

Energy Generation from Molecular Kinesis for Breaking The Second Law of Thermodynamics

Dr. Hewa Ahmed Mustafa, Hawler Medical University, Erbil, Kurdistan Region, Iraq &
Kristiansund Adult Education, Norway, heewa.82@gmail.com

ORCID ID (Hewa Ahmed Mustafa): (<https://orcid.org/0000-0002-5666-7651>)

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Abstract

A novel research paper published by a team from Arkansas University, which was about new emerging technology that extract energy from ambient temperature from graphene ripples. This type of energy extraction is entirely different from all previously available methods, it is only depending on ambient temperature as energy source which is a limitless clean and green source of energy, hence it can be called Super Sustainable Energy. Furthermore, it will break the second law of thermodynamics. This article presents six other new theoretical methods for extracting energy from Molecular Kinesis or Brownian Motion in addition to the above-mentioned method. Among these methods, four of them are mentioned here for the first time. It should be reminded that, Thought Experiments are different from theoretical methods, the latter is more likely to be experimentally proven. Two famous thought experiments also described this article.

Keywords: Graphene, Nanogenerators, Breaking the Second Law of Thermodynamics, Water Evaporative Energy, Molecular Kinetic Energy

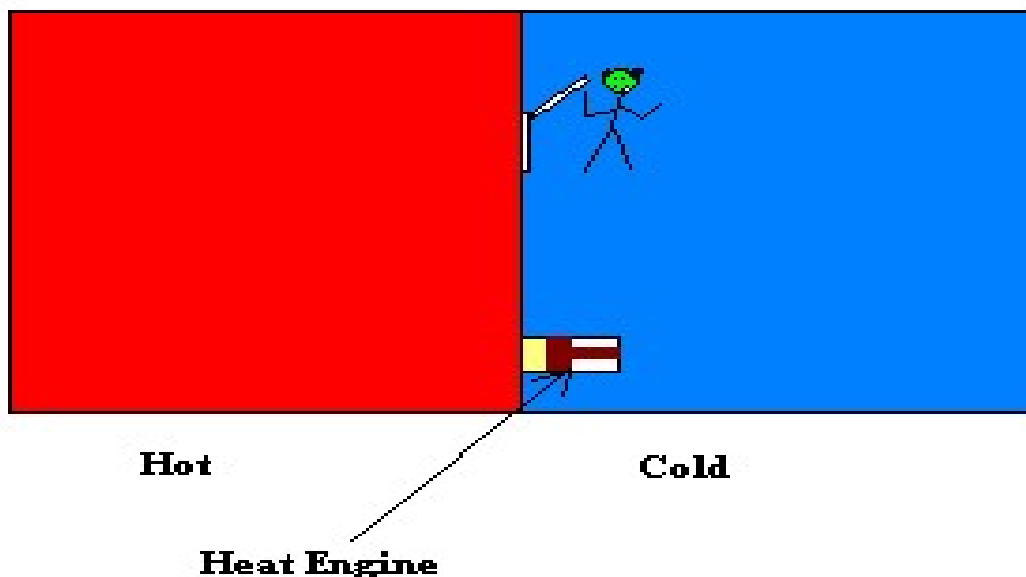
Energy Generation from Graphene Sheet Ripples (First Method for Breaking the Second Law of Thermodynamics)

The research paper of Paul Thibado, a professor of physics at the University of Arkansas-USA, provides strong evidence that the motion of two-dimensional materials could be used as a source of clean, limitless energy. Thibado and his students studied the movements of graphene, which is composed of a single layer of carbon (University of Arkansas News, n.d.). For more details you can look at this link: <https://youtu.be/wrleMqm3HiU>

Maxwell's Demon (Thought Experiment)

Maxwell's Demon is an imaginary creature that the mathematician James Clerk Maxwell created to contradict the second law of thermodynamics (webhome.auburn.edu, n.d.).

