

THE GENERATION OF ELECTRICITY FROM REFUSE

AN HISTORICAL INTRODUCTION

By D. Gordon Tucker

The Edmonton refuse-burning electricity generating station, which Mr. Smart will be describing in his paper, was commissioned over 80 years after the first demonstration of the generation of electricity from town refuse in Halifax, Yorkshire, in 1893. The first combined refuse destructor and electricity generating station for public supply was that at Ealing (opened 3 October 1894), followed by Cheltenham (May 1895) and Oldham (March 1896). The first station actually designed specifically for combined working was that at St. Pancras, London, but it was unsuccessful in the combined role; the first successful one was that at Shoreditch, London, opened in June 1897, and it was actually one of the last to close, continuing in use until the 1940s. By about 1910, 20 per cent of the country's electricity generating stations were combined stations.

The generation of electricity from town refuse was a natural development of the introduction of incineration plants for the disposal of urban rubbish. Up to the 1870s nothing was done about this disposal problem; the refuse was merely dumped in stinking and insanitary heaps on the outskirts of towns -- and in those days the refuse included sewage. It was around 1875 that serious efforts were made to dispose of it by incineration. To destroy the refuse and render it and the gases produced quite harmless, very high temperatures were needed and the process became heat-generating. Thus it could be used for generating steam, and hot water for public baths -- so why not electricity?

The incinerators were called refuse destructors and their principles were clearly stated by 1878; these were as follows:-

1. The temperature of combustion had to be high enough to make the process exothermic; a reverberatory roof reflected the heat back on to the burning mass; and later on, forced blast was used, enabling a temperature of about 2000 deg.F to be attained.
2. The hot gases circulated in a flue in such a way as to dry out the incoming wet refuse.
3. The pre-heater, the main grate and the furnace mouth were all sloped so that the material tended to feed itself through with the minimum of attention.
4. The product taken from the destructor could be ground with lime into an excellent mortar.

By the time these incinerators were associated with electricity generation, a fair degree of perfection had been attained. Fig.1 shows a cross-section of the Horsfall furnace of 1897,

Emeritus Professor D.G. Tucker is Honorary Senior Research Fellow at the University of Birmingham.

and Fig.2 shows the Beaman and Deas furnace of the same period with a water-tube boiler. Fig.3 shows a complete combined refuse destructor and electricity-generating station at Llandudno in 1898.

Most combined stations were designed to burn coal as well as refuse, and the way in which the two fuels were used is illustrated by the winter's-day record from Shoreditch in 1898, shown in Fig.4. At Shoreditch there was a substantial load during the morning due to electric motors, so that the morning load was about 200 kW, twice that of the night, but only about one-third of the evening peak load. It can be seen that the steam from the refuse destructor was able to supply all the demand except for seven hours (and note that it was a dark December day) and even then it coped with more than half of the energy demanded.

As the demand for electricity increased over the years much faster than the production of refuse, the significance of the generation of electricity from refuse diminished and it ceased to be worthwhile. Thus all the combined stations went out of use, as did refuse incineration itself, and little was heard of the idea until it was resurrected 30 years later -- as something new -- in the late 1960s.

References. A long list of references is given in the author's paper:

D.G.Tucker, 'Refuse destructors and their use for generating electricity: a century of development', Industrial Archaeology Review, 2, 1977, pp.5-27.

