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USE OF MULTIFERROIC ALLOY TO CONVERT WASTE HEAT FROM NON-COMMERCIAL GEOTHERMAL WELLS TO ELECTRICITY

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The goal of this research is to come up with a design of a multiferroic alloy ($Ni_{45}Co_5Mn_{40}Sn_{10}$) that utilizes waste heat from non-commercial geothermal power plants to develop green energy. The alloy is surrounded by suitably placed coils and then placed adjacent to a permanent magnet. In the design, the steam coming from the well is used to heat the multiferroic alloy. The alloy then undergoes a reversible first order martensitic phase transformation from martensite at low temperature to austenite at high temperature. The martensitic phase is non-ferromagnetic while the austenite phase is highly ferromagnetic. The magnetic field momentum of the alloy increases rapidly when heated. Extreme fluctuation in the magnetic field momentum that cuts through the coil as the alloy transforms from non-ferromagnetic to ferromagnetic phase induces electromotive force into the coil (Faradays law).

Cooling the alloy in air through natural convection and conduction induces an electromotive force of opposite polarity in the coil. Successive heating and cooling of the alloy results in continuous power generation. The martensitic transformation is extremely fast due to low magnetic hysteresis, absence of diffusion and presence of low energy mode of transformation between the martensitic phase and austenite phase. The speed of interface transformation in the alloy tends to the speed of light in a material. The rapid martensitic phase transformation results in production of electricity at high frequency. The frequency of power generation is further increased by having several permanent magnets and coils. The magnets are arranged such that their fields produces multiple phases of current in the coils.

Through experimentation, computer simulation and modelling, a single non-commercial well producing steam at 130^0C can produce **640kW** of electricity at a frequency of **50Hz**. This is **5,606,400kWhr** per year. The average annual residential power use in Kenya is 2501kWhr. The project can therefore serve approximately **2,242** households in Kenya.

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