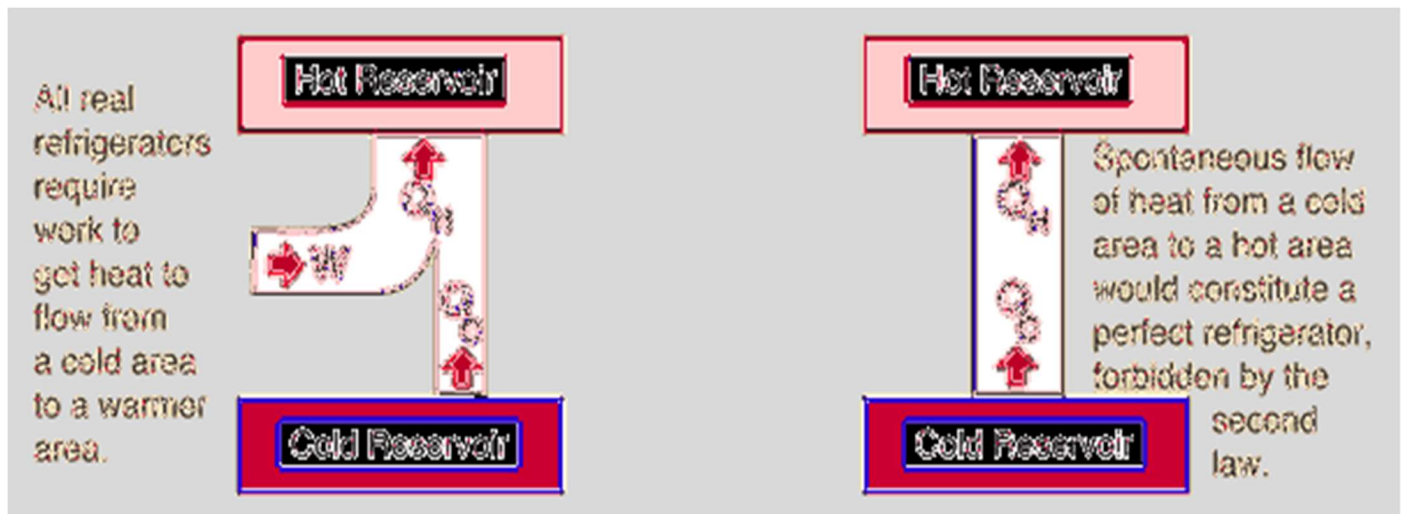
Question: How much energy needed for CPU of the Demon?



Breaking The Second Law of Thermodynamics

Energy will not flow spontaneously from a low temperature object to a higher temperature object (Gsu.edu, 2019). If the theoretical evidence for energy extraction from Graphene sheet ripples is confirmed by experimental results, it will violate the second law of thermodynamics.

***despite all**, the authors from Arkansas University recently denied that their device is breaking the second law of thermodynamics!!!



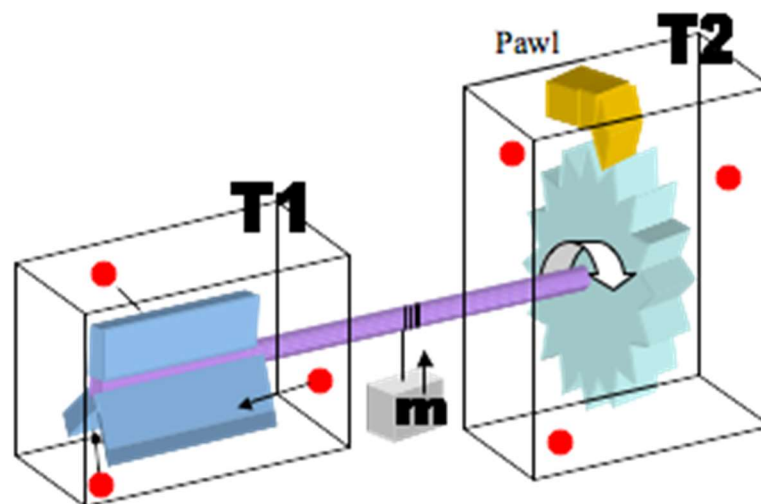
Brownian Motion

Brownian motion is the random movement of particles in a fluid due to their collisions with other atoms or molecules. Brownian motion is also known as pedesis. It is named after the **Scottish botanist Robert Brown**, who observed pollen grains moving randomly in water. He described the motion in 1827 but was unable to explain it. The

