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Green Technology – Emerging green technologies in energy sector

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Abstract: The field of "Green Technology" encompasses a continuously evolving group of methods & materials, from technologies for generating energy to non-toxic cleaner products. In view of this, the paper explores the existing pattern of green innovations and changes in our daily life which the green technology may where in. The various methods used in harnessing the usage of Green Technology in diverse fields through muscle power, cow backpacks, piezoelectricity and human saliva are discussed. Conventional batteries make the nanoscale systems too large and the toxic contents of the battery limit their use inside the body. Several innovative gyms are popping up that convert human energy into usable electricity. The gym machines have nanoscale generators that create energy from movement. In such gyms, human efforts are creating electricity to power the exercise console and supplement the electrical juice it takes to keep the overhead lights on. In these machines, an average person who exercises can generate about 500 W electricity per hour. Bovine emissions are rich in methane and many scientists and environmentalist have developed a method for extracting methane emissions from cows and convert it into biogas of sufficient quality that can be fed into a natural gas pipeline. Researchers have developed a special bovine backpack that captures cow emissions via tube attached to the cows stomach and discovered that the animals produce between 500 – 10,000 liters of gas each day which can be used as bio – diesel and bio-gas fuel. The finger taps could generate power while texting away on cell phones. The push to charge cell phone would feature the plastic buttons sitting at top layer of hard metal. The bottom most material would be made of some piezoelectric crystal so that each time button was pressed, the hard metal directly underneath it would hit the crystal like a hammer generating a small amount of voltage of about 0.5 W. Saliva powered microbial fuel cell produces nearly one microwatt power, enough to be used as an energy harvester in microelectronic applications. Microbial fuel cells create energy when bacteria break down organic material producing a charge transferred to the anode. Many biomedical devices using the micro-sized microbial fuel cells would be portable and their energy sources also be used to run the chip applications. It was therefore desirable to use green technology to increase energy production through nonconventional sources and decrease the rate of depletion of world energy reserves.

Keywords: Green Technology, Muscle Power, Cow Backpacks, Piezoelectricity, Human saliva, MFC.

Introduction

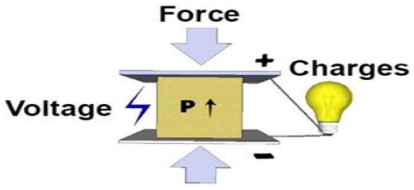
Green Technology is the application of the environmental science and technology for the development and application of products, equipment and systems to conserve the natural resources and environment, as well as to minimize or mitigate the negative impacts on the environment from human activities. 'Green Technology' is trendier terminology and it carries meaning no other than 'Clean Technology' or the traditionally used 'Environmental Technology'. Green Technology development must be a sustainable development. It has been applied in the fields of water and waste water treatment, air pollution control, environmental remediation, waste treatment and energy conservation.

Backpacks

Cows may look pretty benign as they languidly chew on grass in farm fields, but some environmentalists warn that the animals' farting, belching and pooping is a major contributor to climate change. A 2006 United Nations report estimated that cows, along with other livestock like sheep and goats, contribute about 18 percent of the greenhouse gases that are warming the planet -- more than cars, planes and all other forms of transportation put together[1]. That's largely true because bovine emissions are rich in methane, a gas that's 21 times more efficient than carbon dioxide at trapping heat in the atmosphere[2]. Harnessing cow farts as a fuel source might be tricky. Farts or fart, is the gas habitually released from the rectum of all humans and animals. Humans (men and women alike) normally release 0.5 - 1 liters of rectal gas per 24 hours, while ruminating animals emit such huge quantities of flatus (in their case mainly methane) that animal farting actually enters the equation of global greenhouse gases as a sizeable factor. There are two sources of flatus – external and internal. The external source is simply swallowed air, of which the oxygen (~ 20%) is normally absorbed in the digestive system, while the nitrogen (~ 80%) passes through and becomes one major component of flatus. The internal sources are various gaseous end products of the digestive process, mainly hydrogen and methane, together with small volumes of intensely malodorous sulphur-containing compounds. The composition of farts varies dramatically among individuals. Flatulence produces a mixture of gases with major six components-Carbon dioxide (CO_2), Hydrogen Sulphide (H_2S), Methane (CH_4), Nitrogen (N_2) and Oxygen (O_2).Researchers have developed a special bovine backpack that captures a cow's emissions via a tube attached to the cow's stomach, and discovered that the animals produce between 800 and 1,000 liters of gas per day. The gas released from the rectum of cow is captured and collected in a backpack which is attached to the body of cow. At the end of the day around 900 litre of gas is collected which is sent to the purification plan[3]. After purification, major component of flatus CH_4 after purification can be directly used as a fuel or it can be used to run turbines to produce electricity and can be used as a raw material in chemical Industries.

