# Renewables and Higher Physics - the Bananarama

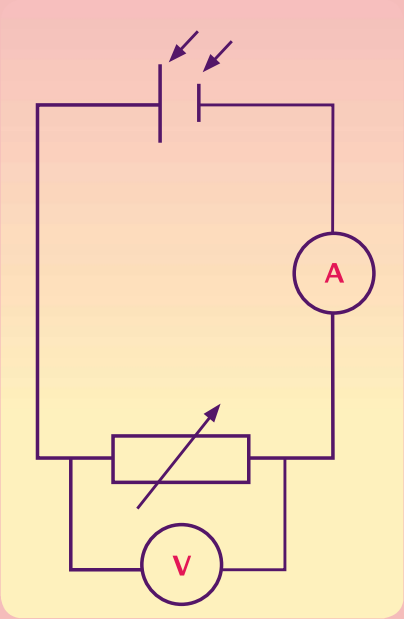



***Figure 1*** *- Circuit used.*

**There is now a Researching Physics exemplar on Renewables. This has had a mixed reception. Some teachers, with no option but to teach N5 and Higher in the same class, welcome the option of a topic that is appropriate to both levels. Others, who have perhaps investigated solar cells and wind turbines at BGE, question whether the work is sufficiently challenging for Higher. Thus was born the Bananarama Conjecture, *It ain't what you do, it's the way that you do it*, after the 1982 song featuring the girl band of that name [1].**

Mentioning the Bananarama Conjecture may raise a smile amongst some teachers of a certain age at Researching Physics professional learning events, but concerns about levels of challenge deserve more than a jokey soundbite. We therefore set out to do some unambiguously Higher level experiments on solar cells. The exemplar is quite clear that it is the power output rather than voltage that should be investigated. Load matching and maximum power transfer are mentioned in the Electricity half unit at Higher, so the following approach was taken. A solar cell was wired up in series with an ammeter and variable load resistor, across which a voltmeter was connected (Figure 1).

A desk lamp was placed directly above the solar cell. With the light level remaining constant, V and I were measured for different values of load resistance *R*. The experiment was repeated with dimmer light, mimicking one of Scotland's cruel summers.

