2011

Feasibility of Harvesting Kinetic Energy from Traffic

Sarah Antolick

Alexander Hyman

Angela Nagelin

Ashley Rosano

Caitlin Walde

Feasibility of Harvesting Kinetic Energy from Traffic

Sarah Antolick (CE), Alexander Hyman (RBE/ME), Angela Nagelin (ME), Ashley Rosano (AE), Caitlin Walde (ME)

Advisors: Professor Brian Savilonis (ME), Hannah McCallum (AE)

Abstract

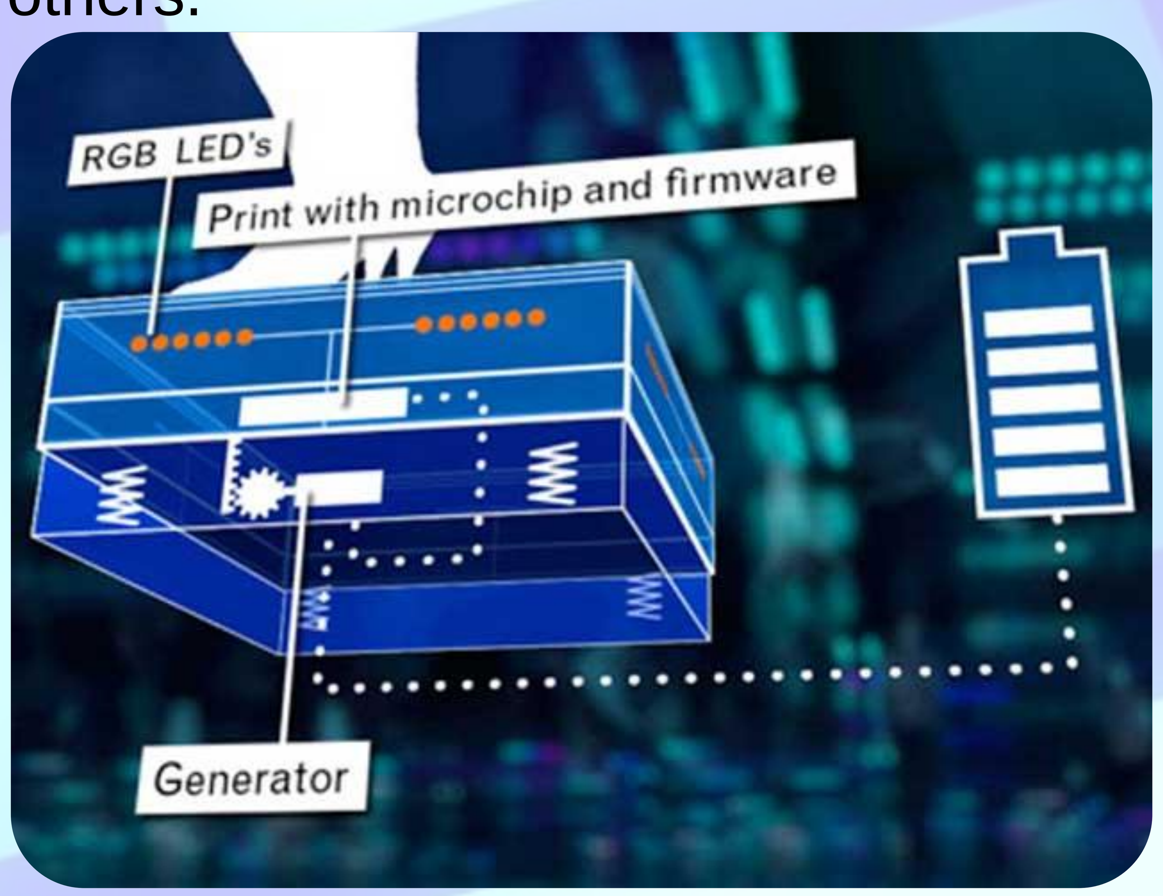
Many energy sources claim to be alternatives to fossil fuels. Various kinetic energy harvesting materials are not yet readying for widespread use, but they show great promise. Applying this technology to roads could produce a useful source of energy. An important step in developing this technology is spreading awareness.

Project Goals/Objectives

Determine the feasibility of harnessing kinetic energy from foot, automobile and locomotive traffic through the use of piezoelectric materials and electromechanics and spread awareness of this technology.

