World Academy of Science, Engineering and Technology
International Journal of Energy and Power Engineering
Vol:17, No:02, 2023

Investigating the Impact of Solar Radiation on Electricity Meters' Accuracy Using A Modified Climatic Chamber

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Abstract : Solar radiation test is one of the essential tests performed on electricity meters that is carried out using solar simulators. In this work, the (MKF-240) climatic chamber has been modified to act as a solar simulator at the Egyptian national institute of standard, NIS. Quartz Tungsten Halogen (QTH) lamps and an Aluminum plate are added to the climatic chamber to realize the solar test conditions. Many experimental trials have been performed to reach the optimum number of lamps needed to fulfil the test requirements and to adjust the best uniform test area. The proposed solar simulator design is capable to produce irradiance up to 1066 W/m2. Its output radiation is controlled by changing the number of illuminated lamps as well as changing the distance between lamps and tested electricity meter. The uniformity of radiation within the simulator has been recognized to be 91.5 % at maximum irradiance. Three samples of electricity meters have been tested under different irradiances, temperatures, and electric loads. The electricity meters' accuracies have been recorded and analyzedfor eachsample. Moreover, measurement uncertainty contribution has been considered in all tests to get precision value. There were noticeable changes in the accuracies of the electricity meters while exposed to solar radiation, although there were no noticeable distortions of their insulationsand outer surfaces.

Keywords : solar radiation, solar simulator, climatic chamber, halogen lamp, electricity meter
Conference Title : ICAETA 2023 : International Conference on Advanced Energy Technologies and Applications
Conference Location : London, United Kingdom
Conference Dates : February 16-17, 2023