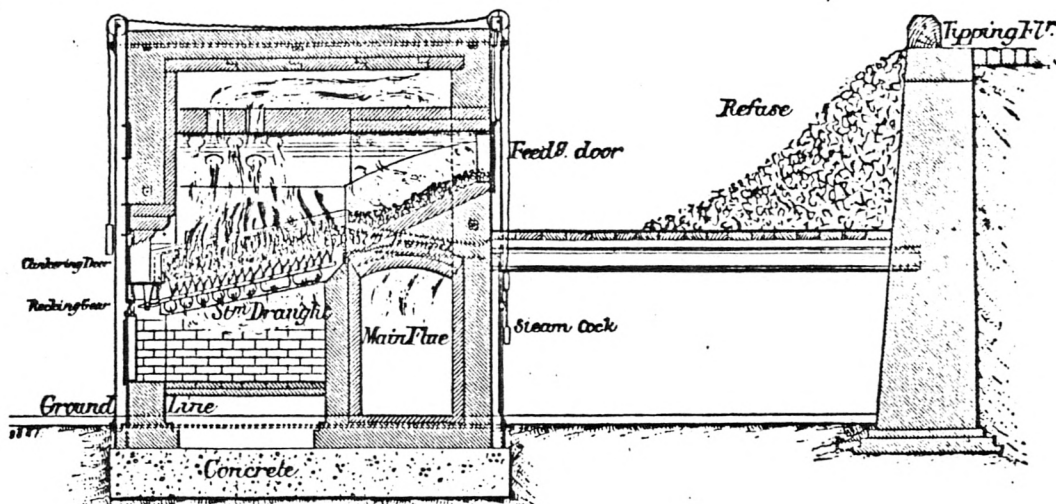


Fig.1. Cross-section of the Horsfall Refuse Furnace (from Engineering, 63, 1897, p.122.)

