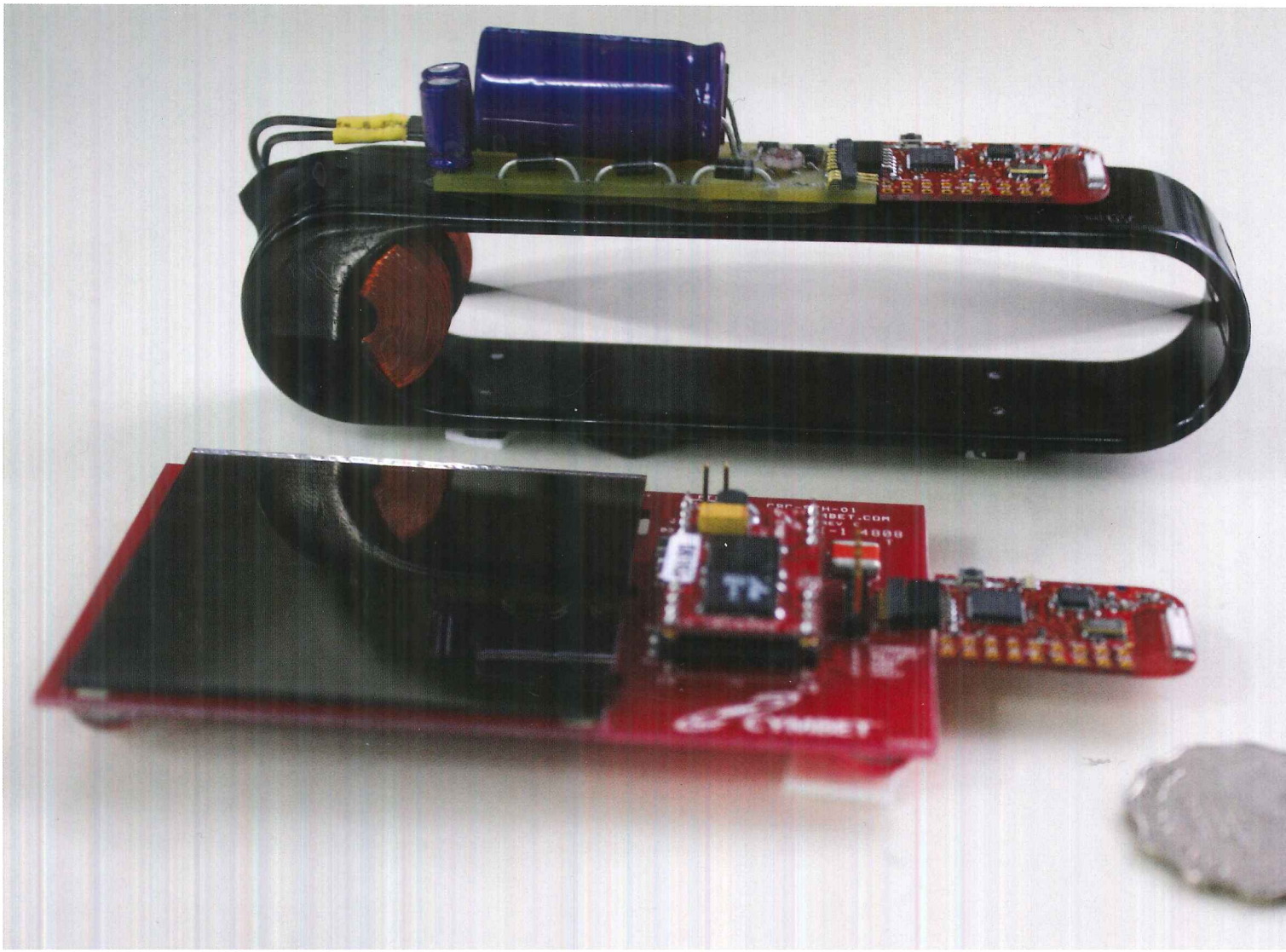
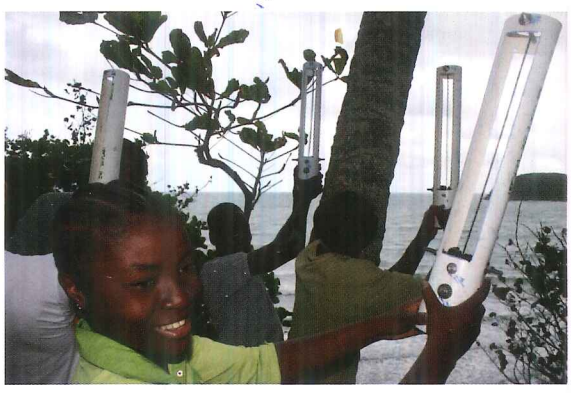
In its smallest form, the **Windbelt** is a clean alternative to the AA battery; it harnesses wind-induced vibrations to produce cheap electricity.

