

- Case Study -

Green innovation for a healthier life



Sustainable development goals (SDGs)

- Goal 3: Good health and well-being
- Goal 11: Sustainable cities and communities
- Goal 9: Industry, innovation and infrastructure
- Goal 7: Affordable and clean energy



Sustainable innovation

Relevant concept/
issues



Manufacturing

Relevant sector

The aim of sustainable urban development is to increase the quality of life (QoL) for citizens through sustainability oriented innovations (SOIs), which means, for example, investing in green products, green transport, green public spaces, and improving urban planning and management in participatory and inclusive ways.

Many green products can improve life in modern cities. One important issue that can be addressed is related to health, and problems caused by the lack of physical activity. The working environment and the majority of jobs have become sedentary. Lack of exercise has become a silent plague today and is one of the four leading risk factors for disease worldwide. For example, studies reported in the National Survey ("4th National Survey to determine the prevalence of non-communicable diseases and injuries and risk factors" of The Action Plan of the Government of Mongolia for 2020-2024.) show that of 6% of all deaths worldwide, 20-25% are from breast and colon cancers, 30% from diabetes and 30% are from cardiovascular disease caused by lack of exercise.

What is lack of exercise?

According to the survey (WHO, 2019), 21.9% of Mongolia's population aged 15-69 is sedentary, 52.4% do not exercise at work, and 48.2% do not exercise during leisure time.

Sources of physical inactivity

The introduction of a variety of automated tools and equipment (cars, elevators, escalators, etc.) into people's lives has drastically reduced the need to exercise and move.

Depending on the nature of a person's occupation, prolonged sitting has been associated with many negative impacts, such as reduced work efficiency, obesity, weight gain and cardiovascular disease. In order to mitigate these effects, workplace health measures often recommend healthy eating, going to the gym and exercising, but this is often not sufficient.

Experience in foreign countries

International research has shown that with the advancement of technology, people no longer need to be physically active at home. The research notes that, as a consequence, the government needs to make infrastructure changes that encourage people to walk and ride bicycles (United Nations 2030 Sustainable Development Goals).

Some countries already understand the importance of physical activity and have been working to support the World Health Organization's "Global Action Plan on Physical Activity 2018-2030" by providing space to exercise, and increasing the number of programs that encourage people of all ages to ride bicycles, walk, dance and play games. Therefore, **changes in urban infrastructure are one of the important measures taken by the governments.**

Another solution is the investment in the **design of green products**, such as **power generating bikes**. In some airports if you want to charge your phone, you need to produce the electricity yourself by riding a bike. In some cafes (e.g. United Arab Emirates), bike-tables have been set up to prevent physical inactivity, reduce weight and generate electricity. This often has a positive impact on the number of customers visiting the cafes.



Fig. 1. Bike-tables used abroad
Source: <https://www.ebay.com/p/14017154946>

Local and international green products for encouraging exercise

Example 1: Design of power-generating bike in the context of Mongolia

Inspired by international examples, The Polytechnic College of Engineering and Technology has developed a bike-table to create electricity to prevent lack of physical activity.

This consumer-driven power generating bike-table is targeted at people who are sedentary in offices and who participate in little physical activity. In addition to exercising, you can power your own 220V devices such as laptops, cell phones and tablets with the bike-table. Following the example from developed countries, developing countries can use available economic resources more efficiently. Spinning this bike mechanism for one hour can produce up to 60 watts of renewable energy and burn up to 300 calories per hour.

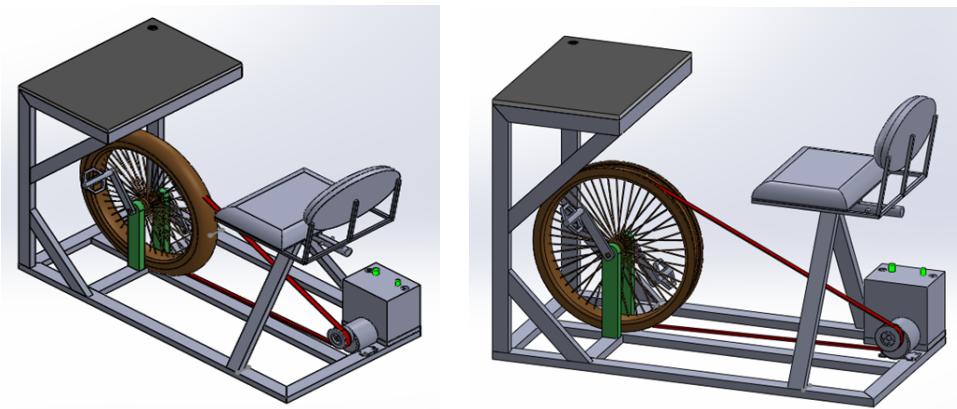


Fig. 2. Power generating bike-table

From the moment the pedals are moved on this consumer-driven power generating bike-table it begins generating electricity. A phone was charged 3% in 5 minutes and the notebook 1% in 5 minutes (see Table 1).

