

## **Piezoelectricity as a Sustainable alternative to the Energy of Small Products**

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### ***Abstract:***

The use of new and renewable energies is considered one of the most important methods of product sustainability due to its ability to supply the products with continuous sources of energy, and not having a negative impact on the environment as is done with the use of traditional energy sources, in addition to its contribution to adding new characteristics to the product such as light weight, speed, accuracy, or Aesthetic appearance, and the ability to use in uninhabited areas. Piezoelectric energy is also considered one of the most important new and renewable energies that can contribute to achieving sustainability due to its dependence - in energy generation - on natural materials. As a result, global interest has begun to employ it in many tasks, especially regarding generating energy through leg movement or by hand. Through breathing or blood pressure, body temperature, movement of the fingers and limbs, in addition to building energy harvesting systems...etc. The problem of the current research lies in the consumption of small products from many traditional energy sources during their life cycle, which causes harm to the environment as a result of the manufacture of these sources which turns into harmful waste that must be treated after the end of its lifespan, also Traditional energy sources increase the size of relatively small products, which causes the user to not want to purchase these products as a result of their large size. The research dealt with presenting the historical development of piezoelectric cells, their working principle, and related terminology. Relevance, discussing the various aspects related to its design, how it is used in many different fields and products, and the impact of its use on achieving sustainability in product design. The research has led to the design and implementation of a group of products (Paper Holder, Weighing Scale, Screwdriver, Remote Car Key) which operate through piezoelectric energy, and characterized by its accuracy and speed of response, which helps in reducing its size and cost and increasing its efficiency and lifespan, and contributes to achieving sustainability by replacing traditional energy sources with a natural environmental source made of quartz.

The rapid rise in energy consumption has led to increased reliance on fossil fuels, contributing to increased carbon dioxide emissions each year. The most important solutions were the transition from energy resources based on fossil fuels to renewable and sustainable energy resources. Over time, fossil fuels have been replaced in some sectors and systems by solar energy, wind energy, biomass energy, and others. "Piezoelectricity" was also discovered, which is one of these sources that appeared recently (United Nations, 2023). This is done using crystals composed of piezoelectric materials that have certain properties, and piezoelectricity appears through piezoelectric materials.

Piezoelectric materials are considered one of the most widely used smart materials, as they can generate electrical activity in response to minute deformations, by converting mechanical energy into electrical energy when stress or strain is applied and vice versa. Due to their wide bandwidth, fast electro-mechanical response, relatively low power requirements, and high generating powers, their use and employment within various fields has increased.

### ***Keywords:***

New and Renewable Energies, Piezoelectricity, Energy harvesting, Sustainability, energy of small products

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