

APPENDIX – 30

PROSPECTS OF BULK USE OF FLY ASH IN AGRICULTURE & WASTELAND MANAGEMENT - INITIATIVES OF FLY ASH MISSION

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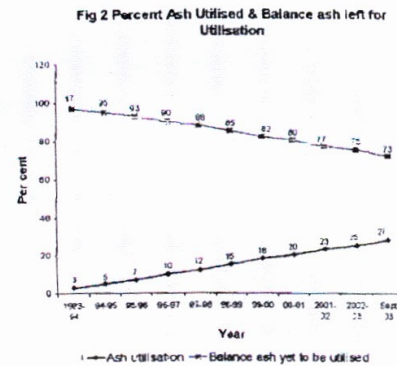
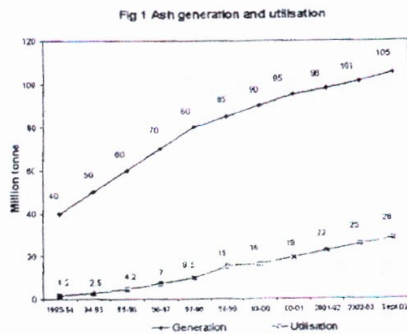
ABSTRACT

Approximately 260 million tonne of coal is consumed per annum by 82 utility thermal power plants (TPPs) in India (2003-04). It constitutes nearly 70 per cent of the total power generation which, in turn, produced 108 million tonne of fly ash* per annum. The annual generation of fly ash is projected to exceed 175 million tonne per annum by 2012 (considering the plans to double the power generation over next 10 years). This large volume of fly ash occupies large area of land and possesses threat to environment. As such, there is an urgent and imperative need to adapt technologies for gainful utilisation & safe management of fly ashes on sustainable basis.

Realising the importance of the subject matter, Fly Ash Mission (FAM) was commissioned by the Govt. of India in 1994, with Department of Science & Technology (DST) as the Nodal Agency and Information, Forecasting and Assessment Council (TIFAC), an autonomous body under the aegis of DST as the Implementing Agency in close cooperation with Ministry of Power (MoP) & Ministry of Environment & Forests (MoEF) to undertake Technology Demonstration Projects for creating awareness / confidence building in ash utilisation / safe management technologies inter alia development and up-scaling of relevant technologies of fly ash. Agriculture and related applications have emerged as one of the potential bulk

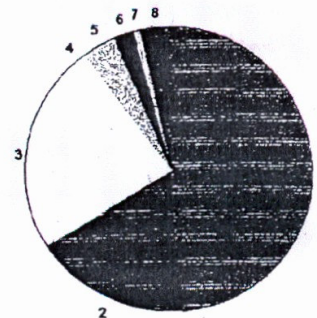
* Unless otherwise stated "fly ash" represents total ash generated at TPP consisting of (i) hopper ash / dry ash (ii) economizer ash (iii) preheater ash (iv) bottom ash. Un-utilised ashes are generally put in lagoons / ash ponds in the form of slurry and are known as pond ash.

utilisation areas for fly ash. Due to concerted efforts of Fly Ash Mission, the utilisation of pulverised fuel ash that has increased from 1 million tonne per year in 1994 to 32 million tonne in year 2004 has also gathered considerable momentum to reach higher levels with appropriate support & facilitation which is graphically presented below:



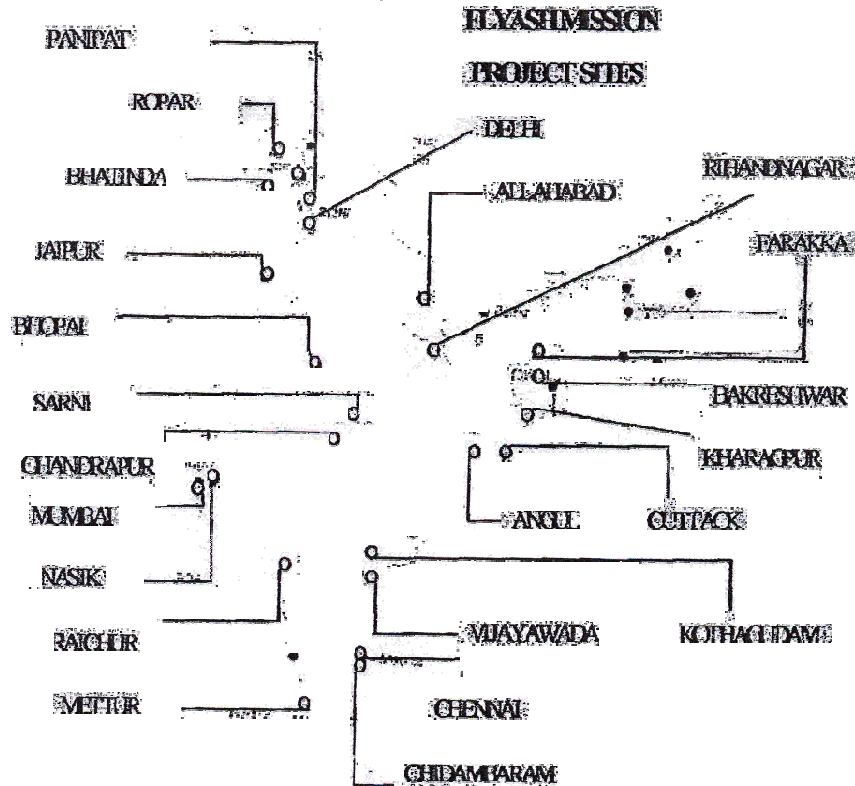
Utilisation Areas – 2004
Total utilisation ~ 32 MnT / year