The bike-table can be used by people of all ages and users can exercise and get fit while they are working.

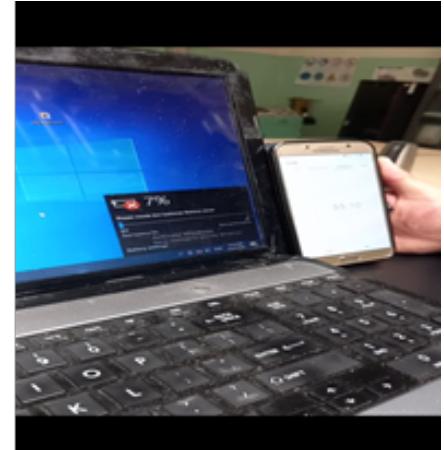
Charging parts	Charging time	Charged percentage	Evidence
Cell phone	5 minutes	3%	
Laptop	5 minutes	1%	

Table 1. Results of charging using the bike-table

Example 2: Eco Gym - Converting exercise into energy

Eco Gym is a fitness center in Rochester, New York, that is equipped with indoor cycling equipment that captures the energy from people's workout and turns it into electricity to power the building. While the gym is fully equipped, there are 21 cardio machines that generate energy –16 indoor cycles, two recumbent bikes, and two ellipticals. The equipment works by turning human energy into utility-grade electricity through micro-inverter technology. When plugged into an outlet, the equipment converts the energy produced through the workout into kilowatts that are capable of producing more than 160 watt-hours of electricity in a single workout (World Economic Forum, 2018).

The Eco Gym uses SportsArt's patented ECO-POWR™ equipment to create a sustainable environment while offsetting costs. It has revolutionized the way people think about cardio workouts. The built-in technology creates a connection between our individual actions and the impact those actions have on the environment by turning workouts into clean, renewable energy. This can help to build healthier bodies and healthier environments by:

- Converting up to 74% of human energy produced into clean, renewable energy
- Motivating members with meaningful impact metrics like watts generated
- Generating up to 220 wH of electricity per hour workout, offsetting energy consumption

As shown in Figure 3, human movement is captured by the generator and the patented micro-inverter transforms the energy into utility grade electricity that can be fed directly back into the circuit for immediate use. Within seconds, energy is fed to the facility's local grid, offsetting overall power consumption and reducing the facility's carbon footprint.

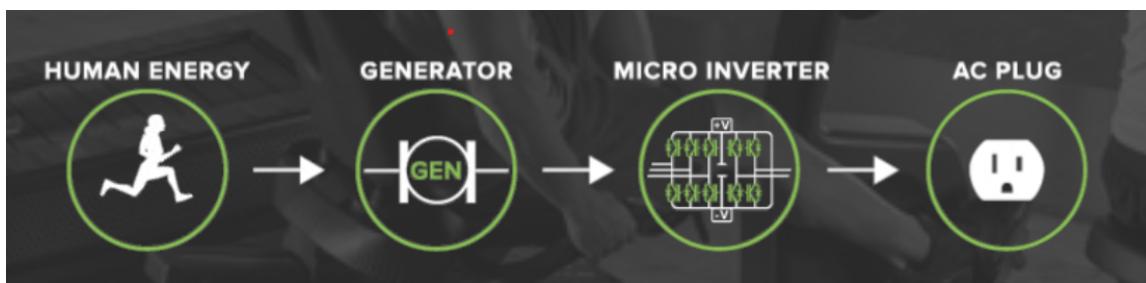


Fig. 3. How it works

Source: <https://www.gosportsart.com/eco-powr-technology/>

When first turned on, like many standard appliances, ECO-POWR™ products draw a small amount of electricity. As the workout begins, the units almost instantaneously stop consuming electricity and, within seconds, enough energy is produced to power the unit and to send excess electricity back into the facility's grid through a standard outlet. That energy is then used to power other machines and devices within the facility, thereby offsetting the power needed from the utility company.

