Biophotovoltaics – Design in Science

Designers are collaborating with scientists at Cambridge University on cutting edge research aimed at developing Biophotovoltaic technology. Biophotovoltaic (BPV) devices generate renewable energy and other useful by-products from the photosynthesis of living organisms such as algae or moss.

Research into Biophotovoltaics is funded by the Engineering and Physical Sciences Research Council (EPSRC), and involves collaboration between the departments of Chemical Engineering and Biotechnology, Biochemistry and Plant Sciences at Cambridge University, and the Chemistry department at Bath University. The research is jointly led by Doctor Adrian Fisher, Professor Christopher Howe and Professor Alison Smith in Cambridge, and Doctor Petra Cameron in Bath.

A separate research project called Design in Science, also funded by the EPSRC and led by Dr James Moultrie, is being conducted at Cambridge University's Institute for Manufacturing. Its aim is to explore how designers can play a role in early stage scientific research.

The teams working on these projects have joined forces to bring together design and science to produce a table incorporating BPV technology. The purpose of the table is to demonstrate through a familiar domestic object, that this early stage technology has potential applications in everyday aspects of our lives. The table was exhibited at Designersblock as part of the London Design Festival in September 2011.

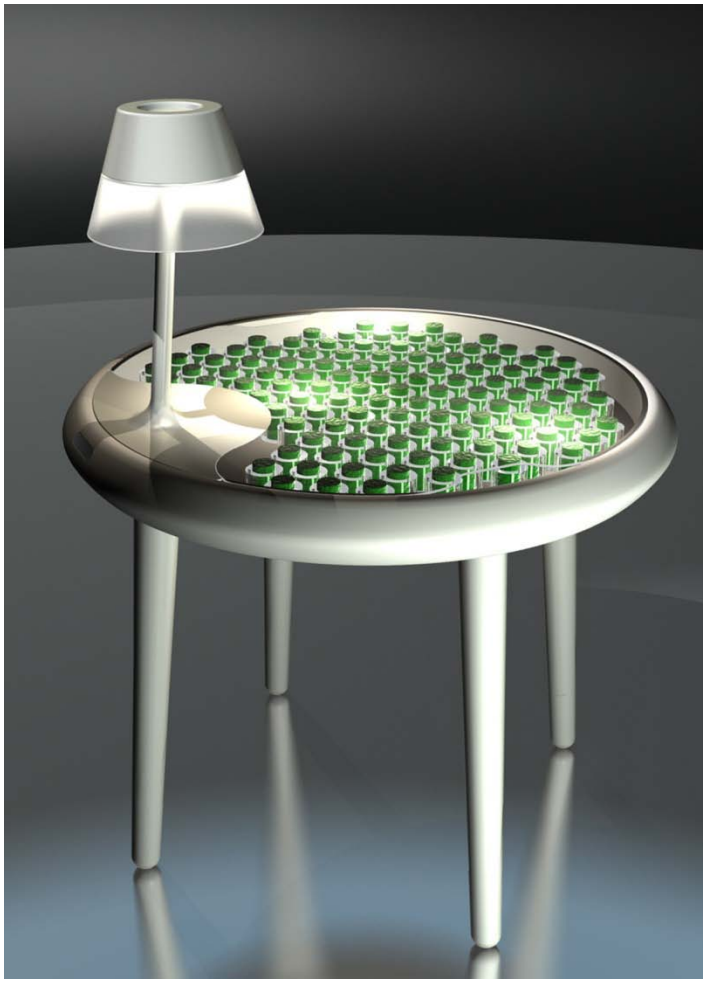

Figure 1 A visualisation of the moss table

Biophotovoltaics - Potential Applications

Prototype Biophotovoltaic devices have recently been constructed and tested in the laboratory, but a great deal of research is required in order to develop BPV into a commercially viable technology. Low cost BPV devices may become competitive alternatives to conventional renewable technologies such as bio-fuels in the next 10 years.

As part of their collaborative project, doctoral researcher Paolo Bombelli and his colleagues worked with designers Alex Driver and Carlos Peralta to produce a range of future product concepts for BPV technology. These included an array of algae solar panels for domestic use (Figure 2), a near shore generator that harvests desalinated water (Figure 3) and the moss table (Figure 1).

The team also conceptualised an off-shore power station consisting of several giant floating 'lily pads' coated in algae (Figure 4). This power output per unit area of a BPV power station would ideally match that of an equivalently sized offshore wind farm (5-6 watts per metre square. Such a power station would even generate energy during the night as a result of excess electrons being stored inside the algal cells during daylight hours. They also visualised a forest of solar collecting masts which could be located inland, and which would draw water either from the ground or from rainfall to keep the algae alive (Figures 5 and 6).

Although BPV technology may require years of development to achieve these applications, they have helped the scientific team to communicate the potential of their technology to commercial partners and investors, and have helped to steer the research in new directions.

