Technical and Scale Efficiencies Measurement of Taiwan's Incineration Plants: An Application of Two-Stage Production System Method

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Abstract

In this study, we establish a two-stage model including undesirable outputs to characterize the technical and scale efficiencies of waste management and electricity generation services provided by incineration plants. Since the system model considers the linkage of different processes explicitly, it enables us decompose the efficiency scores for individual processes/activities so that sources of inefficiency can be identified.

Empirical results show that the overall efficiency score is only 0.36 on average which means there is still around 64% of inefficiency requires to be improved. The decomposition of overall efficiency indicates that the inefficiencies are major from the pure technical inefficiencies. However, if turning to the results of individual production process, it can be found the inefficiency is mainly from the treatment process, its low mean scale efficiency score confirms that there is severe over-supply problem of the operation of incinerators. 19 out of 22 incinerators operate at increasing returns to scale and the more suitable scale of incinerated refuse is about 380,000 Tonnes for an incinerator. Thus, size should be the determining factor of an incinerator's operating efficiency and needs to be given due consideration in policy decisions.

Keyword：Two-stage DEA model, incinerator, scale efficiency, undesirable outputs