Roman poet Lucretius describes the motion of dust particles around the year 60 BC. At 1905 **Albert Einstein** published a paper that explained the pollen was being moved by the water molecules in the liquid. In 1908, **Jean Perrin** experimentally verified Einstein's hypothesis, which earned Perrin the 1926 Nobel Prize in Physics "for his work on the discontinuous structure of matter" (Helmenstine, 2019). Personally, I tried to find a method for extracting energy from Brownian motion since I studied it at secondary school.

Brownian Ratchet or Feynman's Ratchet (Thought Experiment)

It consists of a gear known as a ratchet that rotates freely in one direction but is prevented from rotating in the opposite direction by a pawl, appears to be an example of a Maxwell's demon, able to extract useful work from random fluctuations (heat) in a system at thermal equilibrium in violation of the second law of thermodynamics. Detailed analysis by Feynman and others showed why it cannot actually do this (Wikipedia, 2022).



*The macroscopic Brownian ratchet provided in this video proves that useful energy can be generated from random movements: <https://youtu.be/QU2CKQQLDt4>

Ferrofluid Generator



This manuscript was accepted by Phys. Fluids. Click [here](#) to see the version of record.

<http://dx.doi.org/10.1063/1.4954787>

Harvesting Energy From the Sloshing Motion of Ferrofluids in an Externally-Excited Container: Analytical Modeling and Experimental Validation

S. Alazmi,¹ Y. Xu,¹ and M. F. Daqaq^{1, a)}
*Nonlinear Vibrations and Energy Harvesting Laboratory
Department of Mechanical Engineering
Clemson University,
Clemson, SC 29634*

shown in Fig. 1(b). When a container carrying the magnetized ferrofluid is subjected to external mechanical stimuli, the sloshing motion of the magnetized ferrofluid generates a time-varying magnetic flux, which can be used to induce an electromotive force in a coil placed adjacent to the container. This process generates an electric current in the coil, and therewith, can be used to transduce external vibrations into electric energy as shown in Fig. 1(c).

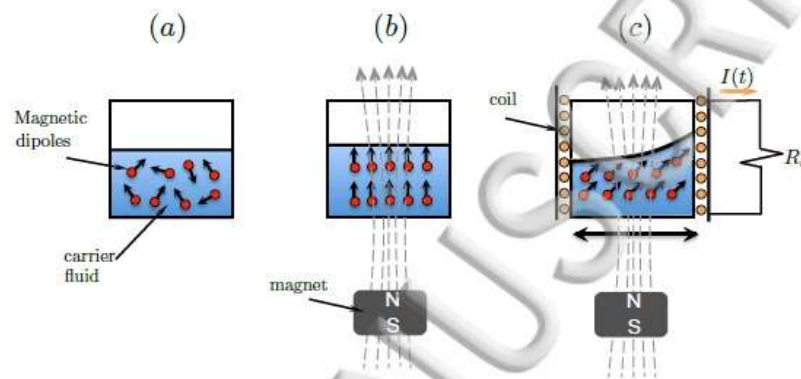


FIG. 1. Schematic of ferrofluid particles (a) without external magnetization (b) with external magnetization (c) with external magnetization and base excitation.

When a container carrying a magnetized ferrofluid is subjected to external mechanical stimuli, the sloshing motion of the magnetized ferrofluid generates a time-varying magnetic flux, which can be used to induce an electromotive force in a coil placed adjacent to the container. This process generates an electric current in the coil, and therewith, can be used to transduce external vibrations into electric energy (Alazmi, 2016).

