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Portable Thermoelectricity Generating Kit

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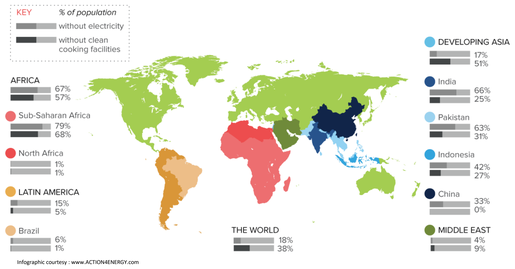
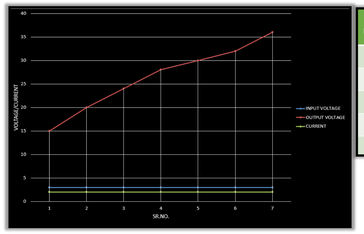
Opportunity

According to "ACTION4ENERGY," a United Nations Development Programme, about 1.3 billion people worldwide live without electricity. There are also 3 billion people living without clean cooking facilities, out of which more than 4.3 million people have already died due to the indoor pollution created by it. This research is focused on creating an environmentally friendly, portable thermoelectricity generating kit which produces thermoelectricity that can be readily used. The kit works in two modes; in first mode, the kit operates as a cooking stove which produces electricity from burning fuel (wood, coal, waste, cow dung, etc.); in second mode, the kit produces electricity from solar energy, but without solar cells. The kit is designed such that the pollution of the burned fuel is reduced to a great extent. The kit uses Peltier tiles, which are made up of thermoelectric materials capable of directly converting thermal energy into electricity and vice versa, for producing electricity which is clean, free and easily accessible. This kit can help people who are deprived of electricity, people residing in the places where setting up transmission lines is difficult. Moreover this will also provide people with clean cooking facility and prevent them from diseases occurring due to indoor air pollution. This kit can also be used as a portable electricity producing incinerator at a larger scale which can light up the streets and small shops of small villages and towns which also solve the problem of proper garbage disposal without creating any pollution.



Results/Data



TEMPERATURE DIFFERENCE(°C)	OUTPUT VOLTAGE (V)	OUTPUT CURRENT(mA)
20	0.97	225
40	1.8	368
60	2.4	469
80	3.6	558
100	4.8	669

In this section, the results of the various experiments conducted and the decisions made after the various observations. First of all, below shown table shows the results for TEG which includes of the voltage and current generated at different temperature differences applied on the TEG. From the Table it can be seen that at a higher temperature difference, higher amount of voltage and current generation takes place. The temperature shown in the table are in degree Celsius, voltage in Volts and current in milliamperes (mA). Similarly, we have the following graph shows the experiments conducted on the buck boost converter. The graph shows input voltage, output voltage and the output current. During the experiment the input voltage was kept constant, while the resistance value in the buck boost converter was changed gradually for which different values of output voltage were obtained. The output current also remained constant. The thermoelectric power generation is a maintenance free way to generate power as long as there is a heat source and a cold source provided continuously. It is also capable of overcoming the solar panels in the places where the power output is low because of sunshine and weather impairment and will produce its rated power as long as the temperature difference remains nearly constant. There are researches going on which are intended to the increased efficiency of the standard modules which will generate high power density, which will not only be more efficient but be economical enough in volume to have mass commercial applications. It will prove to be a boon to the people who are devoid of electricity in remote areas, by producing electricity from maintenance free and user friendly kit made up of thermoelectric generator, filling their lives with light. This kit will produce enough electricity through which a DC fan and a LED bulb can work. The kit can be prepared in such a way that it would be using all the potential sources for TEG to produce thermoelectricity and the different configurations which are reviewed in this report. Thus with the help of this kit not every house will be lighted up but also it will reduce the pollution to a great extent. Also it will help the people to face harsh climatic conditions.

