



Editor's message: harvesting and wireless power transmission

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EDITORIAL



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Electricity is one of the most useful forms of energy, it can be produced in one place and used in another, transformed into heat, light or work, and it runs most of our facilities. This energy is distributed with an amazing, and sometimes forgotten, electrical network that makes this resource available in many places every day.

Most of our apparatus are usually connected to electric outlets; even gadgets and other portable devices are also indirectly connected because their batteries require to be charged. Everything is fine as long as we are at reach of this service, but when far away, we depend upon the batteries that do not last as we wish due to their intensive use.

External batteries, charging spots, the use of solar cells and mini crank generators are among the solutions to extend the operational time of the gadgets. However, the idea of harvesting energy from several electromagnetic waves sources, at least in urban areas, such as TV and radio stations, as well as mobile phone services and Wi-Fi, has gained interest.

Converting electromagnetic waves into electricity is not a new idea: there is a proposal regarding a satellite with solar panels that beams down the collected energy to the Earth by means of microwaves, which are in turn converted into electricity. In this wireless power transmission method, the beam is aimed to a ground antenna located in a specific place in a system designed for obtaining large amounts of energy and minimizing losses.

A basic example of harvesting is the operation of crystal (galena) radios, which run with the power taken from the signal carrying wave, to feed a high impedance earphone and have audio. In this case, the amount of obtained energy is not enough to run other devices, not even a conventional speaker, but other potential applications could emerge with the development of more efficient electronic circuits, including advanced methods for energy storing.

Commercial claims of 'free' energy and greater efficiency of microwave harvesting devices compared to solar cells could be part of the motivation for getting interest in this possibility, but practical issues must be reviewed in advance to propose this technique as a solution for charging batteries or run devices. Although harvesting could be highly efficient compared to solar cells, the available energy to be harvested is very little; for instance, in terms of energy, indoor light alone is estimated to be 300 times greater than RF sources. Therefore, the applications that have shown certain degree of success are those where the electromagnetic waves are directly aimed to the devices or the source is even in the same room, being rather a wireless power transmission in the range of consumption of devices such as sensor networks and Radio Frequency Identification (RFID) tags.

Arithmetically, even very small amounts of energy count, leading to say that charging batteries would be possible, but only for devices that draw less than that energy to run, or


that are not active all the time, so that the accumulated energy could be released on demand. Ordinary gadgets' energy requirements are far above this possibility.

In the side of science, claims are made with proper foundation, and then aspects such as antenna efficiency and realistic availability of energy in the environment, among many others, cannot be ignored. Reports about research in this area are increasing, but there are many cases where the presented results are based on simulations, often with claims of prototypes that validate such results under testing conditions that do not match. Therefore, despite the optimistic conclusions, the difficulties to get to practical applications, especially for gadgets, are evident.

Something relevant in any attempt to reach to practical applications is that they must continue in basic research, and despite the present situation, there is a great opportunity to learn and explore about new topics that are interesting for scientists and engineers working in microwave and RF applications. Everything must fit with well-established knowledge, do the math, and in the particular case of harvesting, to be clear in the difference between harvesting energy and wireless power transmission.

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