Background

- Kinetic energy harvesting systems convert mechanical stress to electrical energy. Frequent and larger forces produce more energy.
- Tiles such as those of the Sustainable Dance Floor can be used to power a smaller display. Lighting up several LED lights can make it fun.
- Different materials can be used depending on the application; some are more efficient and durable than others.

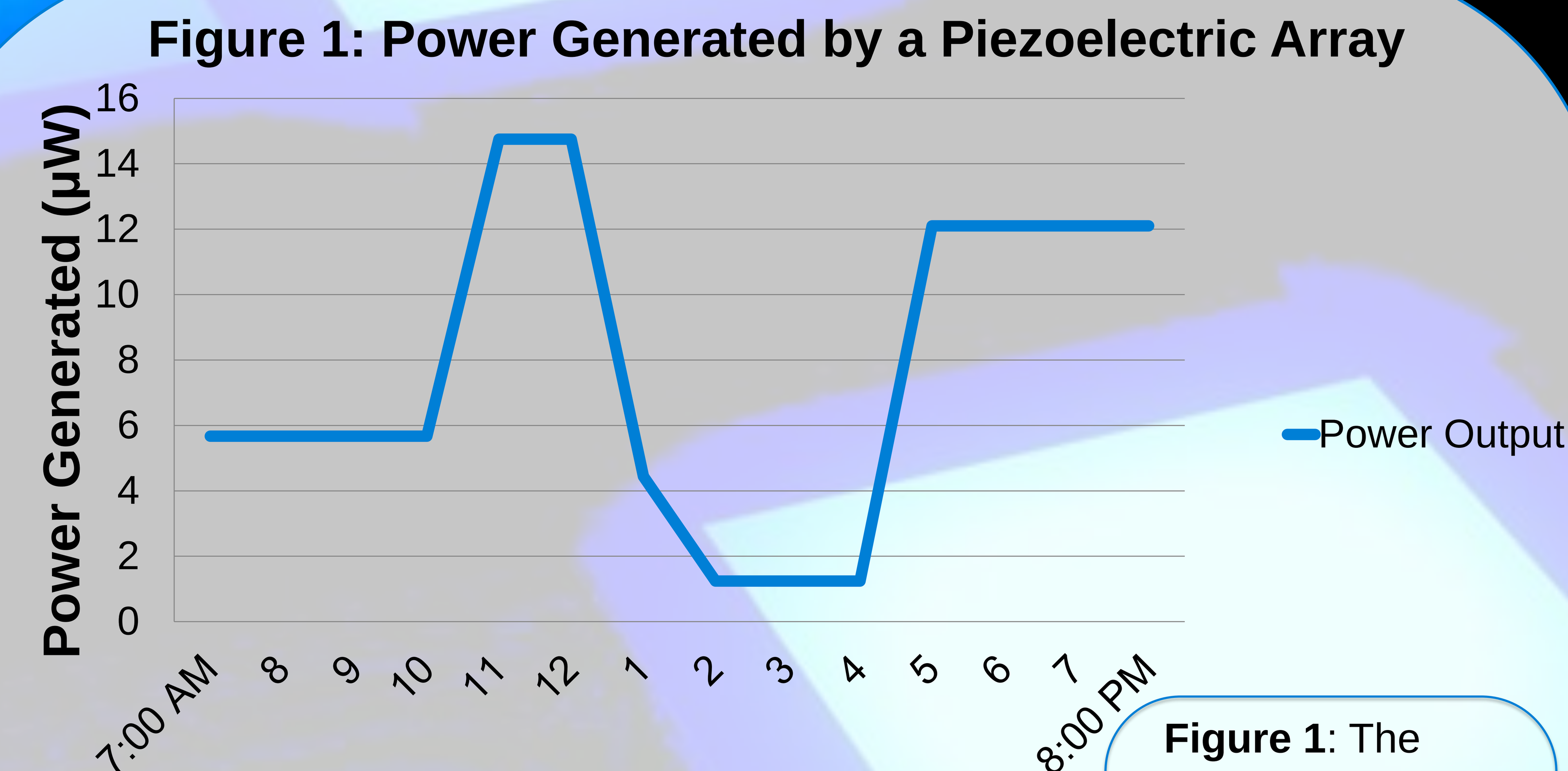


Acknowledgments

We would like to thank Jennifer Santer from the Miami Science Museum and John Klausen from Noliac for taking the time to speak to us.

