Statement No. 24

Arkansas State Highway and Transportation Department
Transportation Research Committee

RESEARCH PROBLEM STATEMENT

DATE: 08/25/2010 | **PROJECT AREA:** Special Projects

TITLE: DC Operated CFL Ballast Design for Efficient Solar Powered Lighting System

PROBLEM STATEMENT:

In our finding of the MBTC-2096 project (Solar Powered Lighting for Highway Signs), we had reported that CFL lighting is essential for illuminating large signs since CFL provides uniform light distribution. Generally CFL uses AC main supply. It was found through our research that the CFL ballast can be modified for it to operate directly from DC voltage. We did some preliminary work, but couldn't be concluded due to time restriction. If CFL ballast operates from DC, it will be of significance for PV (Photo-Voltaic) solar lighting. There is no need for a DC to AC inverter making the driver more efficient and reduce its complexity. No on-going research has been found in the literature for such an approach. Our work will be pioneering in making PV solar an attractive option for lighting and advance efficient application of solar technology. The new ballast design will lead to energy-efficient stand-alone lighting system for any highway application that requires nighttime lighting. This may include highway signs, rest stops, parks, vehicle parking lots, weighing stations, and others that require lighting for safety. With energy cost rising and the dangers of climate change due to greenhouse effect, there has been a great national interest in renewable energy and our research will add to the advancement of the national effort.

OBJECTIVES:

The research objective is to build on the experience of MBTC project 'Solar Powered Lighting of Highway Signs'. One of the key components of the CFL ballast is a high voltage IC designed to drive and control the CFL. It consists of a driver circuit that controls ignition of the lamp. Once ignited, the lamp's operating voltage and current drop making the CFL energy efficient. We plan to redesign the controller with additional circuitry to make it operable from 144V DC. This will require twelve 12V low capacity batteries that will be placed in series/parallel with a smart circuit. Parallel connection is necessary to charge the batteries by solar energy.

Form of Research Implementation:

A prototype of the design will be tested in the solar laboratory that has been established through NSF funding. The laboratory facility has PV panel feed from the building rooftop where the panels are mounted. A new design for a Maximum Power Point Tracker (MPPT) will be incorporated to extract maximum panel energy.

Total Estimated Cost and Project Duration: **$** 90,000 **and** 18 **months.**

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ADVISORY COUNCIL RANKING	TRC RANKING	Statement Combined with Statement Number(s)
23	__	_____

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