

Freight Day V

The Plugin Hybrid Electric Vehicle Routing Problem

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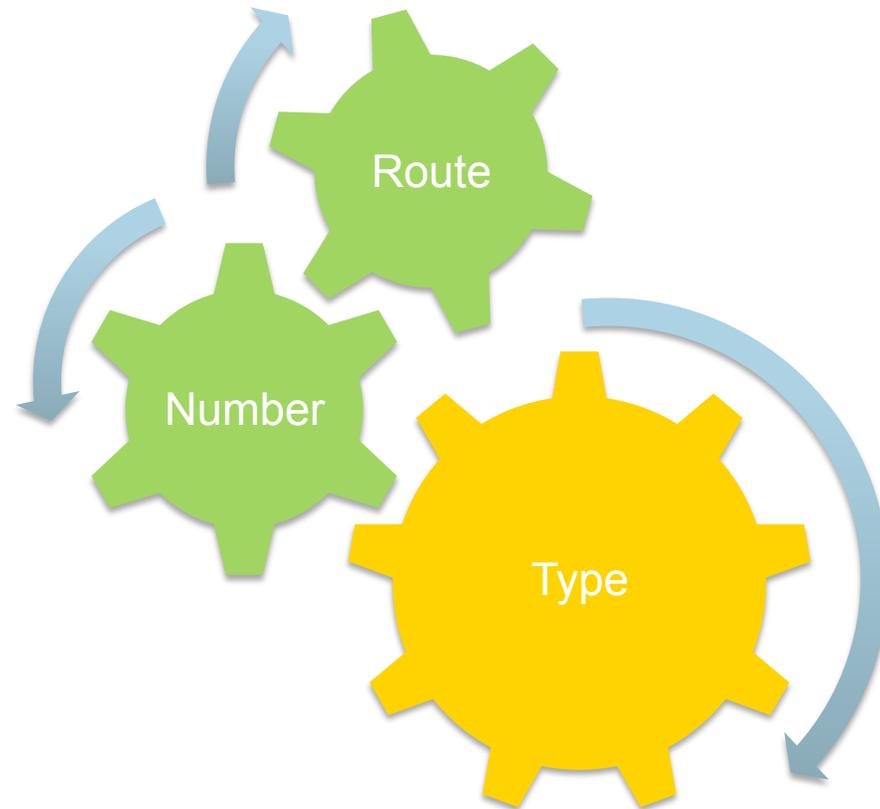
UTTRI University of Toronto Transportation Research Institute