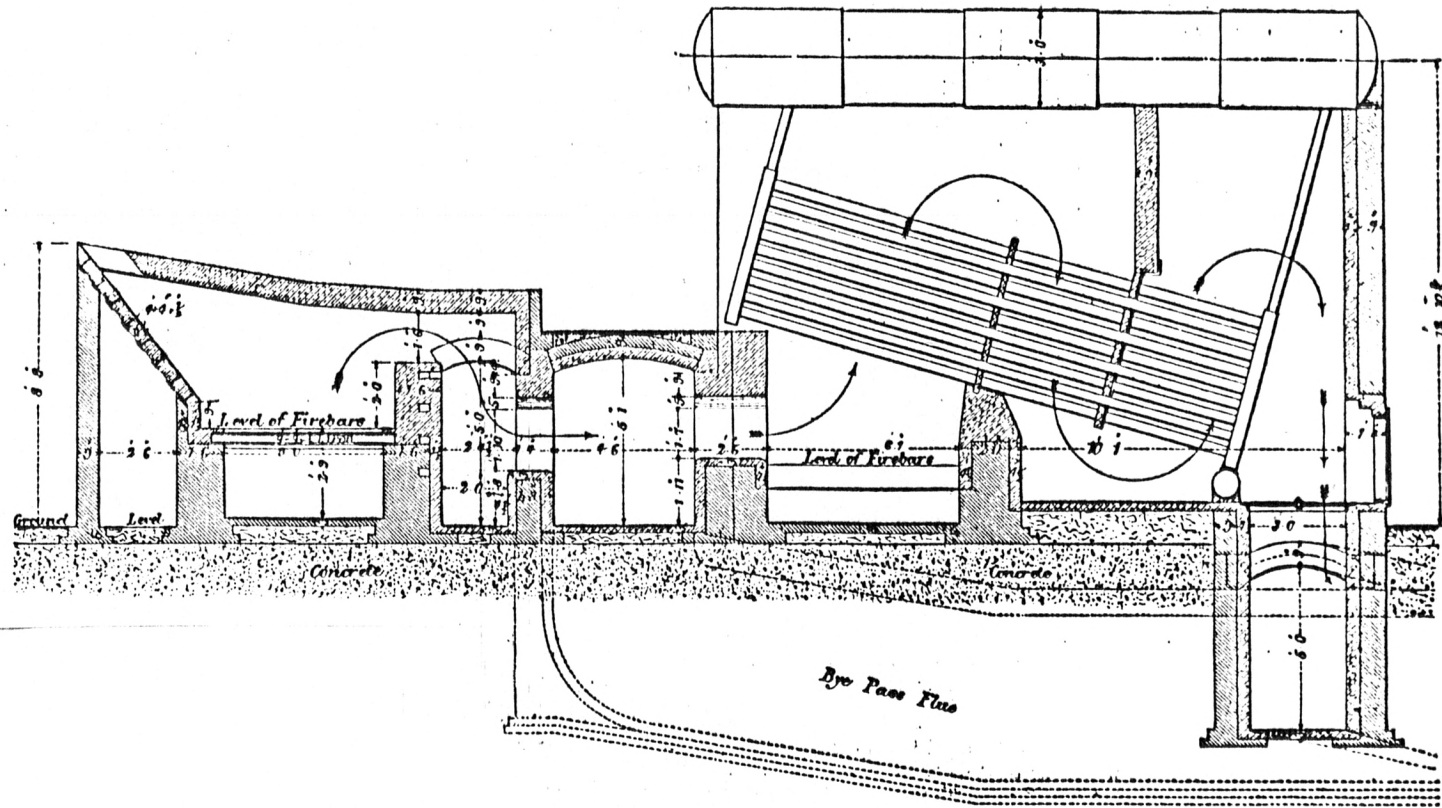


Fig.2. The Beaman and Deas Refuse Furnace with water-tube boiler (from Engineering, 62, 1896, p.670.)

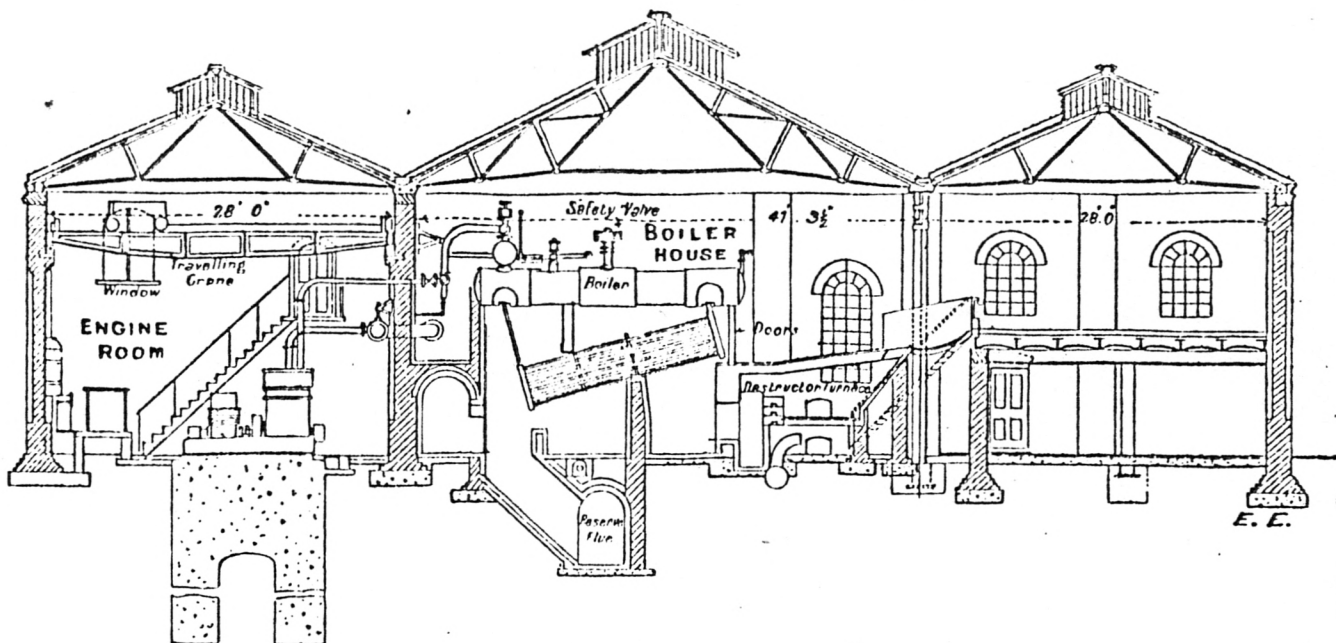


Fig.3. Cross-sectional elevation of the Llandudno combined refuse destructor and electricity generating station. Refuse carts enter at first-floor level on the right; the refuse is tipped into the destructor furnace (4 cells). The hot gases heat two of the three water-tube boilers; the centre one is coal-fired. Total capacity of the three dynamos 250 kW. (From Electrical Engineer, 22, 1898, p.647.)