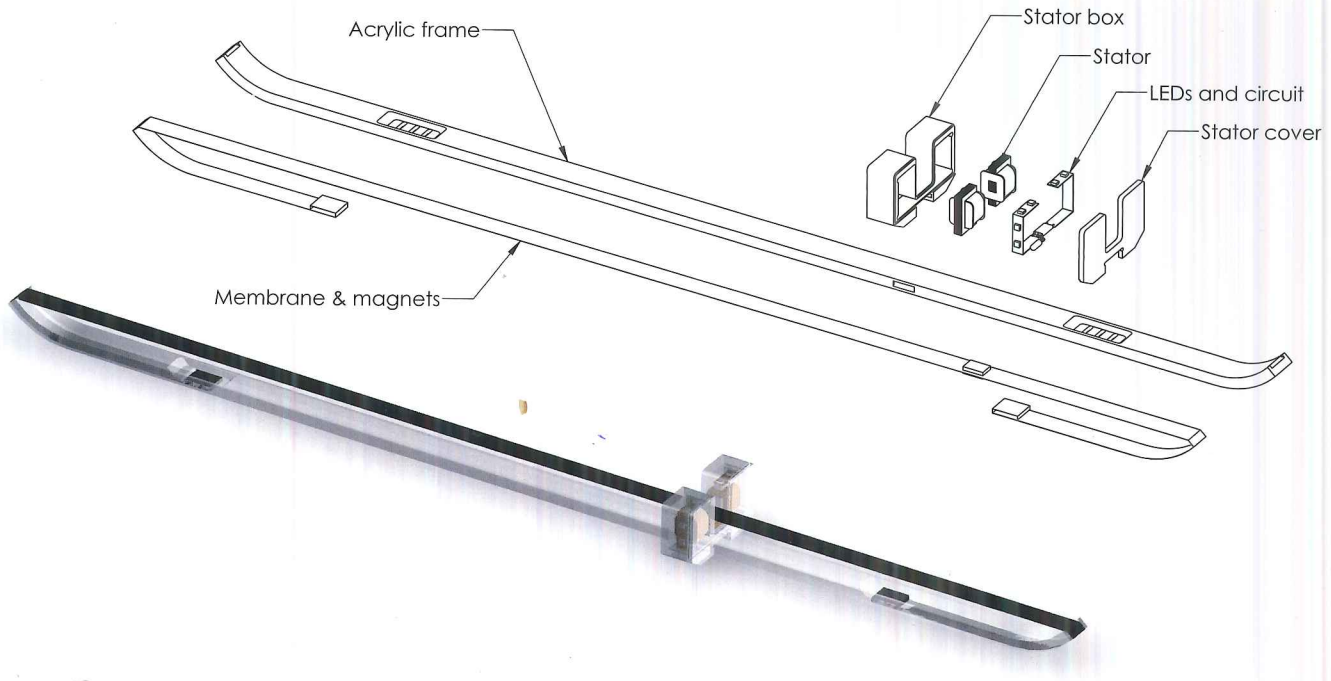
Shawn

Honolu
USA

2004–







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The Windbelt turns wind into electricity, cheaply and without using a turbine. Shawn Frayne, who invented the Windbelt in 2004, co-founded Hawaii-based Humdinger Wind Energy in 2007 to explore and develop the idea. Frayne came up with the idea during a trip to Haiti. He was staying in a small town without mains electricity, where people relied on polluting and costly kerosene and diesel for generating power. Thinking that wind would be a great way to run domestic LED lighting, he tried and failed to design and build an affordable turbine. Instead he came up with the table-top sized Windbelt, which uses a flexible membrane rather than blades to catch the wind. His invention harnesses energy from the rapid wind-induced vibration of a flap of fabric. This motion is translated into electricity by magnets attached to the material. The vibrating fabric moves the magnets in and out of electromagnetic coils, creating a current in the coil's wire.

The aerodynamic phenomenon that the Windbelt relies on is known as 'aeroelastic flutter' – a self-feeding vibration that occurs when a structure is exposed to an airstream. While the phenomenon is known to be a destructive force – particularly on aircraft and bridges, most famously causing the wild collapse of the Tacoma Narrows Bridge – when controlled, flutter energy can be put to good use. The fluttering membrane is the Windbelt's key component and needs to be made from a material with very specific properties. It must be thin and light, so it acts like an airfoil when wind blows across it. It must be fairly rigid, with a high tensile strength, in order to cope with high wind speeds. It must also be able to maintain its shape over time. Frayne's belts are made from mylar-coated taffeta, which is a kite-making material.

Modular and available in three different sizes, Humdinger Wind Energy's plan is for the invention to power a range of devices, from the modest to the massive. The micro Windbelt is a clean alternative to the AA battery. It's especially suitable for use in the millions of small sensors in operation around the world to monitor things like temperature, air quality, humidity or geological activity. To work, the Windbelt needs airflow and so it could sit on the underside of a bridge to monitor stress, or by an air duct in a building with a climate control system. This smallest Windbelt has a 12 cm (4.75 in) long membrane, and can achieve a power output ranging from 0.2 mW in 3.5 m/s (11 ft/s) wind to 5mW in a 7.5 m/s (25 ft/s) wind.

The medium Windcell has a 1 m (3 ft) long membrane and can power larger devices, such as lights and WiFi repeaters. Designed to work alone or together, a few linked Windcells could fuel something like an ocean navigation buoy or a lighting array. Humdinger has been working on an individual light-up Windcell that directly powers a detachable set of LEDs. Weighing under 1 kg (2.2 lb) and only 3 cm (1.2 in) deep, it can operate in wind speeds of 2 m/s (6 ft/s) and more, and accepts airflow from multiple directions.

Arrays of Windcells could also be grouped together into panels with the hope of providing grid-based energy a much larger scale. Mounted vertically, each Windcell Panel will aim at energy costs of £0.3 ($0.5) per kWh in average wind speeds of 6 m/s (20 ft/s). First tested in Hong Kong in 2010, this 1 x 1 m (3 x 3 ft) square design is still a work in progress. The output of large installations varies on the size of the module, but could potentially produce power on a scale comparable to a wind turbine. *Helen Babbs*