- 1 Cement Manufacture / Substitution - 49%
- 2 Low Lying Area Fill - 17%
- 3 Roads & Embankments - 22%
- 4 Brick Manufacturing - 2%
- 5 Dyke Raising - 4%
- 6 Minefills - 2%
- 7 Agriculture - 1%
- 8 Others - 3%



Technology demonstration projects commissioned by Fly Ash Mission on use of fly ash in agriculture

The focus of project was "To develop empirical data on the effect (beneficial as well as possible adverse) of fly ash / pond ash application in terms of crop growth & yield, status of macro & micro-nutrients; heavy metals & toxic elements and radioactivity of soil, plant produce and water". Accordingly, FAM commissioned 15 R & D projects with fly ash at 55 project sites alongwith different R & D Institutes / Universities and farmers as given below in the map.



The technology demonstration projects carried out in (a) agriculture sector, (b) forestry sector for wasteland management, (c) reclamation of saline-alkali soil / eroded land / ash pond & (d) nutritional quality of crop produce obtained from various field demonstration sites are as follows:

(a) Technology Demonstration Projects undertaken at various sites in the area of agriculture sector

Field crops & vegetables grown with fly ash in different soil types at various project sites are as follows:

S.N.	Soil	Fly ash doses range	Crops & No. of Sites	Location	Executed by
1	Alluvial Soil	0-200 t/ha	Rice, wheat (2)	Farakka	CFRI, Dhanbad
2	Alluvial Soil	0-100 t/ha	Mustard, jute (1)	Farakka	CFRI, Dhanbad
3	Laterite Soil	0-200 t/ha	Rice, wheat (4)	Bakreshwar	CFRI, Dhanbad
4	Laterite Soil	0-100 t/ha	Mustard, Potato, Lentil (1)	Bakreshwar	CFRI, Dhanbad
5	Black Soil	0-50 t/ha	Sugarcane	Chidambaram	Annamalai University
6	Laterite Soil	0-150 t/ha	Groundnut	Neyveli	Annamalai University
7	Laterite Soil	0-100 t/ha	Sugarcane	Neyveli	Annamalai University
8	Black Soil	0-150 t/ha	Rice-Green Gram (1)	Sathamangalam	Annamalai University
9	Black Soil	0-120 t/ha	Cotton-Rice (1)	Vellampudugai	Annamalai University
10	Lateritic Soil	0-10 t/ha	Rice-Groundnut (3)	Kharagpur	IIT-Kharagpur
11	Lateritic Soil	0-20 t/ha	Rice, Groundnut-Mustard (1)	Kharagpur	IIT-Kharagpur
12	Lateritic Soil	0-30 t/ha	Mustard-Rice (1)	Kharagpur	IIT-Kharagpur
13	Lateritic Soil	0-10 t/ha	Rice (2) -Mustard, Groundnut, Potato (1)	Balarampur, Gholghoria, Burari	IIT-Kharagpur
14	Lateritic Soil (Red)	0-80 t/ha	Sunflower-Groundnut (2)	Raichur	CAS, Raichur
15	Black Soil	0-80 t/ha	Sunflower-Maize (2)	Raichur	CAS, Raichur
16	Alluvial Soil	0-650 t/ha	Tomato (1), Cabbage (1), Potato (1), wheat (2), Pea (1) - Maize (6), Wheat-Maize (2)	Dhodhar, Nilgiri, Rihand Nagar	RRL, Bhopal
17	Alluvial Soil	0-650 t/ha	Sunflower (1), tomato (1), Potato (1), Wheat (1), Berseem (1), Red Gram (1), Maize (1), Rice (1)	Nilgiri, Rihand Nagar	RRL, Bhopal
18	Alluvial Soil	0-40/0-80 t/ha	Rice-Wheat (1), Cotton-Wheat (1), Sunflower-Maize (1) Wheat-Rice (1)	Ropar, Bhatinda	PAU Ludhaina
19	Alluvial Soil	0-12 t/ha	Wheat	Ropar (Astalpur)	PAU Ludhaina
20	Alluvial Soil	100% ash body with 7.5 cm soil cover	Arhar-Wheat (1)	Bhatinda	PAU Ludhaina
21	Black Soil	0-640 t/ha (Residual Effect)	Wheat-Maize, Soyabean-Maize, Lemon Grass (1)	Sarni	RRL, Bhopal
22	Alluvial Soil	0-640 t/ha	Maize-Onion, Rice-Sunflower (1)	Angul	RRL, Bhopal