Conclusions/Recommendations

- Piezoelectric technology is not yet ready for widespread implementation as it is neither efficient enough nor cost effect.
- Research should be continued. Renewable resources become more effective as technology develops.
- This technology produces enough energy to power an educational display, which would be useful to spread awareness.
- Approximately 2 kW can be generated daily by applying this technology to highways. Since this technology is new, there is a wide range of exactly how much energy is produced.



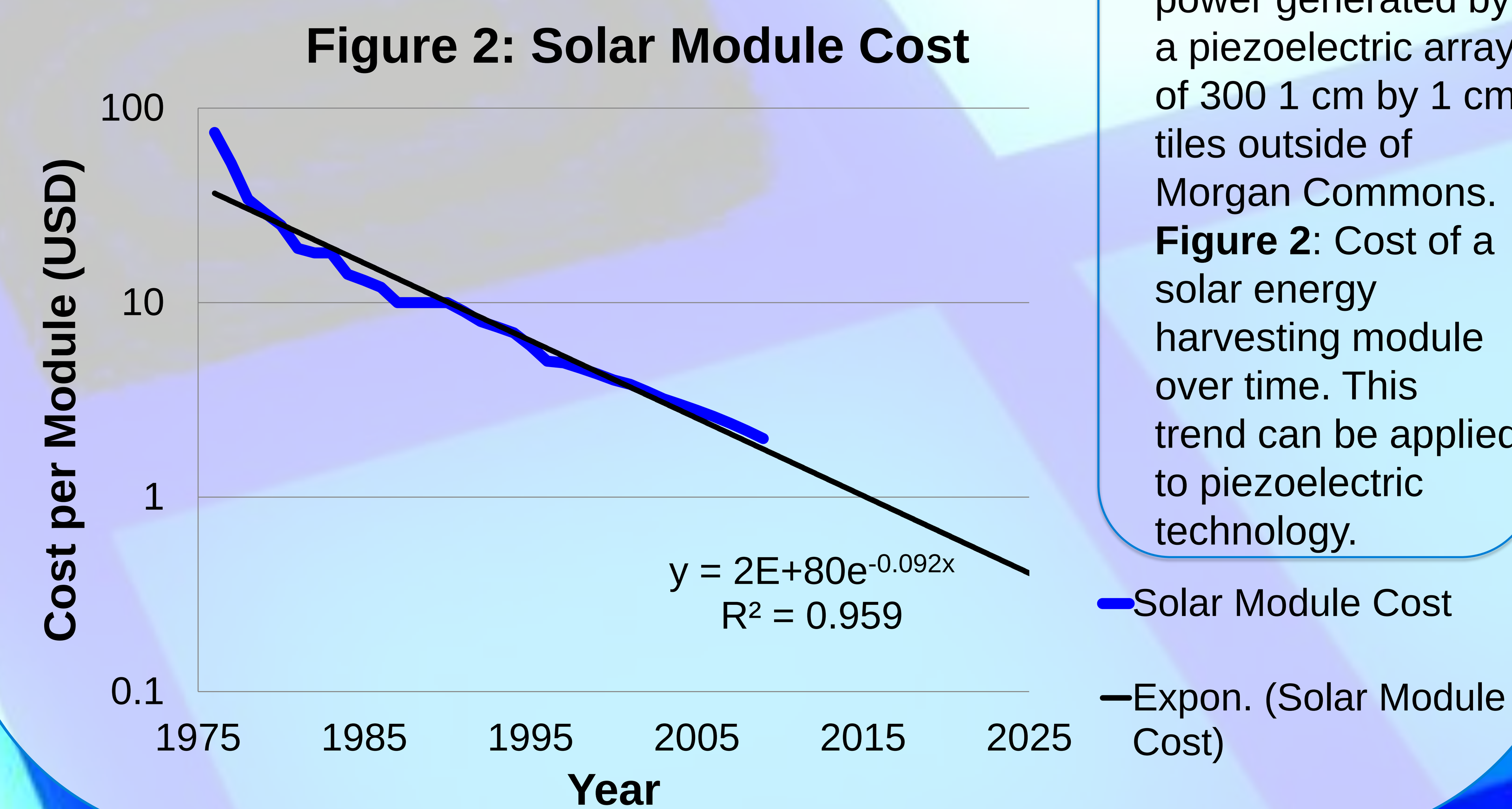


Figure 1: The power generated by a piezoelectric array of 300 1 cm by 1 cm tiles outside of Morgan Commons. **Figure 2**: Cost of a solar energy harvesting module over time. This trend can be applied to piezoelectric technology.

