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TOWARDS SUSTAINABLE SOLAR ENERGY

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Enormous amounts of energy fall on the earth surface in the form of electromagnetic radiation (light) originating from the Sun. Plants utilise this energy effectively if not efficiently in photosynthesis. In the last 60 years our ability to harness this energy directly as electricity using semiconductor technology has increased substantially.

The elements generally used in producing semiconductors fall in a small area of the Periodic Table and include silicon (Si) germanium (Ge) and forms of tin (Sn). Compounds formed by taking an element with one more electron (or two) in combination with one less (or two) have the same electron count and are also semiconductors. Those in common use today include indium phosphide, gallium arsenide, gallium nitride and zinc oxide or more complex structures with 3 or more elements (ternary or quaternary systems).

The elements commonly used, in bulk, in solar cells include: oxygen, silicon, phosphorus, sulphur, copper, zinc, arsenic, selenium, silver, cadmium, indium, tin, tellurium and lead in order of increasing atomic weight. Efficient solar devices are made in silicon but although the element is abundant the processing needed is expensive and energy intensive. In contrast highly efficient cells of CdTe/CdS can be more cheaply made. Ironically the elements that feature prominently in solar technologies are problematic. Cadmium is viewed unacceptable due to toxicity and indium, vaunted as an answer to that problem, is relatively rare.

In this talk the basic structure and function of a photovoltaic cell will be described and Professor O'Brien will view the future of solar energy against a back-drop of socio-economic factors such as world availability of materials and remaining resources. The recent problem with the supply of rare earth elements from China and the high price of copper illustrate how such factors could affect the exploitation of important new technologies. Regulation of certain elements may inhibit approaches being progressed in the 'developed' world.