

# **Self-oscillations in photovoltaic/thermoelectric fuel cells and biological engines**

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A standard textbook picture of photovoltaic/thermoelectric fuel cells (PTF) and biological engines (e.g. proton pumps) assumes a direct transformation of light, heat or chemical energy into electric current. However, this scheme is inconsistent with the basic principles of electrodynamics and thermodynamics. To solve this problem the mechanism of collective electric charge self-oscillations fed by a constant energy supply, has been proposed. Subsequently, a diode mechanism, present in all mentioned above energy transducers, transforms charge oscillations into a direct current. A simple analog system - a steam engine used to propel the so-called "putt-putt boat" - is used to illustrate the physics of work generation in PTF. Another model system - driven elastic capacitor - describes the plausible mechanism of self-oscillations in biological engines. The main new prediction of the proposed theory is the emission of electromagnetic radiation by PTF in THz region, or conversely, resonant stimulation of PTF by electromagnetic oscillations. Remarkably, only the last phenomenon has been observed, but only in biological ion pumps with cut off chemical energy supply and stimulated by an oscillating electric field.