

This paper presents an electromagnetic energy harvesting device for capturing power from ac power lines using a miniaturized linear permanent magnet (PM) synchronous generator. The suggested device is useful to power wireless monitoring sensors in emerging smart grids. Conventional methods for energy harvesting from power lines use current transformers which structurally need to form closed magnetic paths around the lines. However, the suggested device can operate in the proximity of the lines due to using an independent PM generator. This feature facilitates installation of the device particularly in smart grids that require ample of easy-to-install and maintenance free monitoring sensors along the power lines. The proposed energy harvester uses a magnetically driven vibrating beam around the line that is attached to a linear PM synchronous generator (PMSG) including an array of small PMs with opposite polarities. This PM arrangement improves the induced voltage of the generator due to increasing the flux gradient within the linear PMSG. Experimental test results based on a cm-scale prototype show that an average power of 0.16 mW at 50 A (i.e., power density of 3.2 mW/kA) is achievable, equivalent to a 1038-mAh/2.7-V re-chargeable battery per year for a 100-A line.