Pellets may solve a fly ash problem

Anybody who has burnt briquettes knows the difficulty that the remaining fine orange ash presents. A puff of wind, and it covers everything.

More troublesome still is the even finer ash recovered from the electrostatic precipitators of Victoria's brown coal power stations. Some 200,000 tonnes of the material are generated each year in the State's Latrobe Valley.

The State Electricity Commission of Victoria overcomes the handling problem by 'wet ashing'. The precipitator ash is mixed with water and pumped to a settling pond. The ash settles out, and the water is re-used.

However, the method has several disadvantages. The ponds take up a large area, and seepage to groundwater must be guarded against. Because the ash is about 20% soluble, many salts, and some trace elements, dissolve into the water.

The salt burden of the water is the major drawback, since large quantities of water have to be drained off and replaced by fresh water, to prevent the build up of salt (and its deposition) in the sluicing systems.

Discharging the saline effluent to streams is environmentally unacceptable, so the S.E.C. pipes the solution, containing up to 40 tonnes of salt a day, 57 km to the ocean. Apart from the cost of this, the process needs up to 30 megalitres of water a day from the Latrobe River as replacement.

As generating capacity, and tonnages of fly ash, increase steadily, the S.E.C. is finding it more difficult to maintain an adequate water supply and find areas of land for settling ponds. The Commission has therefore turned its attention to 'dry ashing', a technique now in use in some countries where water is scarce. This involves mixing the ash with small quantities of water and then burying it with overburden.

Once again, the solubility of Victorian brown coal fly ash appears to make this technique unfavourable from a groundwater point of view, and dust remains a problem. (The solubility factor also makes fly ash from brown coal unsuitable for use in cement, except in small amounts, whereas fly ash from black coal does not suffer this restriction. On the other hand, brown coal produces less than 2% ash, whereas black coal may be 15-30% ash.)

After Dr Don Tang of the S.E.C. Research and Development Department heard of attempts overseas to make pellets from fly ash, he arranged experiments in his laboratory on the possibility of doing this with Latrobe Valley fly ashes. These confirmed that pellets have the advantage of largely locking in their constituents. A little water acting as binder caused the calcium salts in the ash to cement the material together into a hard pellet that held the soluble salts in its structure.

Pelletizing increases the density of the fly ash by 3–6 times, and allows the material to be transported on conveyor belts or stockpiled before being incorporated into overburden.

However, the S.E.C. found that pelletizing is a tricky process, sensitive to very small fluctuations in material characteristics, moisture, and so on. The Commission called on the CSIRO Division of Mineral Engineering, which has extensive expertise in pelletizing technology, and a collaborative research program was initiated.

Pelletizing is common in the Australian mineral-processing industry, where millions of tonnes of pellets are produced each year. Iron ore, magnetite, hematite, and lead-zinc sinter are minerals that are made into pellets. Phosphate fertilizers frequently come as pellets, since this minimizes dust problems and makes storage and transport easier.

The Division of Mineral Engineering has been involved in tackling many kinds of pelletizing problems in industry. Various approaches include measurement of processing variables, experiments with laboratory set-ups, and mathematical modelling. By increasing their understanding in this way, the researchers can develop new techniques that save energy, improve product quality, or reduce dust levels or other environmental problems.

Dr John Hall of the Division investigated how the behaviour of fly ash during pelletizing paralleled, or contrasted with, that of other materials.

He used drum and disc pelletizers in the laboratory to test the fly ash. These tests demonstrated that Yallourn and Morwell fly ash can be readily worked into spherical granules by adding 33% water as a binder. Slight variations in
moisture content have drastic effects on pelletizing performance, he found.

Compression and drop tests showed that the granules could be immediately stockpiled or transported on fast-moving conveyor belts without breaking unduly. When stored in the open air, the strength of the pellet increases rapidly due to chemical reactions with the water. The process largely encapsulates the soluble salts, as well as undesirable trace elements such as selenium, lead, and mercury. The graph shows the relative inertness of the pellets.

Following these preliminary trials, the S.E.C. has installed a 2-tonne-per-hour pilot-scale drum pelletizer to investigate further the feasibility of the pelletizing scheme. Over the next 2 years, scientists will monitor the minerals leached from a hole filled with 20 tonnes of pellets and overburden. They will compare these figures with those obtained from a hole filled with overburden only and one filled with pellets only.

More work is needed on both the scientific and engineering aspects, but results to date appear promising. According to Dr Harry Schaap, the senior environmental scientist of the S.E.C., the days of wet ashing are numbered. Any new power station in the Latrobe Valley will most likely use dry ashing, and, if the latest approach bears fruit, the ash will appear in the form of pellets.

Andrew Bell


Unlike unpelletized fly ash, Yallourn fly ash pellets retained most of their soluble salt content when immersed in water and agitated.

**Pellets lock in soluble salts**

![Graph showing the amount of salts in water (conductivity units) over stirring time (hours). Fly ash pellets lock in more salts compared to fly ash.](image)