

# An Integrated Performance Evaluation Model for the Photovoltaics Industry

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## Abstract

Global warming is causing damaging changes to climate around the World. For environmental protection and natural resource scarcity, alternative forms of energy, such as wind energy, fire energy, hydropower energy, geothermal energy, solar energy, biomass energy, ocean power and natural gas, are gaining attention as means of meeting global energy demands. Due to Japan's nuclear plant disaster in March 2011, people are demanding a good alternative energy resource, which not only produces zero or little air pollutants and greenhouse gases, but also with a high safety level to protect the World. Solar energy, which depends on an infinite resource, the sun, is one of the most promising renewable energy sources from the perspective of environmental sustainability. Currently, the manufacturing cost of solar cells is still very high, and the power conversion efficiency is low. Therefore, photovoltaics (PV) firms must continue to invest in research and development, commit to product differentiation, achieve economies of scale, and consider the possibility of vertical integration, in order to strengthen their competitiveness and to acquire the maximum benefit from the PV market. This research proposes a performance evaluation model by integrating analytic hierarchy process (AHP) and data envelopment analysis (DEA) to assess the current business performance of PV firms. AHP is applied to obtain experts' opinions on the importance of the factors, and DEA is used to determine which firms are efficient. A case study is performed on the crystalline silicon PV firms in Taiwan. The findings shall help the firms determine their strengths and weaknesses and provide directions for future improvements in business operations.

Keyword : photovoltaics (PV); performance evaluation; analytic hierarchy process (AHP); data envelopment analysis (DEA)