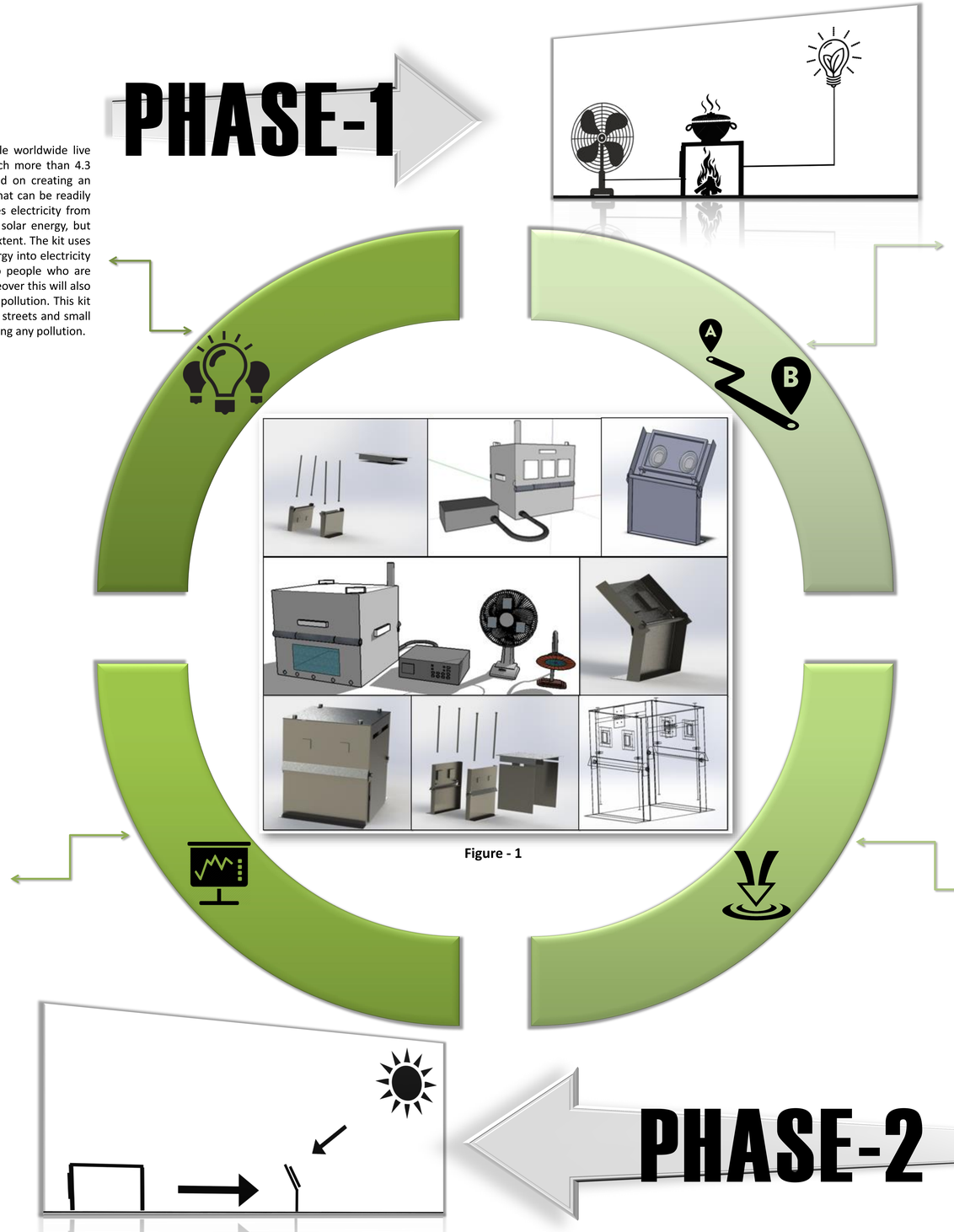


Figure - 1

Approach

Here, in **PHASE-1** the mechanical design is shown in Figure-1. In this phase all those 4 different portable parts are connected together to form a rigid structure. When these parts are folded they become very compact and can be easily transported wherever we desire. All the 4 parts are shown folded and unfolded in the exploded view. For understanding the connection of all the parts together two wire frames model are also incorporated here. During this mode, the fuel (i.e. wood, coal, waste, cow dung, etc.) would be burnt in this structure. As seen from the figure it is a closed structure, so heat loss is less. A small gap is being provided for the oxygen to enter, necessary for the combustion. From the exploded view we can see that the connecting rods are the ones to bring the connection and rigidity among all other parts and allows the structure to withstand a proper amount of force applied over it. During the combustion, heat will be generated inside the unit due to which all the inner sides of the unit will get heated. The plate which is the top surface of the unit will get heated more and one that surface cooking can be facilitated. While on one of the sides where the Peltier tiles/TEGs (Thermoelectric Generators) will be incorporated, due to the heat generated the TEGs will produce thermoelectricity.

In **PHASE-2**, as such there is no vast difference from the Phase-1. Here the solar heat will come into the picture for producing the electricity. Here, not all 4 parts will be in use but only one part will be used. This part if we see in the figure is made up of two different parts. Thus during this Phase, the upper part is made tilted which comprises also of the TEGs. Both this parts are joined with the help of the pin joint due to which they can rotate with respect to each other. Now here, in this Phase for concentrating the solar heat on the TEGs Fresnel lens is used. This lens will be incorporated in this mode in such a way that the concentration of the solar heat would be directly on the TEGs only, so that the available energy can be utilized in the best way possible. The interesting thing in this phase is that to convert the solar heat no solar cells are used but TEGs are only used to convert the solar heat into electricity. Catalytic Combustors are used for prevention of the pollution. For keeping the heat intact, thermal insulating materials are also used.

Impact

The unique feature of my innovation is electricity production from cooking stove waste heat and solar heat.

It will provide electricity in Hilly and Elevated Terrains where it is difficult to set up the transmission lines. Villages and Small towns situated in such areas will be provided with electricity and also with a proper incineration facility (with the help of the Larger unit).

This will provide with clean cooking facility in addition with electricity production. It will prevent from indoor pollution leading to air borne diseases. It will allow the user to use the desired solid fuel, it may be wood, coal, cow dung & even garbage for cooking.

Villages & small towns which are off-grid or out of the reach of transmission lines can be provided with electricity and also with waste management facility. Electricity can be produced from their garbage by using this as an electricity producing incinerator.

Military personnel posted at desolated areas can provided with easy excess to electricity required to charge his/her equipment. It will also provide him/her with a proper clean cooking facility. It would be a handy, light weight & portable unit.

Camps during Natural Calamities and also refugee camps can be provided with electricity and also proper waste disposal. Even it will help the people to carry out cooking without any indoor pollution with electricity as the by-product.