Second method: Microcoils / Nanocoils for Brownian Energy Extraction

If a microcoil/nanocoil is placed inside a ferrofluid or a solution containing superparamagnetic particle with Brownian motion, magnetic dipoles' motion inside or beside the coil will induce electromotive force. The electricity produced by this method is expected to be very low random AC current because of randomness of Brownian motion and small size coils.

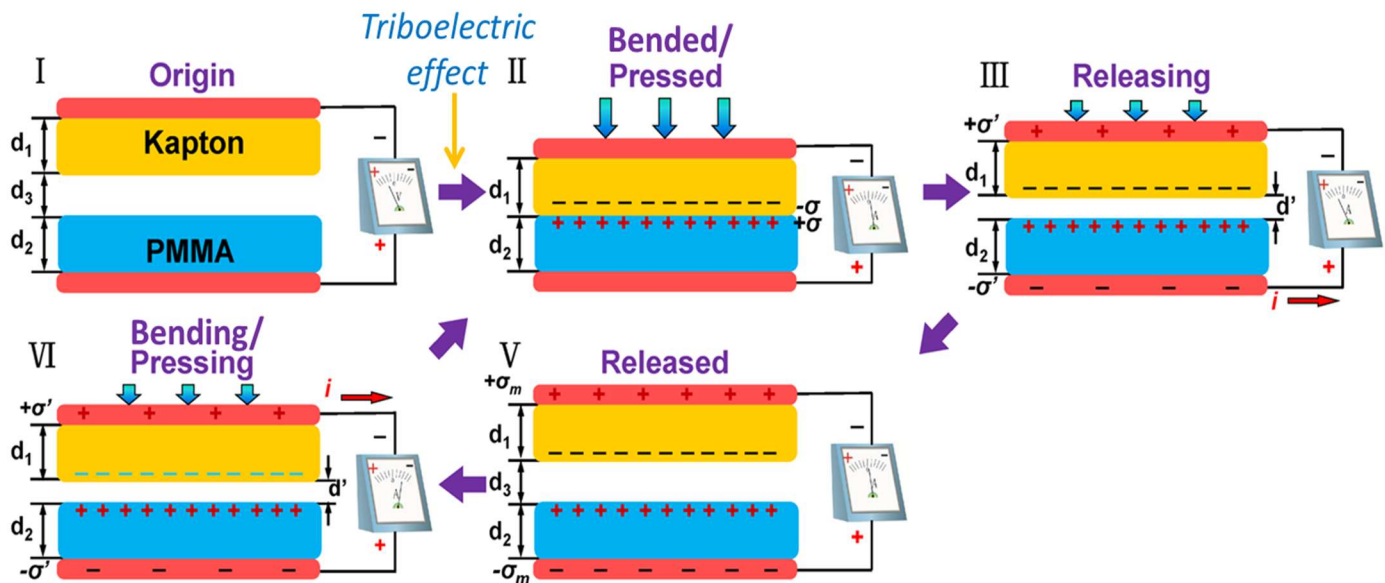
Rectification Problem

An article is published at (Inderscience Publishers) under the title;
Brownian motion of magnetic nanoparticles as a source of energy?
Brownian motion of magnetic nanoparticles in a low-density gas can induce random voltage pulses in a microscopic electric circuit containing a high-number-of-turns coil. It has been shown that in a nanogenerator where the motion of the magnetic nanoparticle is restricted to one-dimensional rotation around its vertical axis and the nanoparticle is inserted into a very low number-density gas ($3 \times 10^{16} \text{ m}^{-3}$) one can generate voltage pulses of the amplitude of $3 \times 10^{-8} \text{ V}$ in one coil turn.

The total number of 10^6 turns is then necessary to reach the rectifying region (Poláček, 2013).

