# Now is the Time for Renewables

*Assoc. Prof. Basil T. Wong*
*TWong@swinburne.edu.my*

> *Energy cannot be created or destroyed; it can only be changed from one form to another.*
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> *— Einstein*

This would sum up what my research in thermal radiation is about. But it does not give you the entire picture.

Thermal radiation is all about energy exchange in the form of electromagnetic waves between a source, e.g. the Sun, and an object like a solar cell, but it can even take place between objects.

Research in converting and storing renewable and sustainable energy has come a long way. Solar cells have become more compact and durable and are powering entire villages now.

But just like how research into data storage systems is driven by making it more and more compact; energy conversion and storage systems are also following that need. Especially as our demand for electricity is predicted to increase.

My research looks into using nanotechnology to enhance the performance of solar cells; particularly by incorporating metallic nanoparticles in the solar cells.

Metallic nanoparticles work pretty much like diamonds. They can scatter light in all directions depending on their properties. By placing them strategically, we can get the nanoparticles to scatter light back to the solar cell which will increase electricity production.

This is particularly important as thin-film solar cells have two big drawbacks; when you have a thin solar cell, the cell volume is not big enough to capture all the radiation at once. The nanoparticles could overcome this as they reflect the light back to the cells.

The other issue is what we call the heating effect. Part of the sunlight which does not get converted into electricity heats up the solar cell, and reduces its life span and efficiency. This calls for an innovative way of managing the heat either by reducing its generation or channelling it away from the cell, which our team is exploring.

Using the principle of thermal radiation where heat and light are transferred and converted, we are also looking into converting wasted heat to electricity. By wasted heat we mean the extra heat of the solar cell, or steam coming out of industrial power plants, or heat generated by a working machine.

The idea is the same as photovoltaic or solar cells, where heat is used to produce electricity. Only here, the source is different. When we put a hot and cold cell within micro or nanometers of each other, the heat transfer radiation exceeds the traditional radiation heat. We want to channel this excessive radiation onto photovoltaic cells to generate electricity.

The implications for the industry are huge of course; especially as ferroalloy production plants are being set up in Sarawak. Our vision is to find renewable energy sources which can either feed industries or can feed off wasted industry heat.

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*Basil teaches thermodynamics and fluid mechanics at Swinburne Sarawak. His research delves into applications of length scales — nano, micro and macro — of heat transfer.*