Piezoelectricity

Even if the planet doubled the amount of solar and wind power available, there would still be a shortage of clean electricity. We need to grab energy from wherever we can find it, that is why piezoelectricity—the charge that gathers in solid materials like crystal and ceramic in response tostrain—has recently begun to pique the interest of scientists. A number of materials are piezoelectric, including topaz, quartz, cane sugar, and tourmaline. That means a charge begins accumulating inside these materials when pressure is applied. It is commonly used in a number of applications in Quartz clocks, for example, rely on piezoelectricity for power, as do many sensors, lighters, and actuators. But these are the old uses for piezoelectricity; scientists today have much more interesting piezoelectric plans in mind[4].



I. Working of piezoelectric material

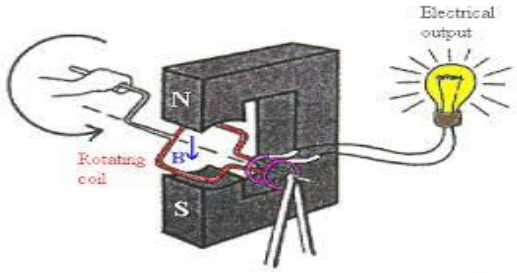
Piezoelectric generators work on piezoelectric effect. It is the ability of certain materials to create electrical potential when responding to mechanical changes. To put it more simply, when compressed or expanded or otherwise changing shape a piezoelectric material will output some voltage.

The Push-to-Charge cell phone would feature plastic buttons sitting atop a layer of hard metal. The bottom most layer would be made out of piezoelectric crystals, so that each time you pressed a button, the hard metal

directly underneath it would hit the underlying crystal like a hammer, creating a small amount of voltage. Small wires located between the layers would convey the charge to a battery for storage.

Muscle Power

Muscle Power is the ability to exert a maximal force in short time as possible, eg. Accelerating, jumping, and throwing implements, workouts and gyming. But tillnow many of us have not delved deep into what happens in a gymnasium and how can we utilize events happening in gym for better purposes. If we look carefully, every member of a gym at a particular time slot is performing some controlled and repetitive motion as lifting weight or running on a treadmill or doing crunches. When people exercise, all the energy created by motion is wasted and it disappears into nothingness. If we can channelize all this kinetic energy into something meaningful then we can contribute to some level, to reduce the use of natural resources. It will utilize all the energy made by gym goers and convert it into usable electric energy stored in on-board batteries. These gyms convert mechanical energy into electrical energy[5]

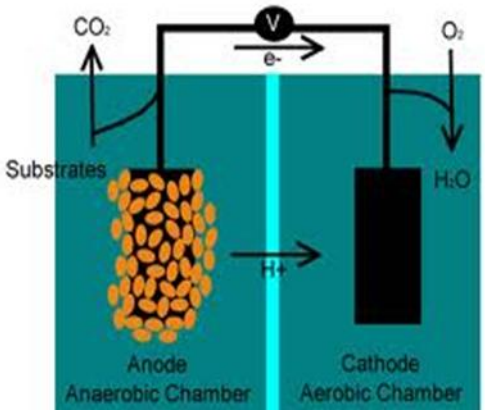


Conversion of mechanical energy to electrical energy

The Diagram shows that an apparatus being used to convert mechanical energy into electrical energy using the principal of Electromagnetic Induction. When the lines of force that pass from the north to the south pole of a magnet are cut by wire, electricity is induced in the wire. Average workout creates 37.5 watt hours, which is enough to power a phone for a week. If all the equipment gets used at one time, it can produce twice as much as it needs to run the facility at any given moment[6].

