

Speed Bump Power Generator

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SDGs promoted: 7 and 9

Abstract

When vehicles pass a speed bump, they exert a downward force and mechanical energy is produced. A speed bump experiences thousands of exertions a day, and what if we harvest this free mechanical energy and transfer it into electric energy? This energy can be used to run the nearby infrastructures like traffic lights, warning signs, or the LED screen panels in bus stops.

Challenge

Harvesting the free mechanical energy from vehicles that pass the speed bumps and transfer it into electricity.

Target locations:

Parking lots

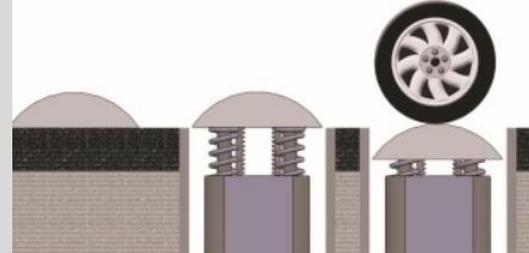
Bus stops

Driveways

A light on a pole in a typical parking lot uses 400 watts, and based on a 12h per day usage, the parking lots electricity cost is about 4000 \$ annually. If we harvest the energy from the speed bump whenever a vehicle enters and leaves the parking lots, the electricity cost and energy used on the light poles could be reduced, and drivers could benefit from paying less parking fee.

My Solution

This is a traditional linear generator that transfers sliding mechanical energy into electricity. The central slider is made of a permanent magnet, and the outside winding is a coil of wires where electricity is produced according to Faraday's law of induction. A traditional linear generator's efficiency is about 45%. My plan is to put it under the speed bump, and electricity will be produced whenever a vehicle passes by.



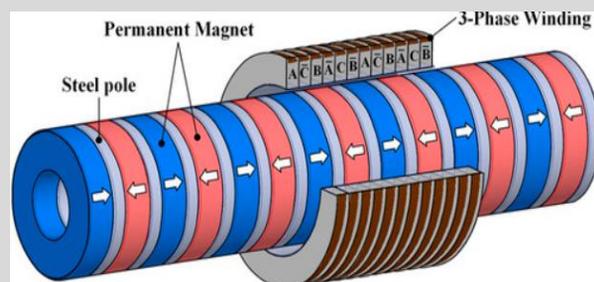
Addressing the SDGs

7 Affordable and clean energy

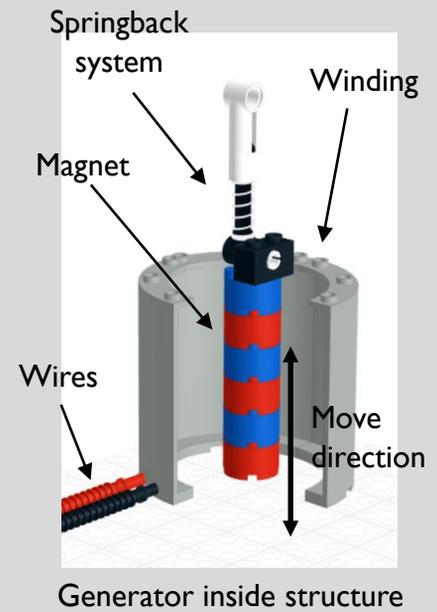
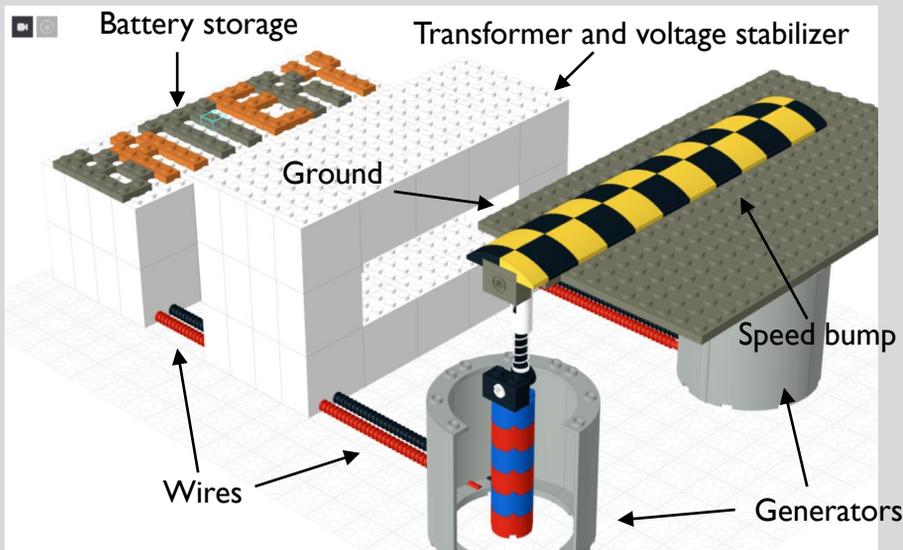
The free mechanical energy is produced by the passing vehicles and transferred to electricity by the generator

9 Industry innovation and infrastructure

The linear generator is used combining with a gear system to better harvest the energy. A mechanical system is built under the speed bump



Design Intents



I used "Studio", a Lego designing software, to build a concept prototype.

Energy Transformation:

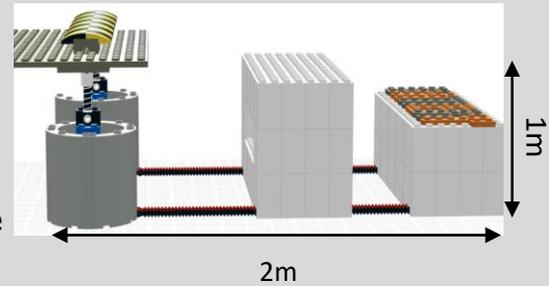
2 linear generators are under the speed bump with springs for cushion. 2 grey hollow cylinders are the windings that change the magnetic flux and produce electricity.

Energy Transmission:

- After the generator, the electricity passes a transformer to step up the voltage so that it can transmit in long distance with low heat loss.
- The weights of vehicles vary, so the push-down force is different, which affects the current produced. To make the current output consistent, a voltage stabilizer is added.

Energy Consumption:

The electricity can be either stored in a battery near the transformer, or directly delivered to the nearby infrastructures that consume electricity.



Benefits:

- For drivers, they pay less parking fees because their vehicles' weights contribute to the part of electricity consumed
- For the bus stop, if the speed bump power generator is mounted, less electricity is used by the screen panels, computers, and cooling fans.
- For the government, since these speed bumps can power the nearby lights, there is no need to bury long-distance underground wires that connect with the power plant. Therefore, in a county or a small remote region, the cost spent on the transmission lines from a distant power plant can be reduced.
- For the ecosystem as a whole, this is a kind of renewable energy. No chemicals are extracted or produced, and it is free and sustainable.

Implementation

Instead of introducing a new technology, I am using the existing parts that are all available in the market. The system has the self sufficiency feature that if combining a speed bump with the nearby traffic infrastructure that runs by electricity, they can produce light themselves when there are vehicles passing. In the area when traffic flow is dense, the energy produced is sufficient to run the light poles or traffic lights.

Improvements and Things to Consider:

- The efficiency of a regular linear generator is over 40%, even double the solar panel's 15~22%. But the electric output depends on the vehicle's weight and pass-by frequency.
- The estimated cost of construction is probably equivalent to mounting a road light as all components are available already.
- Once these speed bumps are mounted, they can take effect immediately. Their working states can be monitored by computers.
- Maintenance is not required frequently but it might be hard to repair as everything is underground.

References and Acknowledgements:

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