Project Title:	'Optimisation of power supply and heat management in LED-based luminaire designs for domestic and industrial lighting.'
Principle Investigator:	Dr J Methven (University of Manchester)
Project duration:	05/03/07 – 28/02/10
Grant Value:	£118702.00

Lighting is a very significant user of electricity in the UK, currently representing about 20% of its total UK energy usage. Currently commercial and domestic lighting is dominated by inefficient fluorescent and incandescent technologies but many of these are expected to be replaced by much more efficient Solid State Lighting (SSL) over the next 20 years. Solid-state lighting uses light-emitting diodes or "LEDs" for illumination. The term "solid-state" refers to the fact that the light in an LED is emitted from a solid object, a block of semiconductor, rather than from a vacuum or gas tube, as in the case of incandescent and fluorescent lighting. It has the potential to reduce energy demand in the UK by 13TWh/year which is approximately the same as total annual energy consumption in the North West. The typically small mass of solid-state electronic lighting device also provides greater resistance to shock and vibration compared to brittle glass tubes/bulbs and long, thin filament wires.

Solid State Lighting is not a direct replacement for conventional lighting but is instead incorporated as "light boxes" into ceilings or into walls. Each individual light box is controlled independently so that one or more regions of a room or the entire room can be illuminated fully or in part. The overall lighting in the room can be adjusted by powering groups of boxes according to the particular task being pursued in the room. This represents an extremely energy efficient arrangement when compared with the on-off control used for conventional room lighting. One secondary but potentially large benefit of SSL systems to the region is in their replacement of spotlights and other point sources of illumination that are used currently in shop fitting enclosures and in display cabinets. This would reduce considerably the heat generated within these displays, all of which is radiated to entire establishment and, in the case of the larger Department Stores, must be removed by an increasing demand on air conditioning. Since it is far more costly to cool a space than to heat it, the use of these devices would save both cost and energy.

The objectives of this project are to optimise Robust Power Supply Units (PSUs) and to develop suitable heat sinks for use on SSL units. This project involved the creation of a room lit by SSL units in the ceiling and was the first such full-scale investigation of its kind. Using this facility, various designs of PSU were evaluated against light output (illumination and colour temperature), switching behaviour and power consumption. In addition to this a number of approaches to the issue of heat management were evaluated. The issue of heat management in SSL units is an important one because it impacts on the amount of light they can output and this is a crucial factor in making the lights commercially competitive. Since there is direct access to the luminaries in the light room, the more subtle but nonetheless critical aspects of heat sinks such as obtrusiveness, accommodation within the waveguides and potential for thermal distortion of the waveguides can be evaluated immediately.

There is an outstanding opportunity for this infrastructure to be created within the region and with it the opportunity for additional employment. This could be achieved with early opportunities for manufacture of luminaries and panel housings within the existing North West plastics manufacturing and compounding sector. The North West can become identified with SSL activities in research, design and manufacture.