30% GHG Emissions

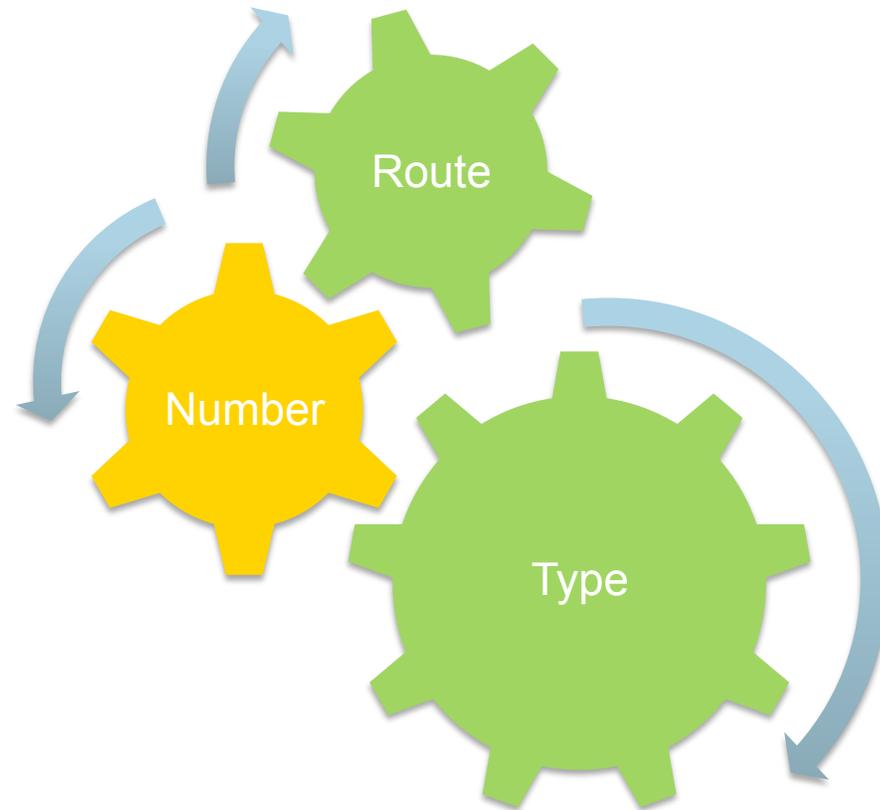
70% Crude Oil

14 Million Grid Vehicles by 2020

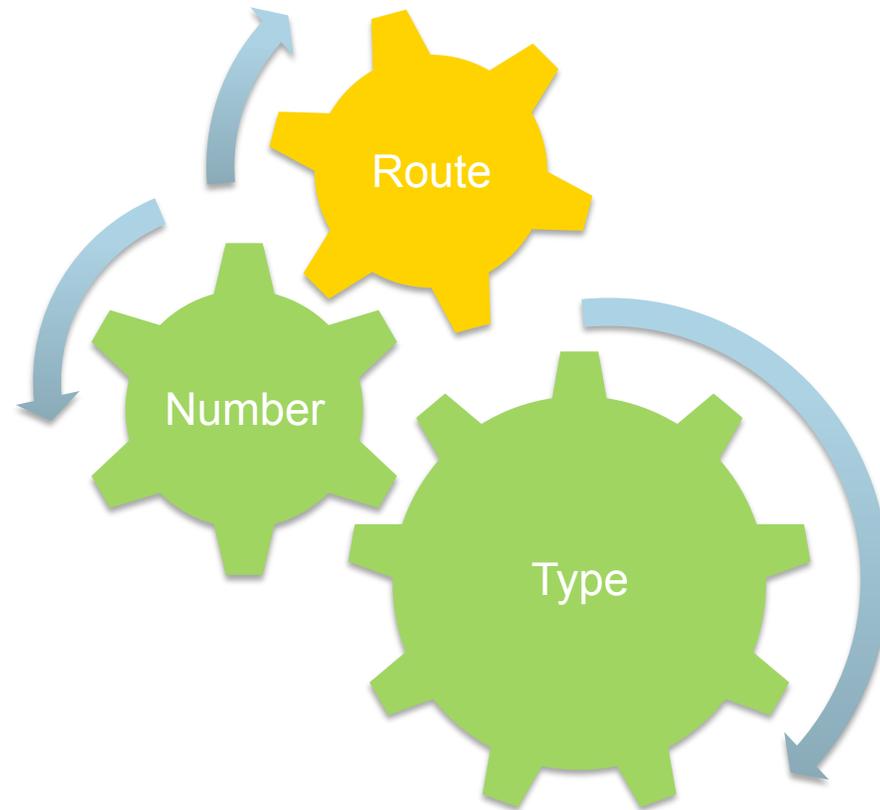
Fleet Composition