Triboelectric Nanogenerator (TENG)

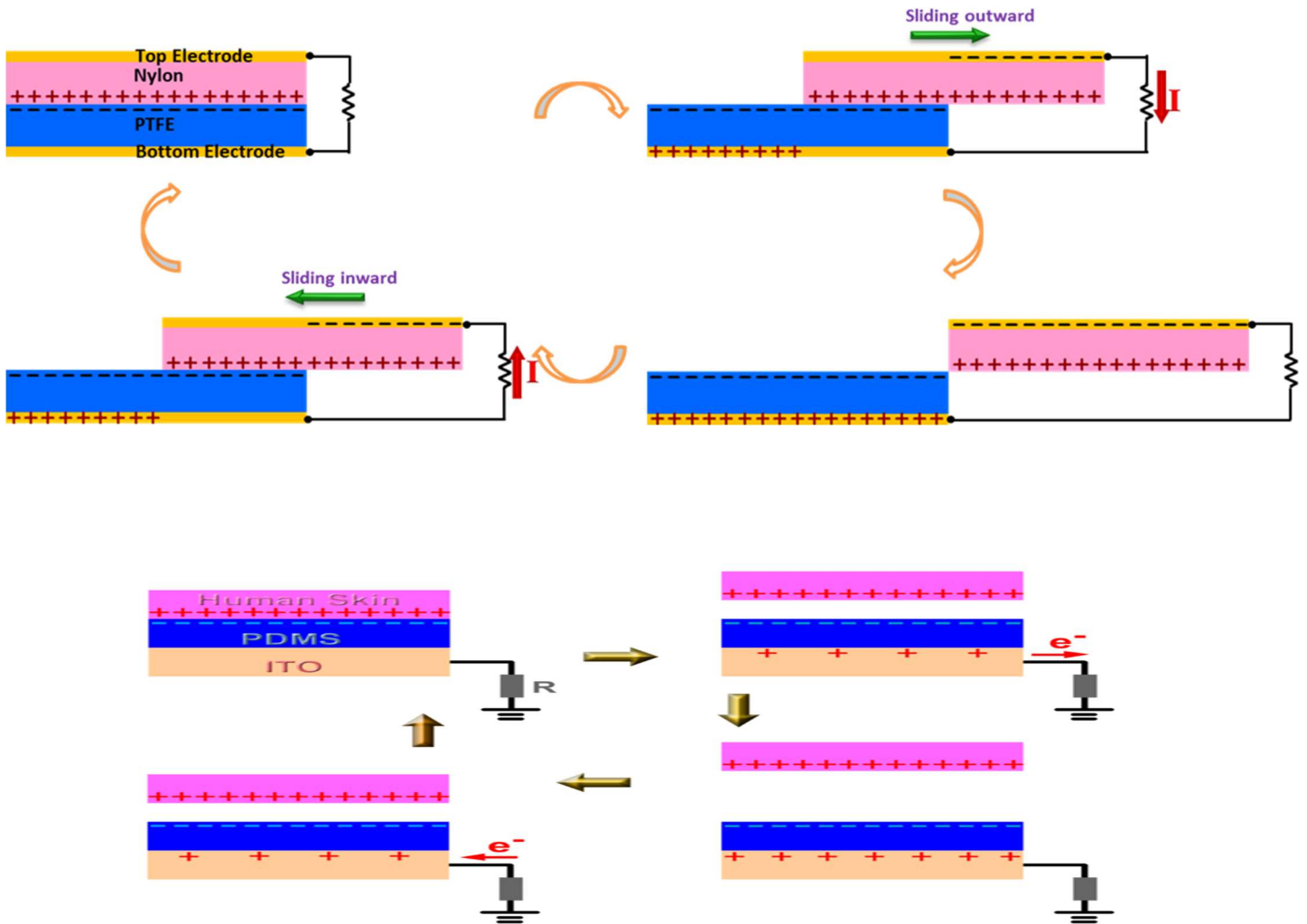
It is an energy harvesting device that converts the external mechanical energy into electricity by a conjunction of triboelectric effect and electrostatic induction.