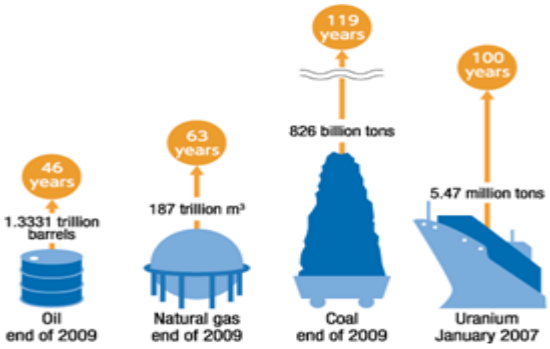
Microbial fuel cell (MFC)

Microbial fuel cell (MFC) is a device which utilizes microbial respiration to convert chemical energy into electrical energy. Like any electrochemical cell, MFC requires an anode wired to a cathode to facilitate the flow of electrons to the cathode and an electrolytic medium to allow positive ions to diffuse to the cathode. Unlike a purely chemical electrical cell however, there is no metal catalyst required at the anode. Instead, in MFC the anode is exposed to aculture of electricigenic bacteria, which obtain electrons from organic molecules. These bacteria use the anode as an external terminal electron acceptor, as the electrons transferred ultimately travel to the cathode where they reduce oxygen. This transfer of electrons to an anode by microorganisms is through the use of exogenous mediators. These mediators function by acting as an oxidizing agent for respiratory proteins in the outer membrane of the electricigenic bacteria, and subsequently transferring the electrons obtained to an anode. Geobacteraceae spp[7], Shewanella spp[8] are some of the potentially electricigenic bacteria which provide strategies of electron transfer.. Devices such as saliva-powered micro-sized MFCs which create energy when bacteria break down organic material producing a charge that is transferred to the anode can produce minute amount of energy sufficient to run on-chip applications. By producing nearly 1 microwatt power, this saliva-powered, micro-sized MFC generates power to be directly used as an energy harvester in microelectronic applications. Biomedical devices using micro-sized microbial fuel cells would be portable and have their energy source available anywhere. Data on the natural environment can be helpful in understanding and modelling ecosystem responses, but sensors distributed in the natural environment require power for operation. MFCs can possibly be used to power devices, particularly in river and deep-water environments where it is difficult to routinely access the system to replace batteries. MFC's have great potential for improving the efficiency of bioremediation for industrial wastes, by allowing energy to be recovered during effluent processing. Hydrogen production by modified MFCs operating on organic waste in which anaerobic conditions are maintained in the cathode chamber and additional voltage of around 0.25 V is applied to the cathode. Such modified MFCs are termed Bio-Electrochemically Assisted microbial reactors (BEAMR).



Conclusion

The world appears to be at a most critical period in recent history. Global resource depletion and climate change are the primary underlying cause of world problems. The world has been using more fossil energy then is being discovered and it appears that the reserves of energy that can be cheaply mined are now at peak production (half these resources have been combusted). As oil reserves are depleted, prices will rise continuously with increasing scarcity. The earth's natural resources are finite, which means that if we use them continuously, we will eventually exhaust them.



Reserves left for natural resources.

The need for electricity generation to be clean and safe has never been more obvious. Nor have those attributes ever been as popularly supported. Environmental and health consequences of electricity generation are important issues, alongside the affordability of the power which is produced. Environmental and health consequences are usually seen as external costs - those which are quantifiable but do not appear in the utility's accounts. Hence they are not passed on to the consumer,but are borne by society at large. They include particularly the effects of pollution on human health. Environmental effects of electricity generation include the effects of obtaining the fuels from mines, using the fuels, and dealing with the wastes following use of the fuel. The variety of fuels used to generate electricity all has some impact on the environment. Fossil fuel power plants release air pollution, require large amounts of cooling water, and can mar large tracts of land during the mining process. Nuclear power plants are generating and accumulating copious quantities of radioactive waste that currently lack any repository. Major problems are global warming, acid rain, soil pollution, Pollution of water bodies. Worldwide emissions of CO_2 from burning fossil fuels are about 28 billion tonns per year. About 38% of this is from coal and 43% from oil. Every 1000 MW power station running on black coal produces CO_2 emissions of about 7 million tons per year. If brown coal is used, the amount is about 9 million tons[9]. There is now widespread agreement that we need resource strategies and energy policies in every country which will minimize our dependency on fossil fuels. In respect to base-load electricity generation and to control the environmental degradation because of pollution, increased use of non-conventional energy sources and Green methods are the most obvious.

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