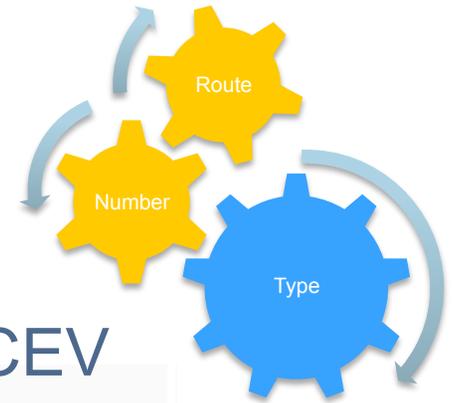
Fleet Composition



Fleet Composition



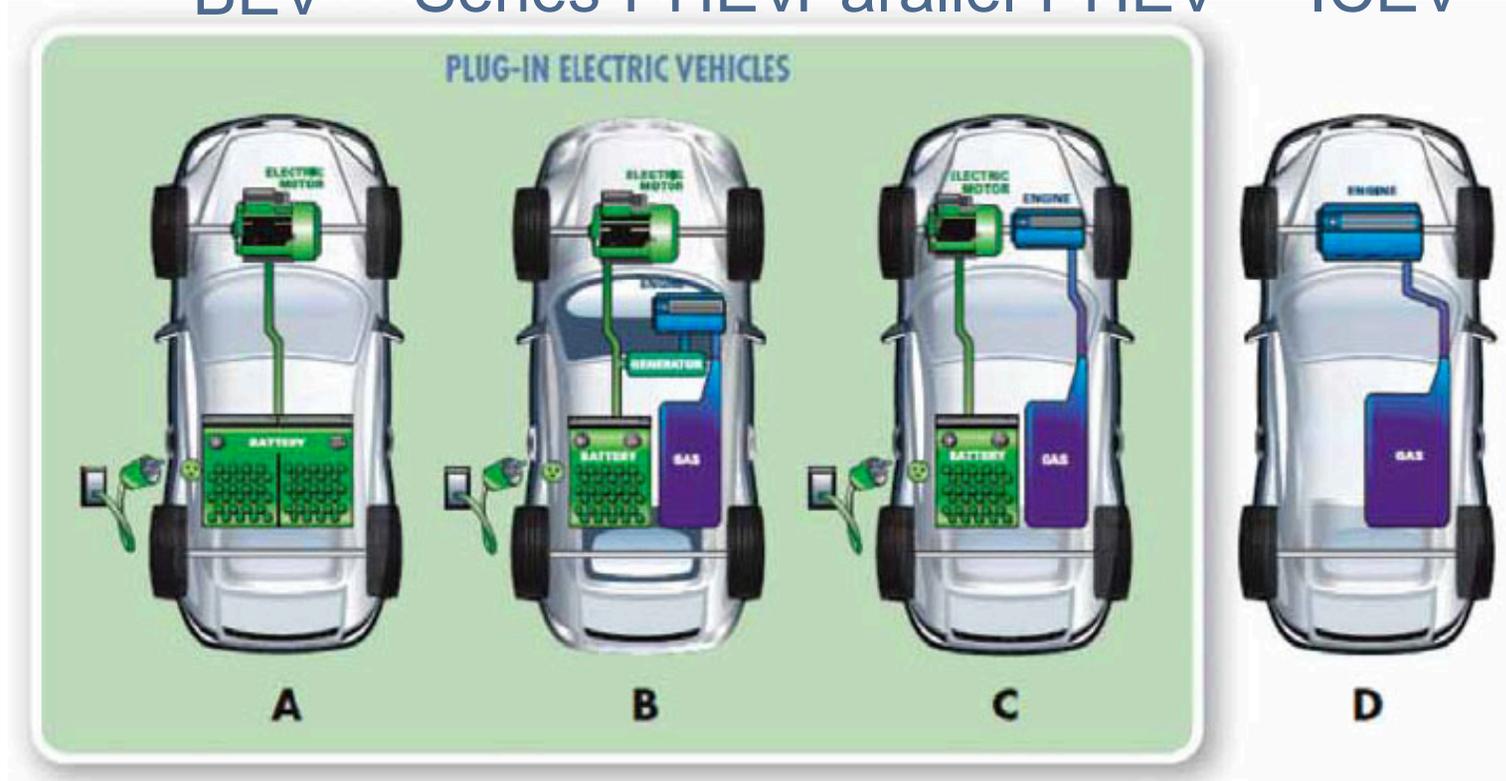
Types



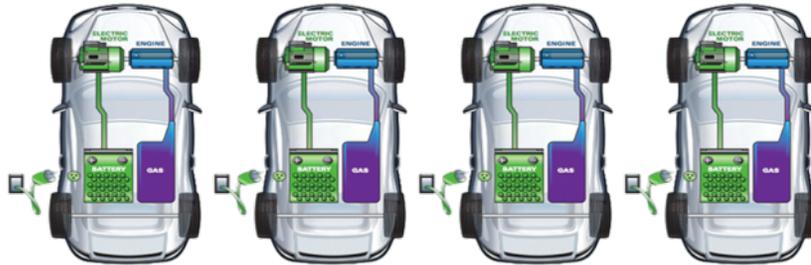
BEV

Series-PHEV Parallel-PHEV