Vertical contact-separation mode TENG (Wikipedia Contributors, 2019)

PMMA: Poly (methyl methacrylate) also known as acrylic or acrylic glass

Lateral sliding mode TENG



Single-electrode mode TENG (Wikipedia Contributors, 2019)

PTFE: Polytetrafluoroethylene (Teflon) PDMS: Polydimethylsiloxane (dimethicone)

ITO: Indium tin oxide

Human skin (colored pink in the above diagram) is acting as free moving triboelectric component of this single electrode generator



Summary on the progress made in the output power density of a TENG within 12 months. The insets are the people in Wang's group who have made important contributions to the discovery and development of TENG.

(Wang, 2013)

Third Method: Molecular Kinetic Based Triboelectric Nanogenerator

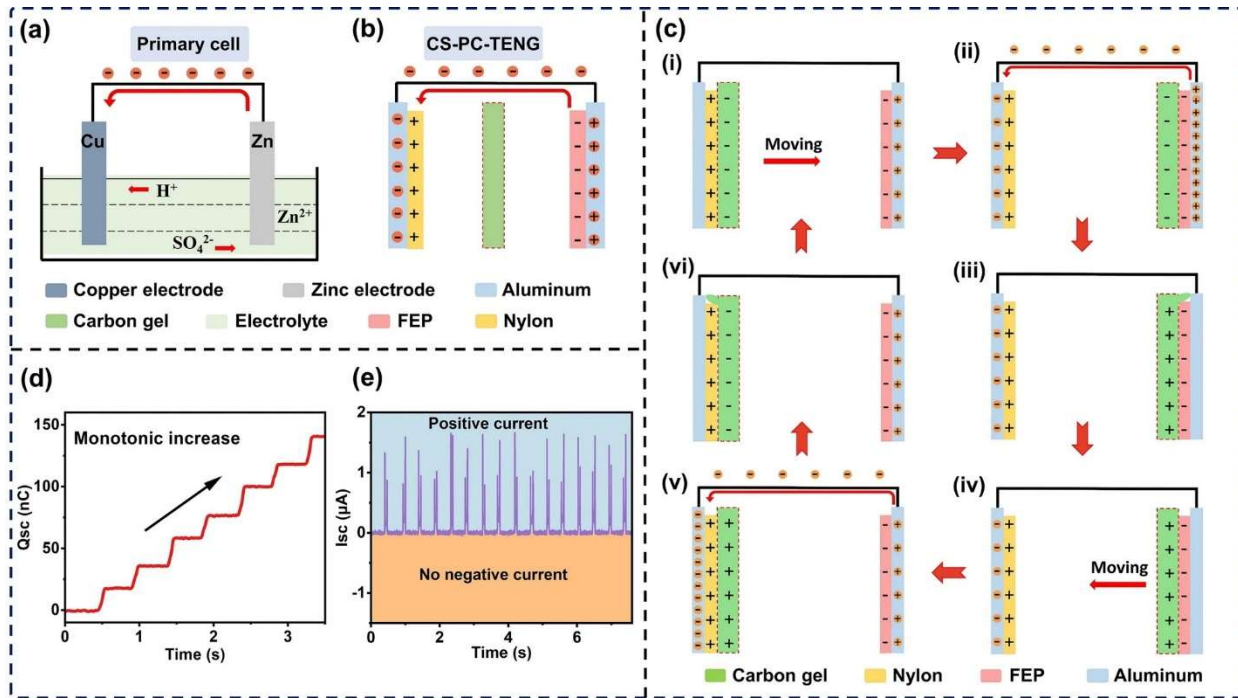
The motion of free triboelectric component of the single-electrode mode TENG can be changed from vibration-based motion in to molecular kinesis. (According to my proposed method), I mean, instead of using for example, human skin as triboelectric component, we can use nanoparticles or molecules inside fluids to induce current in the single electrode Triboelectric Nanogenerator.

