

# Energy Harvesting

Author: Miha Čančula  
Mentor: doc. dr. Dušan Ponikvar

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## Abstract

## 1 Introduction

Small electronic devices are increasingly present everywhere around us. With their ubiquity and ever decreasing size and power consumption, connecting each of them to the power grid becomes impractical.

The traditional solution is to use batteries, but they come with their own set of problems. Replacing them can be expensive, especially in hard-to-reach places. A much better option would be if the device had a power source of its own, removing its dependence on the power grid and drastically reducing the maintenance cost.

The method of drawing small amounts of electricity from the device's immediate surrounding is called Energy Harvesting (EH).

## 2 Use-cases

### 2.1 Sensors

The most common use for energy harvesting systems are nodes in Wireless Sensor Networks (WSNs). Such a network can contain a large number of independent nodes, so it would be difficult to connect each node to the power grid with wires. The sensors themselves usually consume very small amounts of power, so they are ideal applications for Energy Harvesting methods.

The applications for WSNs include:

- Weather stations
- Air and water pollution measuring
- Fire detection
- Industrial machine health monitoring
- Structural monitoring in buildings

Most of these applications require the nodes to be outside or in other areas where a direct connection to the grid would be difficult. On the other hand, they can still be close enough to the central node so they can transmit the measurements over a wireless connection with their own harvested power.

## 2.2 Consumer electronics

Many popular electronic devices, including TV remote controls, digital watches, portable music players and mobile phones, have power consumption low enough to be powered or at least assisted by EH. Though their batteries can last a very long time, they can run out unexpectedly and cause a severe inconvenience.

## 3 Photovoltaic cells

The best known method of generating electricity from the environment on a small scale are photovoltaic cells.

## 4 Thermoelectric generators

## 5 Piezoelectric generators

## 6 Energy management and storage

## 7 Conclusion

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