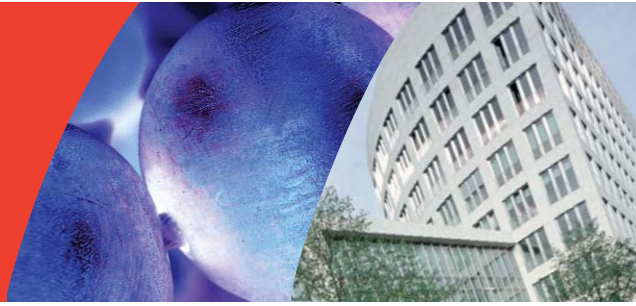

Mini-generators to operate on waste heat power

Project details	
Project title	Si/SiGe nanowire arrays for thermoelectric power scavenging
Participant	Imperial College of Science, Technology and Medicine, UK

Miniature power generators that reclaim waste heat and convert it to usable electricity are being innovated as part of the E.ON International Research Initiative.

The concept envisages portable devices with thermoelectric cells that employ nanotechnology and capture waste heat from a variety sources, mostly related to electrical equipment.

These would provide energy for recharging appliances such as mobile phones, laptop computers and personal entertainment systems.

Recycling – or 'scavenging' – of energy that might otherwise be lost would enable development of green, carbon neutral compact units able to fulfill the role of mini distributed generation systems.

Overall efficiency would increase because energy produced elsewhere is being made to go further, reducing demand on large, centralized generating plant.

Proposer of this project is the Imperial College of Science, Technology and Medicine, London, which is drawing on expertise from three departments. The experimental team members, from the Department of Electrical and Electronic Engineering, are Emeritus Professor Mino Green and senior lecturers Dr Kristel Fobelets and Dr Zahid Durrani.
The theoretical team, based in the Departments of Physics and Materials, comprises Dr Arash Mostofi, a lecturer, and a PhD student.

Recovering energy through thermoelectric cells is seen having the potential to exploit many areas where heat is currently lost. These include electrical resistors and heat expelled from mains- and battery-powered equipment.

The cells' construction will be one of the key areas of the innovative focus in this project.

A key aim will be to achieve a breakthrough in optimizing their thermodynamic efficiency by lowering heat conductivity while maintaining high electrical conductivity. In this area, part of the research will look at smaller nanowire semiconductors which may lead to more efficient thermodynamic performance.

Nanowire structures to be developed for the cells will use silicon and silicon-germanium. The resulting nanowire 'arrays' will then be embedded in liquid polymers.

At this stage the arrays will have high concentrations of mobile 'charged carriers' added to help achieve the high electrical conductivity. In the final step, the arrays are assembled progressively into blocks to create the two legs of thermoelectric cells, which then form part of full thermoelectric systems.

A further innovative step is that the project will use advanced 'self assembly' methods to manufacture the nanowire arrays, in preference to complex nanofabrication techniques. This, the university says, would be a cost-effective way to exploit nanotechnology for energy production.

The results of this research could show great value in the market for low level power requirements which have increased dramatically with the use of appliances and technology in 'on-the-move' lifestyles.

A portable thermoelectric power supply would increase flexibility and reduce mains recharging. It could be used as either the sole power source, or in conjunction with batteries.

Further advantages are the lack of moving parts, silence, robust nature and the ability to operate wherever there is a temperature gradient.

The knowledge gained will also benefit wider research into thermoelectric power generation and energy scavenging. Scaling up of these devices into medium and large thermoelectric units will extend the potential sources of waste heat that could be used to include vehicle engines, industrial plants and power stations.

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