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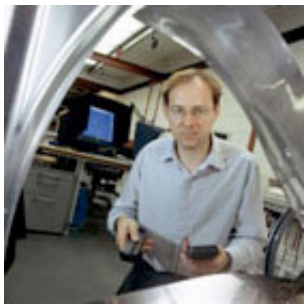
Dr Philip Davies - Turning the desert green



Well over one billion of the worlds population live in areas that suffer from severe water shortages. Over the past twenty years global rainfall has remained roughly constant but human demand for water has doubled. An alternative source of water is the sea but desalination is expensive. There is a clear need for technology that can assist dry regions to economically exploit alternative water sources and conserve freshwater. One such technology is the Seawater Greenhouse. Dr Philip Davies has just started a Royal Society Industry Fellowship at the University of Warwick that will improve the design of the Seawater Greenhouse and hopefully lead to its widespread use to turn the desert green.

Why did the Society award this Fellowship?

"The original concept of the Seawater Greenhouse was the brainchild of Charlie Paton in 1993," says Philip Davies, principal engineer at Seawater Greenhouse Ltd. "The idea was to grow crops in arid coastal areas where lack of fresh water normally prevents agriculture from being viable." Unlike a conventional greenhouse in temperate regions, which heats the ambient air to promote growth, the Seawater Greenhouse cools the ambient air to reduce water use. "The greenhouse uses seawater in two processes," explains Philip. "Firstly, sea water is used to cool and humidify the air - this reduces the crops transpiration, their equivalent of sweating, and secondly the seawater is distilled into freshwater for irrigation." The fellowship will allow Dr Davies to use state-of-the-art modeling and design systems to refine and improve the greenhouse - in particular its capital cost and use of energy. The thermodynamic design of the greenhouse is critical to the effectiveness of the technology.

How has this work helped society?

Population growth is seriously threatening the availability of fresh water in many regions of the world. Irrigation for agriculture accounts for an average of 70% of human water use. In arid areas this can rise to 90%. "But conventional agriculture is very inefficient in its use of water," says Philip Davies. "Hundreds of litres of water are typically required to produce just one kilo of edible produce and in dry coastal areas this is simply not possible as desalination of seawater requires a large energy input. And energy is as precious a resource as water." The Seawater Greenhouse offers a possible affordable and sustainable means of producing food without reliance on large inputs of fresh water or energy. The first prototype Seawater Greenhouse was constructed in 1994 in Tenerife followed by one in the United Arab Emirates. A project in Oman is now underway.

What are the current areas of research being investigated?

The work at Warwick will take two years and will initially cover an engineering design study of the greenhouse. "There are three principal objectives to this part of the study," says Philip. "I want to use computational fluid dynamic modelling to gain a better understanding of the air flow distribution in the greenhouse to minimise the power required for fans. To reduce transpiration via further filtration and attenuation of sunlight, the use of special horticultural films will be investigated and I want to develop a new lower cost condenser to increase the amount of freshwater produced." Later stages of the research will include a survey of renewable energy technologies to find appropriate cost-effective systems that can enable the greenhouse to operate in a truly stand-alone configuration. Finally the results of the first two stages will be brought together and the whole system modelled before the results are implemented. Some of the recommendations will be used in a new greenhouse being constructed in Oman. Data collected from the Oman project will be compared to modelling results to validate them and then applied to future projects in the Middle East and in the developing world.

What will the impact of the Fellowship be?

"I hope the time at Warwick will enable a big step forward in the design and cost effectiveness of the Greenhouse," concludes Dr Davies. "The Fellowship gives me access to tools that would otherwise not be available to me. This technology could make a major contribution to sustainable development in many disadvantaged regions of the world and it is gratifying that the Royal Society has been able to support its development in this way."

Source of funding

Dr Davies is one of the Royal Societys eight current Industry Fellows. This scheme enhances knowledge transfer in science and technology between researchers working in industry and those working in research institutions funded by the Society, BBSRC, EPSRC and Rolls Royce plc.