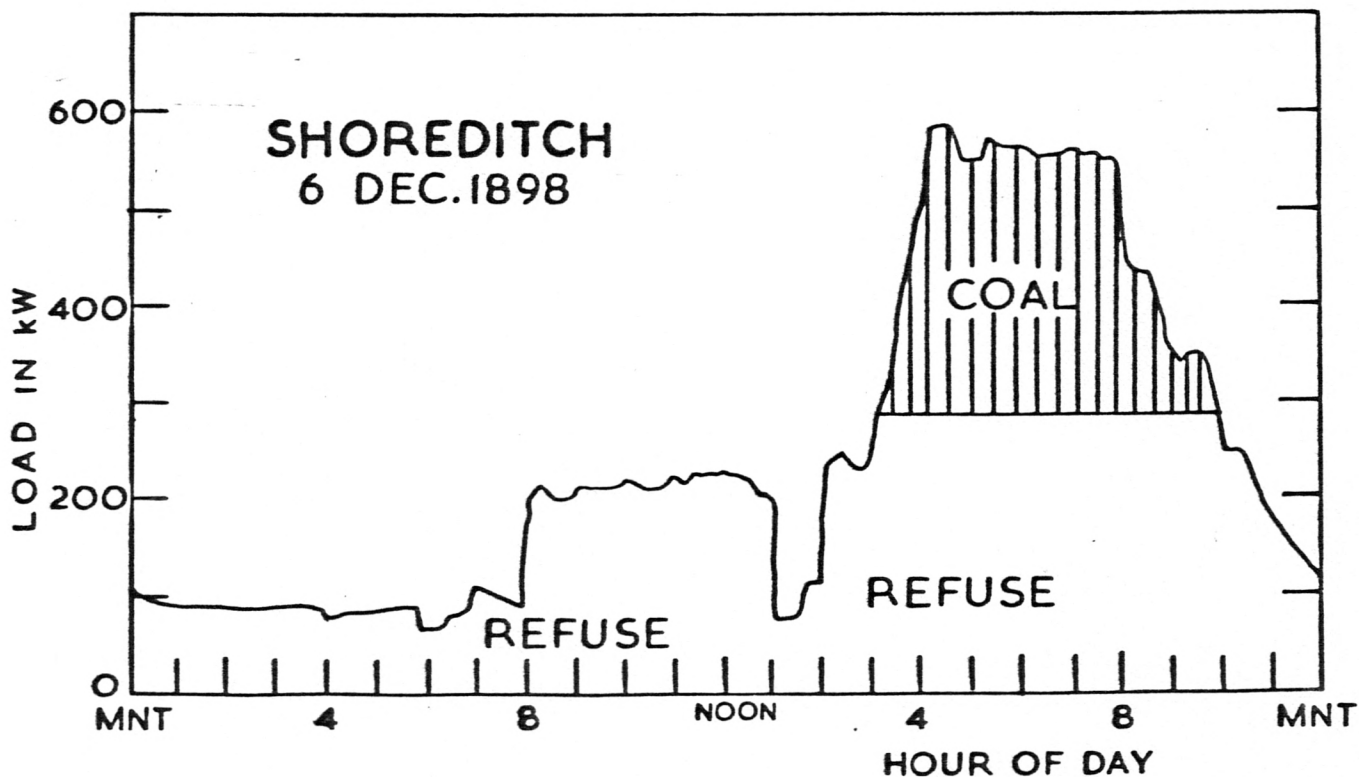


Fig.4. Operating record for Shoreditch combined station, 6 December 1898.