(b) Projects undertaken at various sites in the area of forestry sector for wasteland management

Various forestry species grown with fly ash in wasteland at various sites are as follows :-

S.N.	Soil/Land Type	Fly ash doses range	Tree Species & No. of Sites	Location	Executed by
1	Laterite Soil	0-240 t/ha	Eucalyptus (1)	Chaudwar, Cuttak	TCRDC, Patiala
2	Laterite Soil	0-24% of pit volume	Eucalyptus, Acacia auriculiformis, Casurina equisetifolia, Acacia mangium (1)	Durga Prasad, Cuttack	TCRDC, Patiala
3	Alkali-Saline Eroded land (in Arid Zone)	0-20% v/w	Eucalyptus, Zizyphus, Jojoba (1)	Jaipur	TERI, New Delhi
4	Ash Pond	-	Melia azadirach, Delbergia Sisso, Eucalyptus sp., Populus deltoides (1)	Badarpur	TERI, New Delhi
5	Low Fertile Soil	1/3 Pit volume	Ceiba pentandra, Melia azadirach, Cassia siamea, Erythrina indica, Cassia glauca, Bauhinia purpurea, Putranjiva, Pongamia glabra, Thevetia elifera (1)	New Delhi	TERI, New Delhi

(c) Project undertaken at various sites on reclamation of Saline-Alkali Soil / Eroded Land / Ash Pond:

Different crops, forestry / floriculture species grown on saline-alkali soil / eroded land / ash pond at different project sites are as follows :

S.N.	Soil/ Land Type	Fly ash doses range	Crops/Tree Species	Location	No. of Sites	Executed by
1.	Usar	0-5%	Rice-Wheat	Dailapur	1	IFFCO, Phulpur
2.	Usar	0-5%	Rice-Wheat	Tardih	1	IFFCO, Phulpur
3.	Usar	0-5%	Rice-Wheat	Yakubpur	1	IFFCO, Phulpur

Contd.

4.	Usar	0-6%	Rice-Wheat	Purisudi	1	IFFCO, Phulpur
5.	Usar	0-6%	Rice-Wheat	Parasinpur	1	IFFCO, Phulpur
6.	Usar	0-6%	Rice-Wheat	Mobarukpur	1	IFFCO, Phulpur
7.	Alkali Saline Eroded Salt Affected	0-20%	Eucalyptus, Jojoba, Zizyphus	Chaksu	1	TERI, Jaipur
8.	Ash Pond	-	Rajnigandha, Tagetus, Carnation, Palmarosa and Sunflower	Badarpur, New Delhi	1	TERI, New Delhi

(d) Project undertaken on nutritional quality of crop produce at National Institute of Nutrition (ICMR) is as follows:

Crop produce namely cereals (rice & wheat), pulses (pea), oilseeds (mustard & groundnut), vegetables (potato, tomato & cabbage) grown on fly ash treated plots and control plots (without fly ash) at various project sites as at (a) above were taken up for the nutritional study with the following scope:

- (i) To evaluate the nutritional quality and heavy metal content of the agriculture produce.
- (ii) To assess the growth promoting activity between samples of agriculture produce obtained with or without fly ash application.

To achieve (i) & (ii) above, the food crops grown with or without fly ash (control) were analyzed for:

1. Nutritive value : Moisture, protein, fat, energy, ash, carbohydrate, crude fibre, vitamins and trace element content.
2. Heavy metal content : Pb, Cd, As and Cr.
3. Growth promoting activity in weanling rats, after feeding for 6 months at 90% level (food).
4. Hematological and histopathological changes in different tissues collected from animals fed on diets containing food grains grown either on fly ash treated plots or on control plots.