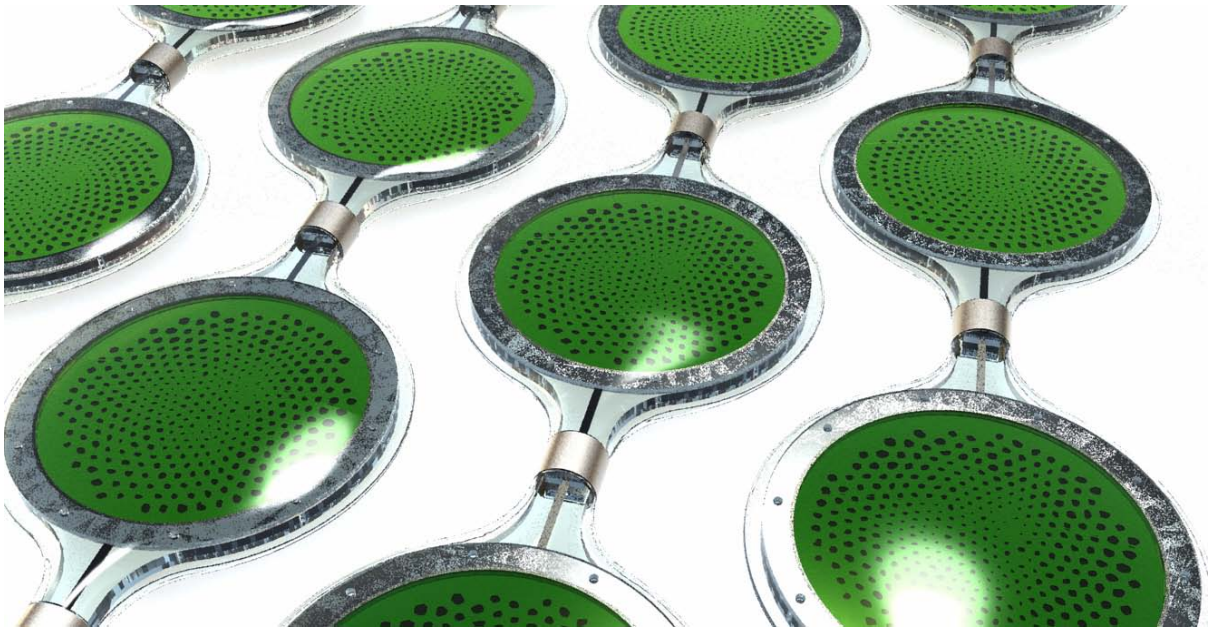

Figure 2 An array of Biophotovoltaic solar panels

Figure 3 A floating Biophotovoltaic generator, designed to harvest desalinated water

Figure 4 A Biophotovoltaic power station consisting of algae-coated 'lily pads'

Figure 5 A forest of algae-coated masts that draw water from underground using wind-energy

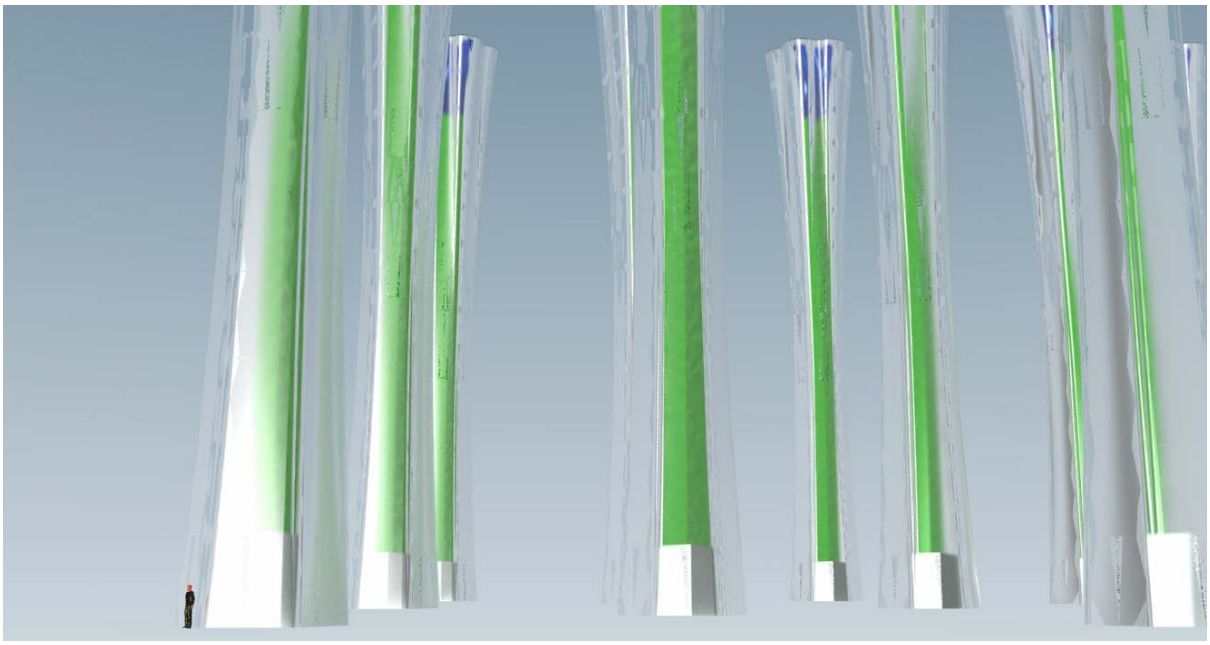

Figure 6 Biophotovoltaic masts that capture rain water to feed the algae

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