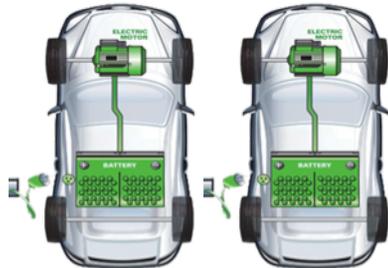
ICEV



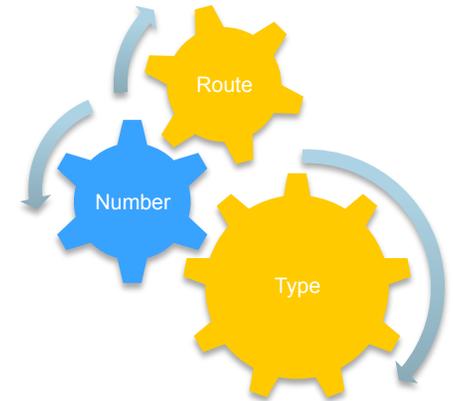
PHEV



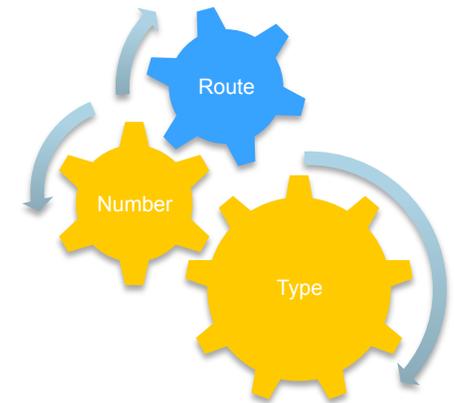
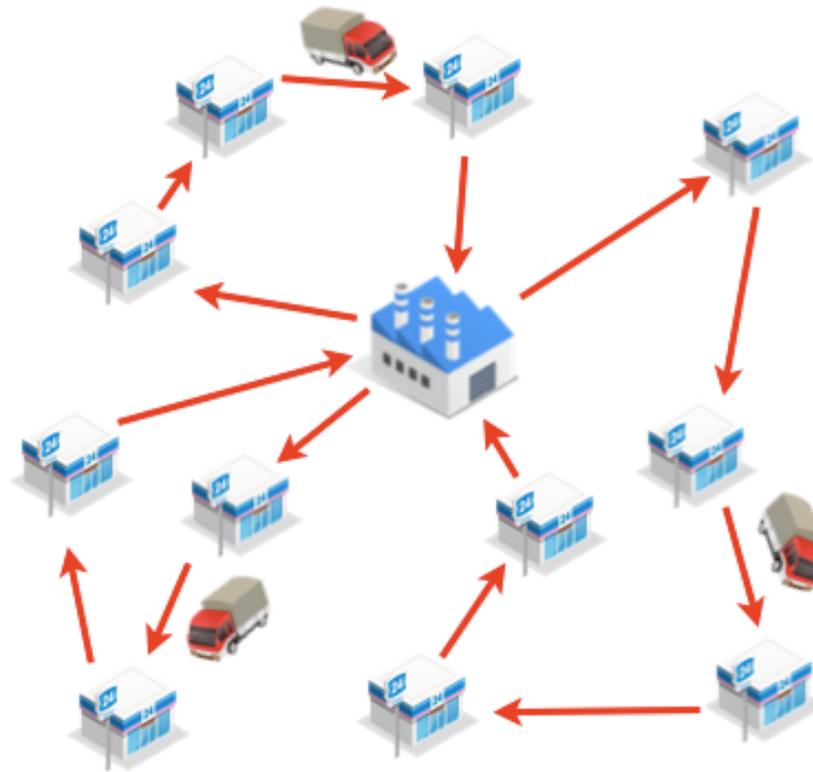
BEV