There are two possible substitutes for free triboelectric component:

- 1- Mixed gases with different triboelectric tendency or low pressurized gas
- 2- Solution or suspension with different triboelectric components

*Concentration of the solutes/ nanoparticles or the pressure of the gas can be used as a factor to build relatively bigger stable electrodes.

Contact-separation Primary Cell Triboelectric Nanogenerator (CS-PC-TENG) can also be used for the same purpose (Fu, 2022).




The structural comparison of primary cell and the CS-PC-TENG, and working mechanism of the CS-PC-TENG. a Basic structure of the Zn/Cu primary cell. b Basic structure of the CS-PC-TENG. c Schematic diagrams of the working principle of the CS-PC-TENG. d, e the basic output charge and current of the CS-PC-TENG. We can use Brownian motion for moving carbon gel between two triboelectric components.

Newly Invented, Commutator DC TENG

I invented a new type of DC type Triboelectric nanogenerator. However, it does not violate the second law of thermodynamics, but I like to share with you this experimentally proven newly invented nanogenerator.

One of the drawbacks of TENG is their random AC current. Recently there are many inventions to improve efficiency of these nanogenerators. I invented new DC TENG by mixing the idea of using commutator in DC motors with rotatory TENG. Any kind of rotation that occurs between two triboelectric components can be used for example:

- Belt and pulley (all types)
- Gears with toothed wheel (all types)
- Touching wheels
- Or any similar method

During rotation, one side of the circle is always moving toward each other while the other side of the circle  is moving away from each other, thus one side is always producing a current opposite to another side. If we connect two sides with a commutator we can obtain a DC current, hence this type of TENG can be named as Commutator DC TENG. I did an experiment on pulley and belt type by using graphite from pencil as electrodes with nylon tape and teflon as triboelectric components and It was working perfectly. Further experiments can be done for evaluating its efficiency.

The Water Evaporative Energy

There are many methods for extracting energy from water evaporation at ambient temperatures. The most recent devices are these two novel generators:

- The **evaporation-driven engines** can power common tasks like locomotion and electricity generation. These engines start and run autonomously when placed at air–water interfaces. They generate rotary and piston-like linear motion using specially designed, biologically based artificial muscles responsive to moisture fluctuations (Chen, 2015).

- In new work, nanotechnology researchers have shown that evaporation from the surface of a variety of nanostructured carbon materials can be used to generate electricity: the evaporation driven water flow in nanoporous carbon film converts ambient thermal energy into electricity via the water molecules' interaction with the carbon material (www.nanowerk.com, n.d.).

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Fourth Method: The Water Evaporative Energy in A Closed System

In this method, we propose using one of the devices mentioned above, in a vertically long closed container and putting the devices in the bottom, with the presence of a small pump to allow movement of water vapor only upward to act like a one-way valve. At the top there should be a condensing plate. when the water vapor moves upward against gravity, it loses some of its kinetic energy and it is condensed easier in the top of closed container. Thus, the system can gain thermal energy from the bottom by water evaporation process. The input of energy could be less than the output energy by the small pump. Thus, energy can be generated from surrounding ambient temperature.

Fifth Method: The Brownian motion of nanoresonator arrays

The nanoresonator double-array device has been proposed by some researchers by using arrays of piezoelectric nanopillars (Rattinacannou, 2014).

Sixth Method: Using pH Gradient from Gibbs–Donnan Effect

Separation of two ionic solutions with a permselective membrane that is impermeable to some of the ions leads to an uneven distribution of permeating ions on the two sides of the membrane described by the Gibbs–Donnan (G–D) equilibrium with the G–D factors relating ion concentrations in the two solutions (Waniewski, 2021).

We can use Gibbs-Donnan effect to produce H^+ hydrogen ion gradient, then the hydrogen ions can be used to produce current through an electrochemical cell. Thus the molecular kinesis is the source of this electrical energy.

