Evaporation-driven engines for renewable energy generation

Technology #cu14162

This technology is a water-responsive bio-hybrid material that converts a humidity gradient into usable mechanical energy.

Unmet Need: Method to convert energy of evaporation to mechanical energy

While the use of renewable energy has become increasingly widespread, many of these technologies depend on inconstant environmental conditions, resulting in inconsistent energy production. Evaporation is a natural energy transfer process that could provide a constant and reliable source of energy. However, few methods exist to convert the energy from evaporation into usable mechanical energy. As such, there is a need for a robust method to harvest renewable energy from evaporation.

The Technology: Spore-based linear actuators generate mechanical energy at low cost and high efficiency

This technology harnesses the natural swelling and shrinking of bacterial spores in response to changes in humidity to generate mechanical energy. The flexible hybrid biological-polymer material can function as a linear actuator or oscillator, driven entirely by relative humidity gradients. The spores have been shown to demonstrate excellent reversibility, with mechanical forces maintained even after 1 million expansion-contraction cycles. This technology has been shown to store energy far more efficiently than available actuators, with a potential energy density two orders of magnitude greater than those of existing synthetic water-responsive materials. Additionally, the low cost and wide availability of key components lend to cost-effective energy generation and storage. This technology is a cost-effective and efficient means for consistent energy generation, and can be adapted for applications ranging from renewable energy production to biomedical devices.

A prototype of the technology coupled with a turbine generator was used to generate electrical energy, with the evaporation of a standing body of water as the sole input.

Applications:

• Renewable energy production
Advantages:

- Mechanism of energy generation is driven by evaporation, a constantly occurring process
- Can complement existing renewable energy production methods (e.g. hydroelectric dams)
- Energy density is two orders of magnitude greater than existing synthetic water-responsive materials

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Related Publications:


Tech Ventures Reference:

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