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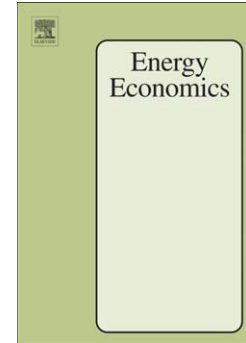
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Measurement of Returns to Scale on Large Photovoltaic Power Stations in the United States and Germany

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Abstract: This study discusses how to classify the type of RTS (Returns to Scale) in the framework of DEA production analysis under the assumption on a unique optimal solution on projection and a reference set. The RTS measurement is classified into two categories: input-based RTS and output-based RTS. The two measures depend upon the sign of an intercept (σ) of a supporting hyperplane on a production possibility set. In the DEA framework, multiple solutions usually occur on the intercept. This study discusses how to handle such an occurrence of multiple intercepts within the framework of the input-based and output-based RTS classifications. As an application, this study applies the proposed approach to classify the type of RTS on large photovoltaic power stations, often referred to as “mega solar parks”, in the United States (US) and Germany. The input-based RTS measurement identifies that US photovoltaic power stations are classified into increasing (64 stations: 80.0%), constant (5 stations: 6.3%) and decreasing (11 stations: 13.8%), respectively. German photovoltaic power stations are classified into increasing (73 stations: 91.3%), constant (7 stations: 8.8%) and decreasing (0 station: 0.0%), respectively. The finding is confirmed by the output-based RTS measurement on the German photovoltaic power stations. However, the output-based RTS on US photovoltaic power stations shows an opposite result. The US photovoltaic power stations are classified into increasing (26 stations: 32.5%), constant (6 stations: 7.5%) and decreasing (48 stations: 60.0%), respectively. The decreasing RTS is because the US photovoltaic power stations have less efficiently operated than those of Germany in such a manner that they cannot produce sufficient outputs from a give level of inputs in such a manner that they have failed to utilize a scale merit for their operations.

Key Words: Photovoltaic Power Stations, Returns to Scale, Scale Elasticity, DEA

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