Solution for Rectification Problem

Theoretically I found a solution to overcome rectification problem, I am gladly ready for cooperation with any researcher who is interested to work on this subject or any other of my projects in Physics that can be found in my blog; www.babanyblog.wordpress.com

Including but not limited to the following;

- Modification in Thermal Gradient Systems
- New Heat Exchanger for Ground Source Heat Pump
- New Cycle for Heat Engines
- Mountain Thermal Energy Conversion (MTEC) in comparison to Ocean Thermal Energy Conversion (OTEC).
- New electric generators for solid state wind energy transformation

- New Approach Method for Description of Gravity Based on a gap in classical electromagnetism

References

- Alazmi, S. X. Y. a. D. M., 2016. Harvesting energy from the sloshing motion of ferrofluids in an externally excited container: Analytical modeling and experimental validation. *Physics of Fluids*, 28(7), p. 077101.
- Chen, X. G. D. G. Z. C. A. S. N. D. M. D. A. a. S. O., 2015. Scaling up nanoscale water-driven energy conversion into evaporation-driven engines and generators. *Nature Communications*, 6(1), p. 7346.
- Fu, S. H. W. W. H. S. C. D. Y. L. G. W. P. G. H. C. J. a. H. C., 2022. High Output Performance and Ultra-Durable DC Output for Triboelectric Nanogenerator Inspired by Primary Cell. *Nano-Micro Letters*, 14(1).
- Gsu.edu, 2019. *Second Law of Thermodynamics*. [Online] Available at: <http://hyperphysics.phy-astr.gsu.edu/hbase/thermo/seclaw.html> [Accessed 1 Apr 2023].
- Helmenstine, A. M., 2019. *An Introduction to Brownian Motion*. [Online] Available at: <https://www.thoughtco.com/brownian-motion-definition-and-explanation-4134272> [Accessed 7 Feb 2023].
- Poláček, J. a. A. P., 2013. Brownian motion of magnetic nanoparticles as a source of energy?. *International Journal of Nanotechnology*, 10(12), p. 1109.

Rattinacannou, J.-S., 2014. A promising new energy source: The Brownian motion of nanoresonator arrays. *EPJ Web of Conferences*, p. 01006.

University of Arkansas News, n.d. *Using the Natural Motion of 2D Materials to Create a New Source of Clean Energy*. [Online] Available at: <https://news.uark.edu/articles/40324/using-the-natural-motion-of-2d-materials-to-create-a-new-source-of-clean-energy> [Accessed 2 Apr 2023].

Wang, Z., 2013. Triboelectric Nanogenerators as New Energy Technology for Self-Powered Systems and as Active Mechanical and Chemical Sensors. *ACS Nano*, 7(11), p. 9533–9557.

Waniewski, J. P. M. a. P. L., 2021. Calculation of the Gibbs–Donnan factors for multi-ion solutions with non-permeating charge on both sides of a permselective membrane. *Scientific Reports*, 11(1), p. 22150.

webhome.auburn.edu, n.d. *Maxwell's Demon*. [Online] Available at: <https://webhome.auburn.edu/~smith01/notes/maxdem.htm> [Accessed 21 Mar 2023].

Wikipedia Contributors, 2019. *Nanogenerator*. [Online] Available at: <https://en.wikipedia.org/wiki/Nanogenerator> [Accessed 15 Feb 2023].

Wikipedia, 2022. *Brownian ratchet*. [Online] Available at: https://en.wikipedia.org/wiki/Brownian_ratchet

www.nanowerk.com, n.d. *A nanotechnology approach to generating electricity from water evaporation*. [Online] Available at: <https://www.nanowerk.com/spotlight/spotid=45918.php> [Accessed 8 Mar 2023].

Note: This article was originally presented as a seminar at Salahaddin University at 22/01/2019

The Super Sustainable Energy that might break The Second Law of Thermodynamics – College Of Education

<https://colleges.su.edu.krd/education/the-super-sustainable-energy-that-might-break-the-second-law-of-thermodynamics/>