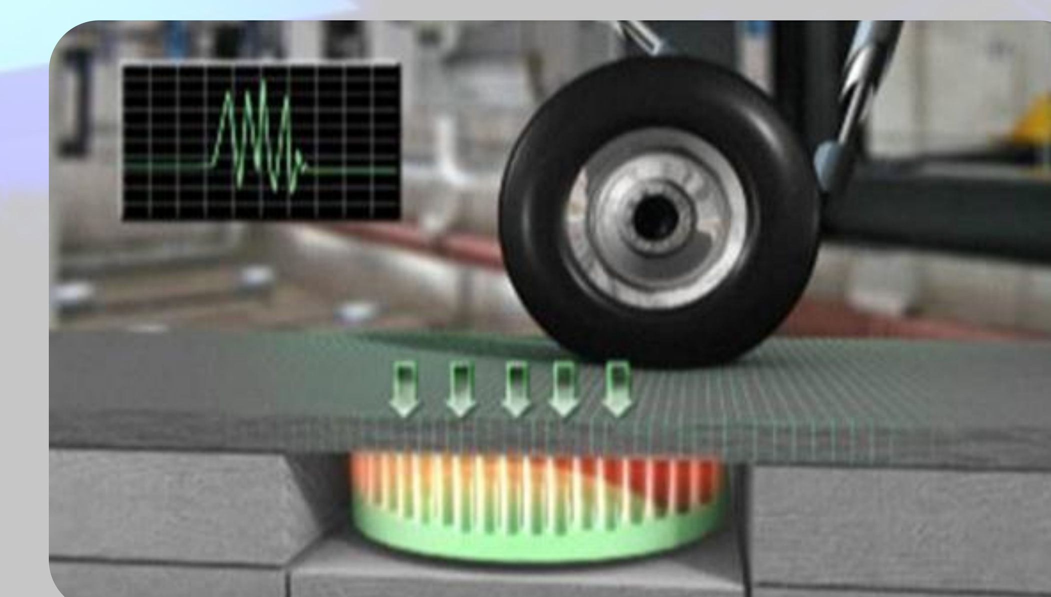
References

- Feinberg, K. & Kim, T. (December 7, 2010). Piezoelectric Energy Harvesting. Retrieved from http://courses.engr.illinois.edu/ece445/projects/fall2010/project6_final_paper.pdf
- Innowattech energy harvesting systems (2011). Retrieved from http://www.innowattech.co.il/
- Interstate 90 annual average daily traffic (AADT). (2003) Retrieved from http://www.interstate-guide.com/i-090_aadt.html
- Sustainable dance club. (2011). Retrieved from http://www.sustainabledanceclub.com/home

Methods/Process

- Researched the physics of the technology.
- Analyzed case studies in respect to vehicle, foot and locomotive traffic.
- Interviewed professionals in the field.
- Analyzed economic feasibility and efficiency of solar energy systems to predict a possible future of kinetic energy harvesting systems.

Large Scale Application



Y=.62x (for single 1 cm x 1 cm module)

Y= power (μW) X= force (kN)

Force of average car on road	18.09 kN
Energy generated per car for 16 cm x 1 km	403.92 J
Cars per day on I-90 near exit 20 (Boston)	104,507 cars
Power generated	~1.95 kW

Dance Floor

ITEM	NUMBER OF ITEM	PRICE PER ITEM	TOTAL PRICE
Module	80	$3,375	$270,000
Cables	80	$135	$10,800
Controllers	2	$3,400	$6,800
Energy Meter	1	$3,200	$3,200
Total			**<$300,000**

- 18 square meters
- 30 W per module
- Roughly 125 people