

## ABSTRACT

The sustainability of energy generation is primarily based on the effectiveness of the methods used for minimizing the wastes and optimum utilization of available energy resources. Mobility and its ease is therefore being an essential component of development. Automotive technology is an area where methods are explored in recent times to provide sustainable solution for reduction of fuel consumption and carbon emission by switching to hybrid technology and electric vehicles where regeneration of energy plays an important role. At present the research is focused on achieving methods of solid state conversion of heat into electricity but it's limited to thermoelectric which has lower conversion efficiency. A comparative analysis of the direct energy convertors shows that thermionic energy conversion stands better with a higher conversion efficiency.

Very close and non-contact type of electrode spacing having electrical insulation provided with vacuum or inert gas environment is the basic requirement while designing any thermionic energy generator. Identifying these key research challenges, this article discusses a design, simulation, prototyping and experimentation of thermionic regenerator. The thesis hence explores a platform for design of a thermionic regenerator applying reverse engineering, development of a thermionic regeneration system (TRS), Integration of the TRS with hybrid electric vehicle for improving fuel economy and drive range i.e. vehicle's overall efficiency. Special HEV control algorithm is developed to simulate the vehicle performance.

The results of design simulation have validated the design for thermionic emission and electric potential. The conversion efficiency achieved is 14.3 % in experimentation following the simulation path. Full scale vehicle simulation have shown 23% reduction in fuel consumption with the installation of TRS.

Keywords: thermionic energy generator; thermionic emission; electrode spacing.