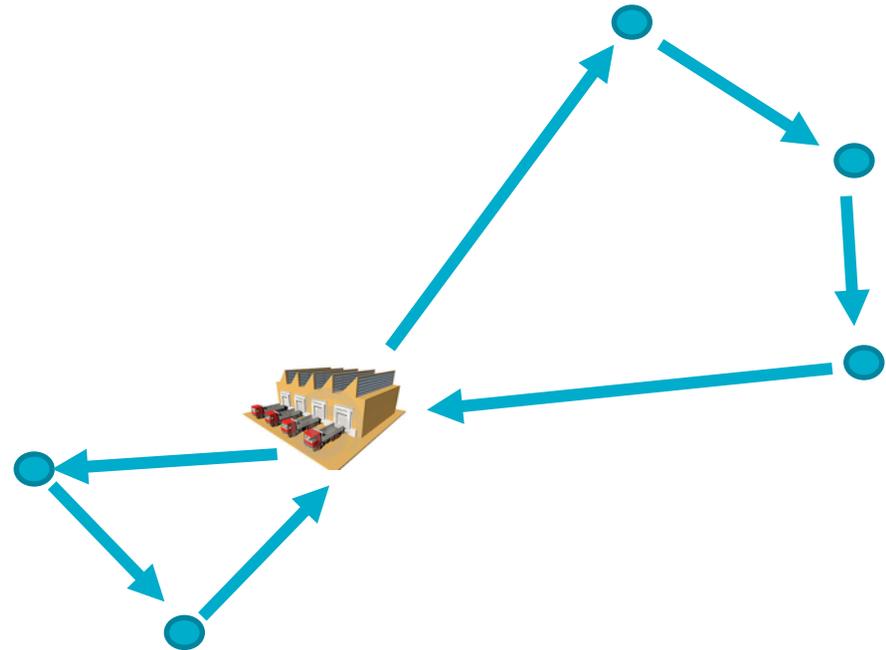
ICV



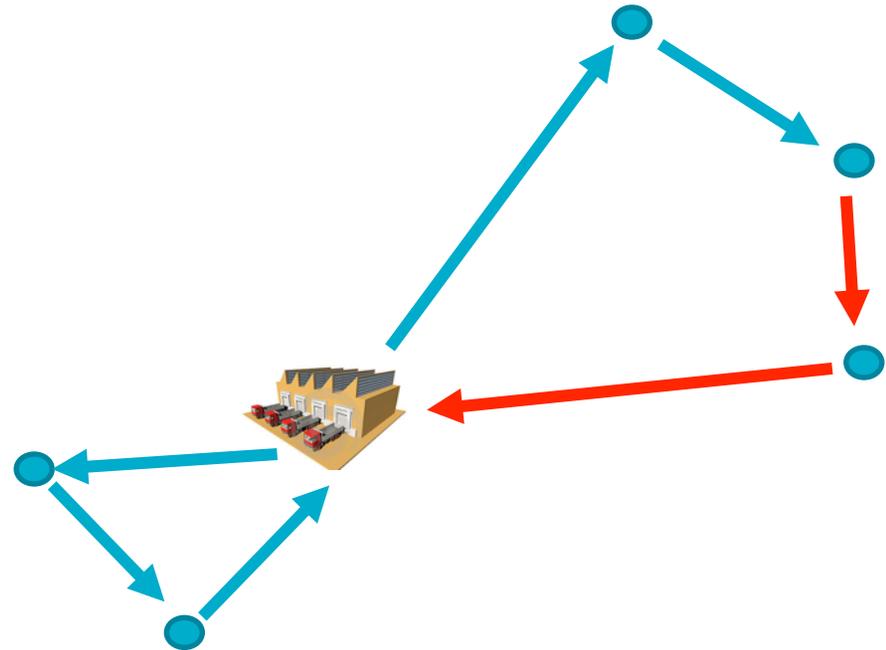
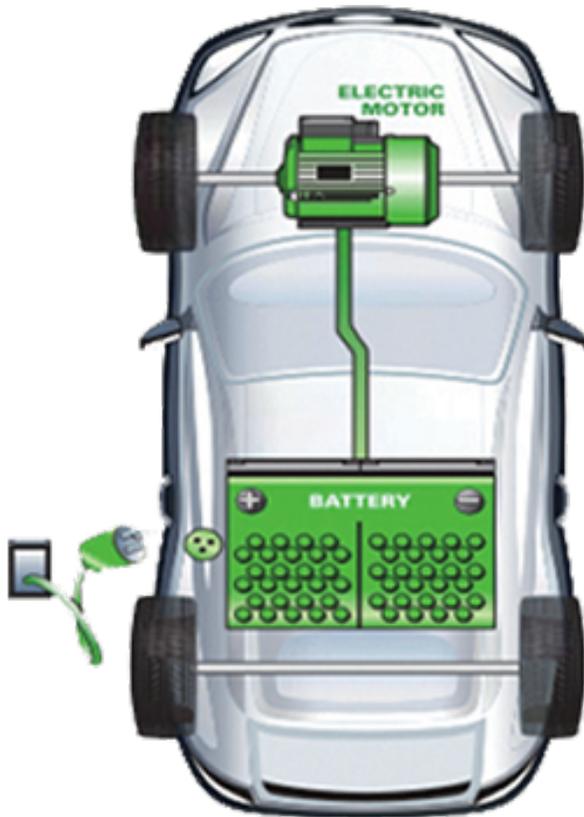
Routing - VRP



