage (2010 and beyond). The stage is increasingly focused on environment-friendly development as well as technology upgrades. Review of existing regulations and policies, draws up specific national plan on industrial

solid waste utilization and revises the out-dated administrative measures on fly ash utilization. Further enhancement of law enforcement and introduction of more incentive policies

Trade barriers of fly ash utilisation are the following:

1. There are no major trade barriers, and foreign firms are encouraged by China’s government to be involved in the fly ash comprehensive utilization sector -- from equipment and technology supply to direct investment of fly ash utilization projects

2. However, there are some invisible trade barriers such as:

- Chinese government’s policies to promote indigenous innovation
- Rising nationalism
- Government procurement process that favor local companies
- “Trading market for technology” policies
- Opaque market and policy environment

Key national players in the field of fly ash utilisation are listed below:

- China Association of Resource Comprehensive Utilization (CARCU);
- China Building Materials Industry Association (CBMIA);
- China Building Materials Foundation (CBMF);
- China Coal Processing and Utilization Association (CCPUA);
- Ministry of Industry and Information Technology;
- National Development and Reform Commission (NDRC);
- Ministry of Housing and Urban-Rural Development.

## **5. CONCLUSIONS**

China has a huge fly ash output every year, which will only keep growing with the pace of China’s economic expansion and the reality of China’s energy mix. The market will be huge for foreign companies if foreign companies provide innovative solutions and works with the right partner.

However, there are already many local Chinese companies and research institutes working in this sector, although the majority utilization of fly ash in China is still at the low value-added end.

Foreign companies will need a strategy to distinguish itself from those competitors and raise its profile in the market as an innovative leader. Leveraging the support from the Australian government, foreign companies might like consider establishing a Sino-Foreign Fly Ash Utilization Initiative, which could be:

A platform to engage with government agencies for financial support and preferential policies; and, a leverage to raise the company profile to attract good partners and potential investors.

**D. Harris.** Fly Ash Utilization in China // Proceedings of the V Conference “Ashes from TPPs: removal, transport, processing, storage”, Moscow, April 24–25, 2014 — M.: MPEI Printing House, 2014. P. 133 – 136.