

Phenomena Explored — SOCKET To Me! A demonstration of energy harvesting.



Try this! (1-2 minutes)

1. Gather a group of 5 -10 people and get them to stand in a circle and kicking a socket ball between them. Think about how you consume electricity. Where does your power come from? How much power do you estimate they use? Why do you use so much or so little power? Most examples will likely deal with using electricity for their devices and that much of it comes from different types of power plants.
2. Continue passing the socket ball. Determine how you can possibly power personal devices using your bodies. Think kinetic or piezoelectric energy (such as pendulums and vibrating crystals) and thermal energy (using thermocouple or thermoelectric devices produce electricity).
3. Stop the passing of the ball and demonstrate how the ball has been generating power as the user have been passing it around. You can do so by plugging in the provided light to show that it provides electricity. Since you cannot disassemble the product, you will need to use visuals available at:

<https://www.youtube.com/watch?v=hzchNIVqjQ4>



The above image displays the interior of the SOCKET II Ball. Notice the pendulum along the right side that rotates the shaft of the generator that converts the kinetic energy into electrical energy which is then stored in the battery for later use. Courtesy of SOCKET II Ball Video Link to the Left

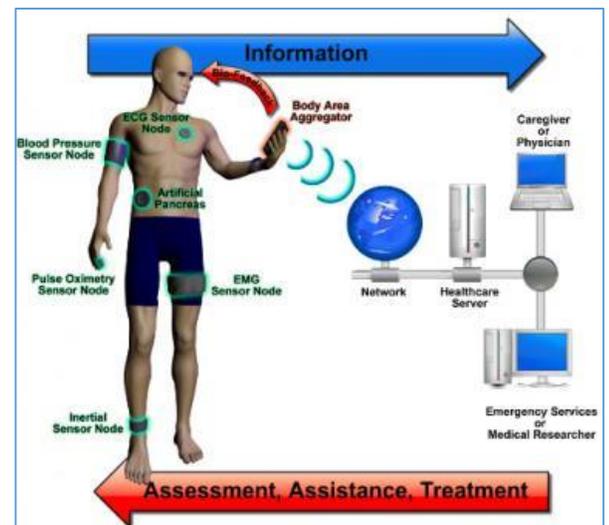
Now try this! (5 minutes)

1. Have people brainstorm how the idea of the soccer ball using kinetic energy to produce electricity can apply on the body so that the body generates energy for devices.
2. Lead on to how these devices could be health devices such as sensors that monitor blood pressure, heart rate, glucose levels, temperature, hydration, etc... as is research at the NCSU ASSIST Center.
3. Why would people need to have these types of devices? What positive and/or negative impacts of society would such devices have in our lives?

What's going on?

Kicking the SOCKET II ball is generating energy with the motion of their bodies. Inside the ball is a pendulum attaches to a mechanism much similar to a wind turbine. As the pendulum rotates with every kick of the ball, the generator converts the kinetic energy into electrical energy, and stores it in a Lithium Ion battery.

After kicking the socket ball and generating electricity, the people are then informed they have been producing energy with their bodies and are then encouraged to take that information and discuss how it can applied to devices on their bodies. How can we develop small devices that utilize nanotechnology to power devices on our bodies? Furthermore, how can these small devices monitor our health and keep us safe? Scientists are also using thermoelectric devices on the body to generate electricity through the differences of heat. As a temperature difference occurs, electrons can flow, creating a current that produces electricity.

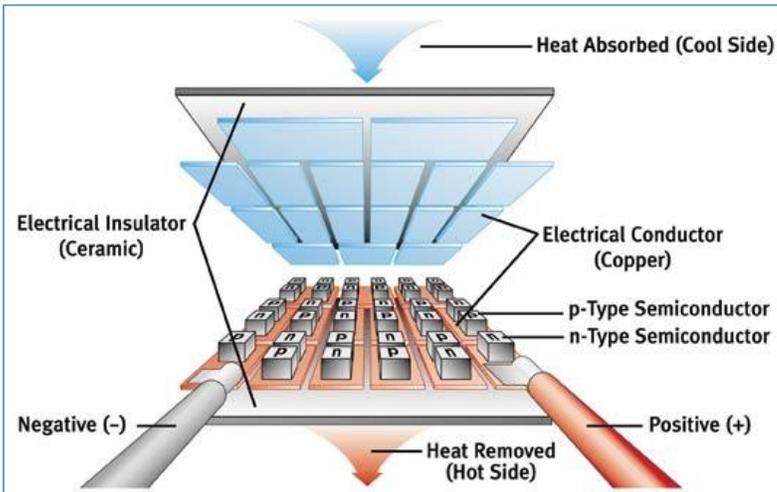


Demonstration of how a body-monitoring nanosystem could work. An aggregator, center, would compile data from various body-powered sensors and communicate them via computer to computers, where it could be reviewed by the wearer or his or her physician.

Courtesy of UVA Today Sep. 2012:

<http://news.virginia.edu/content/uva-nsf-partner-nanosystems-engineering-research-center-self-powered-health-monitoring>

How is this nano or ASSIST?



Thermoelectric Patch Diagram. Courtesy of Lauda-Noah Manufacturers and Developer: <http://www.lauda-noah.com/thermoelectric-overview.html>

In order for these devices to be small enough to wear on the body, they must use nanomaterials to help produce the energy. The thermoelectric sections must be small enough so they arrange in large numbers to produce the appropriate amount of electricity to power the devices that can be used to monitor health. As these devices become self-powered, they meet the goals of the center of Advanced Self-Powered Systems of Integrated Sensors and Technologies (ASSIST) by powering sensors that can be placed on the body to monitor health factors such as blood pressure, heart rate, glucose levels, temperature, hydration, etc...

Learning Objectives

1. Participants will discuss how they use electricity and where that electricity comes from.
2. Participants will identify alternate ways the human body can produce electricity.
3. Participants will observe how kinetic energy can be converted to electrical energy
4. Participants will explain how self-powered sensors on a body can impact one's health

Materials

- SOCKET II Ball Kit with Plug-in Light
- Area for about 5 -10 people to pass around a ball
- Visuals (images or video) for how kinetic energy is converted to electrical energy (Cross-section of a generator is available video link above)

Notes to the presenter

Before doing this activity, please do the following:

- Understand how kinetic energy can be converted to electrical energy
- Understand different ways to produce energy from the body using thermoelectric and piezoelectric means.
- Have examples of how devices can be self-powered and why there is a need for self-powering devices (hint: less chance of forgetting to charge a device, no need to be near a power outlet for charging, etc...)
- You may need to pre-charge the SOCKET II ball for the sake of time and demonstration. The SOCKET II ball takes 1 hour of play to get 3 hours of light from its battery.

Tips: As people are coming with ideas on how sensors can monitor health, mention how important it is to keep constant focus on body temperature during certain situations. Mention how a thermometer is a sensor and how it measures temperature on one's body constantly in hospitals. Similarly for an electro-cardio gram keep.

SAFETY: Be sure to keep the ball on the ground. If someone gets in the face or above the knees, they may be hurt or injured. In addition, keep property safe by keeping the ball on the ground. The ball is not rated for officially regulated soccer play.

Related educational resources

For further research:

- Visit the NCSU ASSIST Center Research page full of energy harvesting information:

<http://assist.ncsu.edu/research/>

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Erik Schettig, ASSIST Center at North Carolina State University.