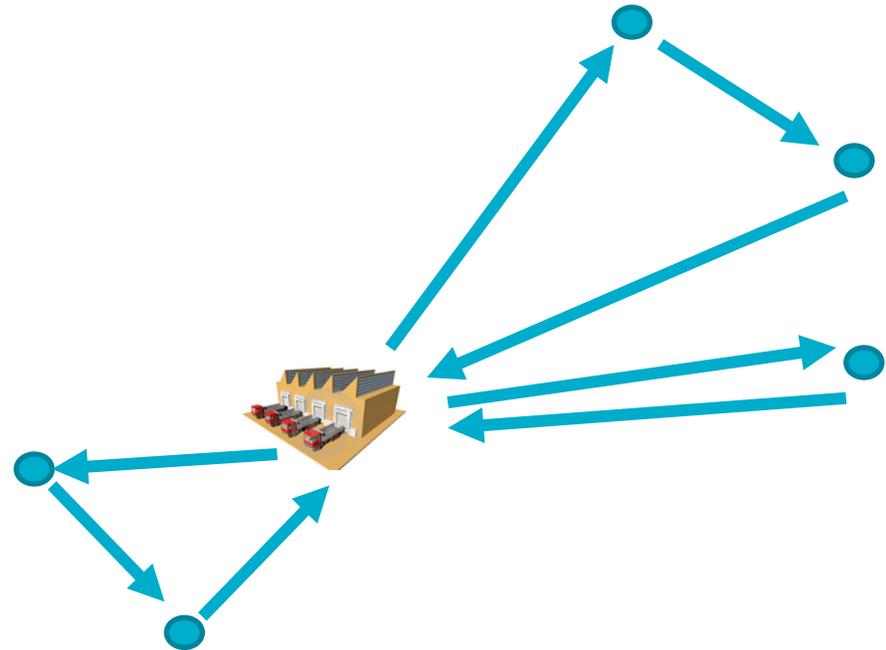
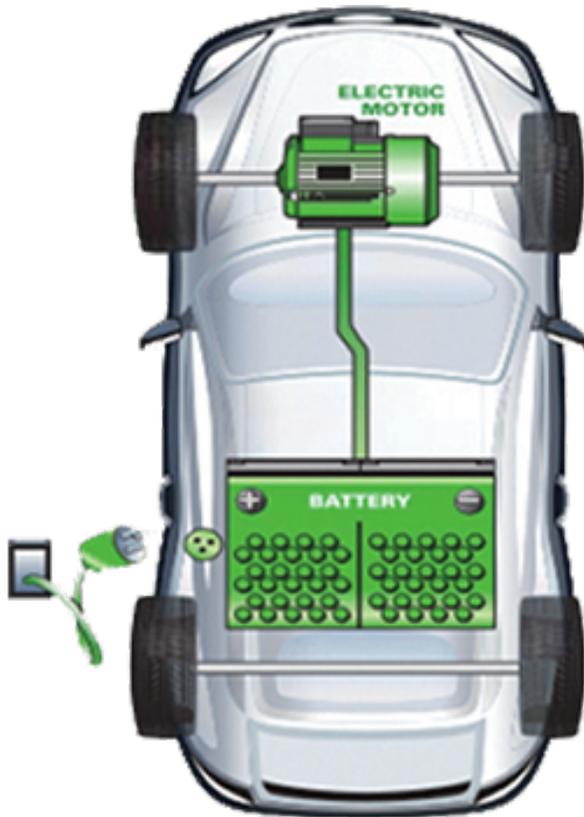
Internal Combustion Engine