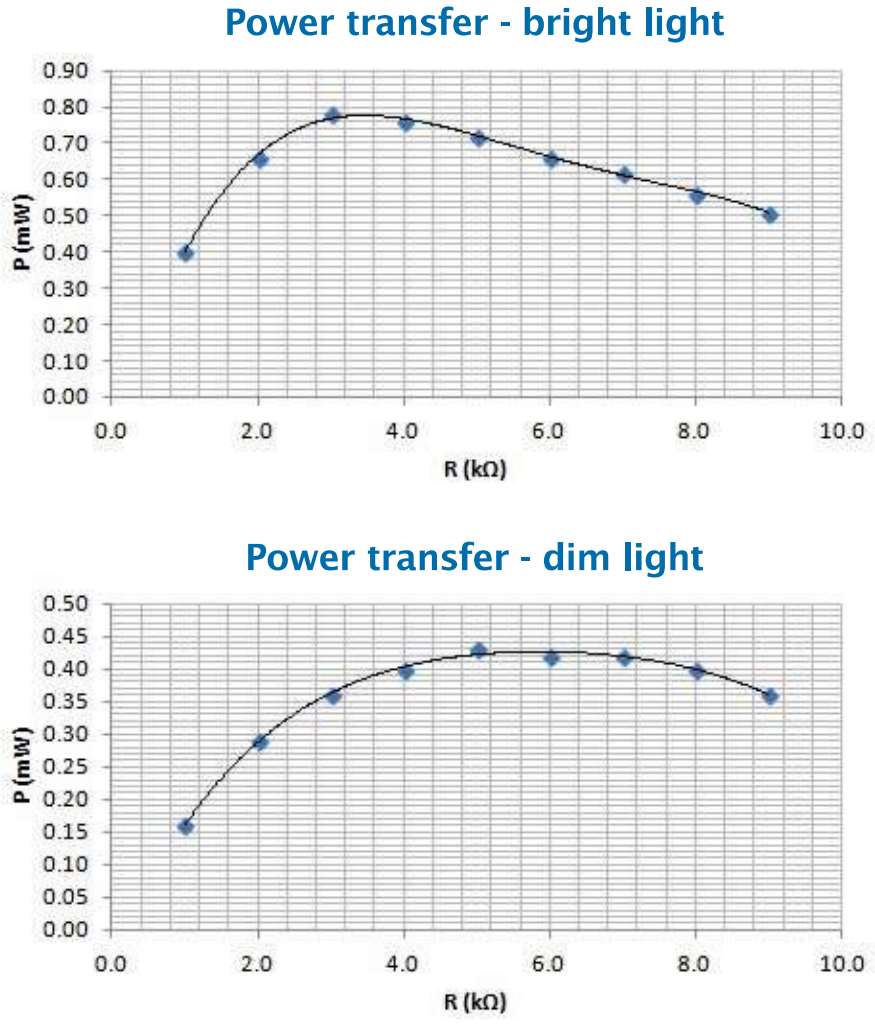



***Figure 2*** *- These graphs seem to be really saying something.*

# Conjecture

The results are shown in Figure 2.

As expected, the power transferred to the load resistor peaks at a certain value of *R*, which theory tells us happens when the internal resistance of the solar cell and the load resistances are equal. If this is the case, then the internal resistance has increased as the light falling on the solar cell has decreased.

A Researching Physics investigation might then result in a series of power transfer curves, each for, say, a different angle of tilt of the cell. A graph could then be drawn of maximum power transferred versus angle. Conventional wisdom states that Researching Physics investigations are generally unsuitable for Outcome 1 write-ups. This is almost certainly correct. However, a single power transfer experiment could well form the basis for such a report.

## Notes

We used a DJB Decade Resistance Board [2] with an unbranded solar cell. At low light levels, the highest resistance available from the board was just enough for us to be able to identify the peak power. We have, however, heard from teachers who tried the experiment using solar cells whose internal resistances were significantly lower than that of our cell. They agree that we can unambiguously (hey hey) kiss goodbye to doubts that this is not a suitable investigation at Higher. ◀

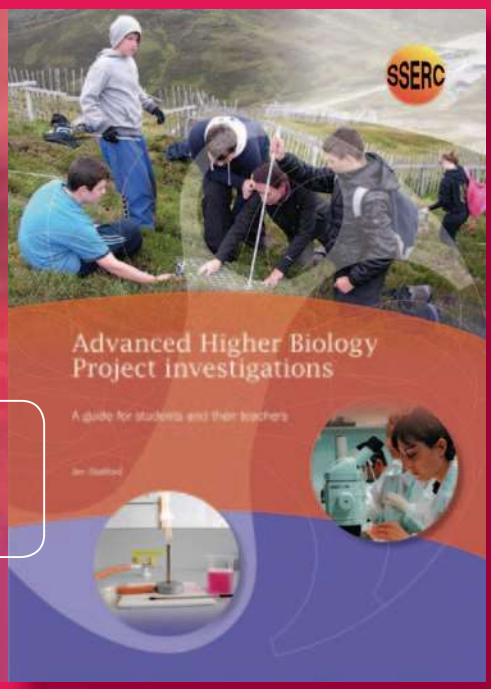

**References**

[1] The song was actually released by The Fun Boy Three, with Bananarama supplying the backing.

[2] http://www.djb.co.uk/ppe_decade_resistance.html.


# Coming soon ...

**We are pleased to let you know that SSERC will shortly be publishing a new guide entitled 'Advanced Higher Biology Project investigations'.**




**Copies of the guide will be made available through the SSERC website.**

The guide has been written by Jim Stafford who is a Senior Associate with SSERC. Previously Jim has been a Principal Teacher of Biology, a Local Authority Science Adviser and Quality Improvement Officer.

Iain Hunter (Executive Dean of Science at the University of Strathclyde, in his foreword to the Guide, writes *'This Guide, from SSERC, fills a much-needed gap for both student and teacher. It provides generic guidance and support for both. It will be invaluable in detuning the anxiety of the Investigation, and enhancing the student experience and attainment'.* ◀