The role played by power converting circuits is extremely important to almost any electronic system built today. Circuits that use converters of any type depend on power that is consistent in form and reliable in order to properly function. In addition, today's demands require more efficient use of energy, from large stationary systems such as power plants all the way down to small mobile devices such as laptops and cell phones. This places a need to reduce any losses to a minimum. The power conversion circuitry in a system is a very good place to reduce a large amount of unnecessary loss. This can be done using circuit topologies that are low loss in nature. For low loss and high performance, soft switching topologies have offered solutions in some cases.

Also, limited study has been performed on device aging effects on switching mode power converting circuits. The impact of this effect on a converter's overall efficiency is theoretically known but with little experimental evidence in support.

In this thesis, non-isolated buck type switching converters will be the main focus. This type of power conversion is widely used in many systems for DC to DC voltage step down. Newer methods and topologies to raise converter power efficiency are discussed, including a new synchronous ZVT topology [1]. Also, a study has been performed on device aging effects on converter efficiency. Various scenarios of voltage conversion, switching frequency, and circuit components as well as other conditions have been considered. Experimental testing has been performed in both cases, ZVT's benefits and device aging effects, the results of which are discussed as well.