STEM Connections

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How do thermoelectric generators work?

Thermoelectric generators (TEG) are semiconductors that can convert temperature difference and heat flow to electricity. TEG ability to generate electricity is because of Seebeck effect. Seebeck effect is an energy conversion from heat to a voltage potential due to the movement of charge carriers within the semiconductors. The semiconductors include two types, p-type and n-type. Charge carries diffuse away from the hot side of the semiconductor. Therefore, we need a heat source to keep the one side hot and the opposite side needs to remain cold. The more temperature difference the more charge carriers moving away from the hot side and the more voltage potential generated.

TEG are bright alternatives among others for green power production, due to many of their advantages, such as environmentally safe, they work quite and with good manufacturability. They are also a feasible solution for direct electricity generation from waste heat in industrial processes. There is a huge demand of alternative power production, due to increasing power costs, global warming and environmental pollution. Therefore, TEG are one more promising green power solution.

How to test out various insulators and conductors

Suitable year groups: Year 5, Year 6, Year 7, Year 8, Year 9

Learning Objectives:

- To be able to compare everyday materials on the basis of their properties (KS2)
- To be able to understand the terms insulators and conductors and group materials into the categories (KS2)
- To understand how the temperature difference between two objects leads to energy transfer and how this applies to conductors and insulators (KS3)
- To explain why the melting rate varied between different types of materials (KS3)
- To explain the changes of state observed and the conservation of material and mass in this situation (KS3)

Materials required:

- Ice cubes
- Different materials e.g. metal, plastic, wood, foam
- Paper towels (to clean up any spillages)

Estimated time: an hour (for ice cubes to melt in room temperature)

Step by step instructions:

1. Place your materials side by side. Make sure to get a variety of different materials to see the difference.



2. At the same time, place the ice cube on top of the material

- 3. Observe which ice cube will melt the quickest. You can even measure how long it takes using a stopwatch.
- 4. Consider what type of materials (insulators or conductors) will cause the ice cube to melt quicker



Ideas to explore this concept further

- Repeat this experiment for a different set of materials
- Repeat this experiment in different conditions such as outside
- Try to combine materials and see what effect this has on the rate of melting of ice cubes