RACK Innovate To Mitigate Round 2 Submission
Using Piezoelectric Technology to Reduce our Carbon Footprint

Climate change is a major problem facing our society and it is our responsibility to fix it. Because of the increased usage of fossil fuels, such as natural gas, coal and oil to generate energy, levels of CO_2 and other greenhouse gasses in the atmosphere have gone significantly higher, leaving behind dangerous ramifications, including ocean acidification and increased global temperatures. According to the EPA, the U.S. greenhouse gas emissions totaled 6,673 million metric tons of carbon dioxide equivalents in 2013. Being the ones who inherit this world, it is our duty to lower the amount of carbon emissions as an effort to mitigate our environment.

Over the past several years, people have done a lot to lower their carbon footprint, but more action can be taken to reduce our effect on climate change. Unlike energy from fossil fuels, electricity from renewable resources do not contribute to climate change or environmental pollution because no fuels are being combusted during the process. Efficiency is important in energy usage and by creating energy from an readily available force can be used to our advantage in finding a creative way to generate energy.

The piezoelectric effect is the ability of certain materials to generate an electric charge in response to applied stress or pressure. It is also known interaction between the mechanical and electrical state in crystalline materials, such as crystals and ceramics. Through their interaction, the generation of an electrical charge is the result of an applied force or pressure. Piezoelectricity is often used for sound detection in microphones as well as generating high voltages.

We propose to create and place piezoelectric transducers under ceramic tiles and walkway coverings that would use mechanical stresses from footsteps and generate them into usable electric energy. At these locations, energy can be transferred to an external battery for storage. This way, the energy from the footsteps can be used for more practical uses, such as powering streetlamps. As of right now, we use this technology on a small scale, usually with watches and small electronic device. But with the right amount of research, this could be implemented on a much larger scale and has a lot of promise.

In the nation's capitol, hundreds of thousands of employees and tourists walk through the city every day. People often explore the capital and visit the monuments, the museums, or walking in the parks. After looking at foot traffic patterns, we can implement this technology in commonly visited locations in DC. From the mass amount of footprints taken on a daily basis, the amount of energy created as a result, is enough to sustain power for multiple uses. This in turn decreases the amount of external energy needed and can reduce our impact on creating greater carbon

emissions. We can mass produce piezoelectric generators cost efficiently and implement them in commonly visited locations in DC, such as the metro station and near popular tourist attractions. In that way, we will be collecting as much energy as possible. The concept of renewable energy is applied and the people of the city can receive the electricity they need without harming the environment. The electrical energy generated from the mechanical stresses will then be sent to an external transformer and then be able to be used for wide spread use.

On a smaller, more local scale we can start by using piezoelectric transducers at our own high schools. The product can be placed underneath hallway tiles that collect energy from the footsteps taken as students and teachers walk around the building. The piezoelectric transducers can generate enough energy to reduce some of the electrical costs, while benefiting the environment at the same time. Everyday, energy is needed to power the lights in classrooms and hallways. In addition, with new technological advances, an even greater amount of electrical energy is needed to power new computer labs and workshops. With the piezoelectric transducers in place, over a school day, an average student body can generate 36 kilowatts-hours, which is enough to power all the computers in our school for three and a half hours or the lights the whole day. Because piezoelectric technology is meant to be used for small, handheld items such as cell phones, more usage and further development can be done to discover new ways of using piezoelectric technology more efficiently.

Piezoelectric technology has the potential to counteract the excessive amount of energy use that we use on a daily basis. Mitigating our planet does not consist of leaps, but of footsteps in the right direction. Implementing transducers does not involve changing people's habits or forcing them out of existing ones. People walk on a regular basis, regardless, so why not use those footsteps to our advantage to help lower our carbon footprint, taking steps to a brighter future.