Eco Charging System Design for Plug-in Electric Buses

There are four objectives of this thesis. First, it determines an optimal distributed generation (DG) size and location for the Plug-In Electric Bus Depot Charging (PEBDC) ecosystem integrated with a low voltage (LV) feeder to reduce deployment costs, voltage limit violation and power losses.

Second, it develops an efficient and optimal control scheme Energy Management System (EMS) model for the PEBDC ecosystem. The proposed EMS model is based on a double-sided auction mechanism which not only reduces the carbon emission but also maximizes the Bus Depot Operator's (BDO) profit.

Third, it proposes charge scheduling algorithms for the depot and pantograph based Plug-In Electric Bus (PEB) charging. These charging algorithms not only need to overcome the bus driver range anxiety issue but also to reduce the PEB charging impact on the LV feeder.

Finally, it investigates the two proposed PEB charge scheduling algorithms: i) Overnight Depot Charging and ii) Pantograph Charging. Digital simulation studies were conducted to show the effectiveness the proposed algorithm. The results show that the PEBDC ecosystem significantly reduces the load on the grid while pantograph charging immensely increases the load on the grid and thus, it causes the distribution transformer to be heavily overloaded.