For more information about ECO-POWR™ products and how they work, please refer to: <https://youtu.be/cbhnPFC9Hc0>

Sustainable living involves more than just shutting off lights in empty rooms and recycling plastic. With ECO-POWR™ equipment, fitness facilities can transform into power plants that offset their building's electrical costs. It has suggested that if there was a similar, or several free gyms as urban infrastructure for the public to use in every city and where anyone can go to exercise, then the energy produced by the people would feed the city grid. Clean green electricity keeps people healthy, saves them money and helps the environment.



G690 Verde Treadmill



G886 Verso Cross Trainer



G876 Elliptical



G576U Upright Cycle



G576R Recumbent Cycle



G516 Indoor Cycle

Fig. 4. ECO-POWR™ products
Source: <https://www.gosportsart.com/status-cardio/eco-powr-line/>

Example 3: New flooring tech – generating electricity through walking

Pavegen, a British clean-tech company, is taking an innovative approach to sustainability by generating energy from an activity that most people do every day: walking.

The technology is basically a multifunctional, custom flooring system that is outfitted with a wireless transmitter, which allows data from the tiles to be captured, and generators that harness kinetic energy as people walk. It may sound complicated, but the way it works is simple: As people walk across the flooring, the pressure causes generators in the flooring to vertically displace. This creates kinetic energy through electromagnetic induction, and that energy can then be used to power lighting or whatever else is needed.

When a person walks, they generate 5 watts of energy continuously, so 10 people can generate 50 watts of energy continuously. That may not seem like an exorbitant amount of energy, but it is enough to supply power for a number of needs. For example, the power can illuminate paths as pedestrians walk upon them. The flooring can also store the energy from people. Let's say, if there are 40,000 people an hour passing through Grand Central Station, that energy is stored in batteries and, at nighttime, the power comes on. So municipalities, train stations, offices and schools – anywhere where lots of people walk – are perfect locations for this technology. In addition, this flooring technology can encourage people to walk more and help reduce the carbon footprint.

For more information about how this floor works, please refer to “Pavegen’s launch in San Francisco with Tribal Planet”: <https://youtu.be/7iuws880kG4>, and the product website: <https://www.pavegen.com/smart-cities>.

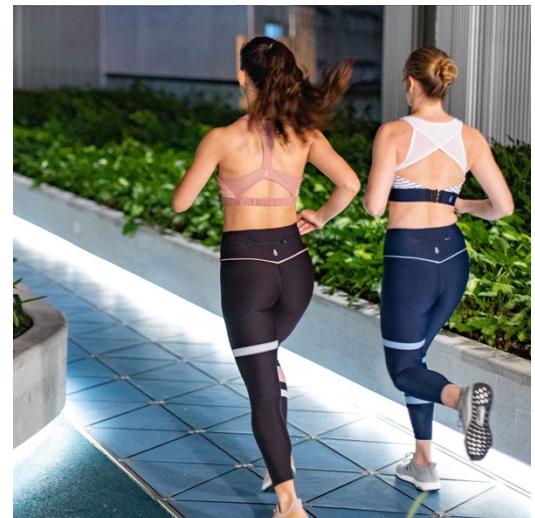


Fig. 5. The quayside, Hong Kong
Source: <https://www.pavegen.com/smart-cities>

Adjusted based on New Flooring Tech Generates Electricity Through Your Footsteps (Jolene, 2016).

Example 4: Washing machine powered by feet

A typical washing machine can use up to 87 liters of water per load, not to mention its ability to eat up electricity. An efficient energy star rated machine can reduce water usage to about 49 liters per load and significantly cut energy usage. But, it is still a lot.

Drumi, a non-electric, portable washing machine, can help to address this and maintain an active lifestyle. It washes clothes without using electricity, but also uses as little as 10 liters of water per load. To achieve this, it just needs some legwork, which has a positive effect on the environment by reducing carbon emissions.

For more information about how the washing machine works, please refer to the introduction video:
<https://www.youtube.com/watch?v=o424IWJB66g>



Fig. 6. Drumi - Portable non-electric washing machine
Source: <https://www.yirego.com/shop-drumi>

Reference:

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