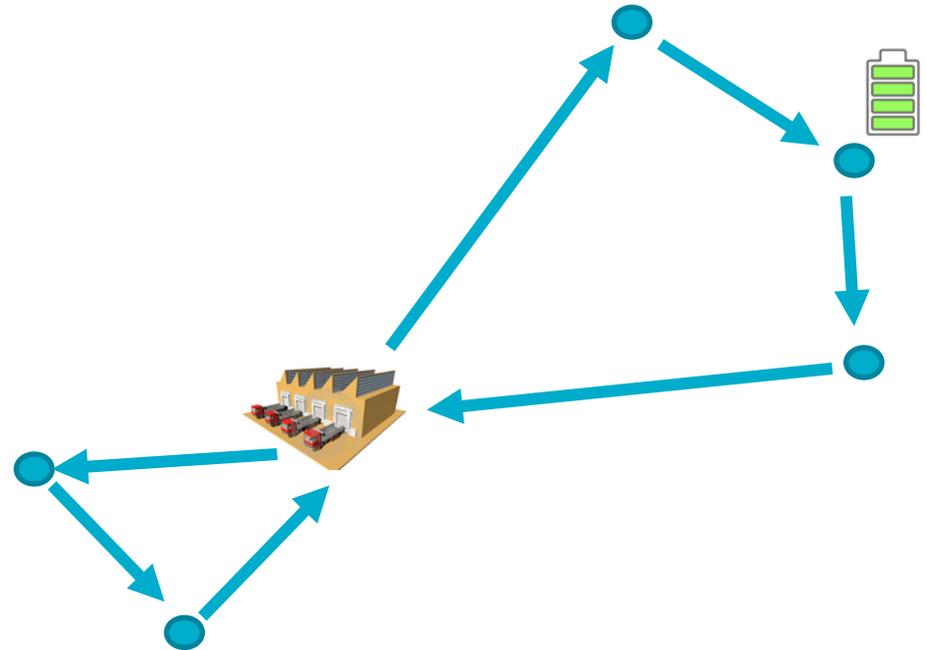
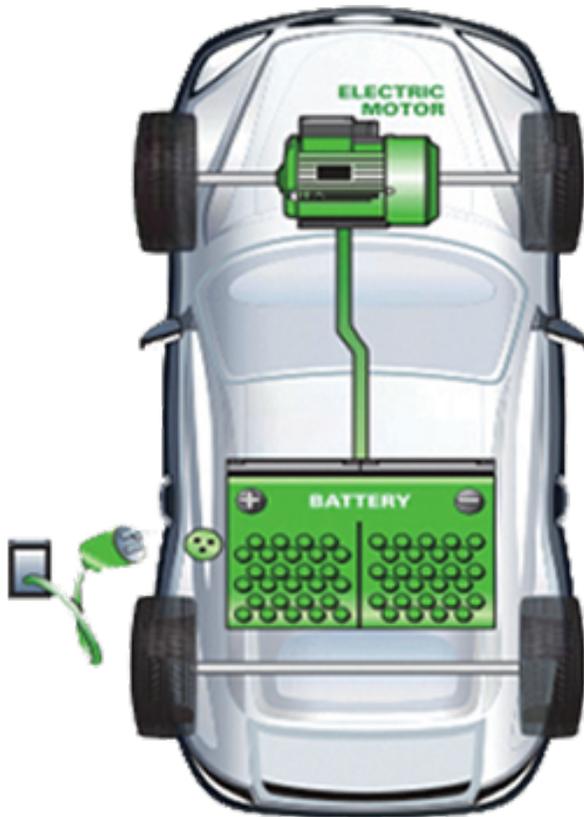
Battery Electric



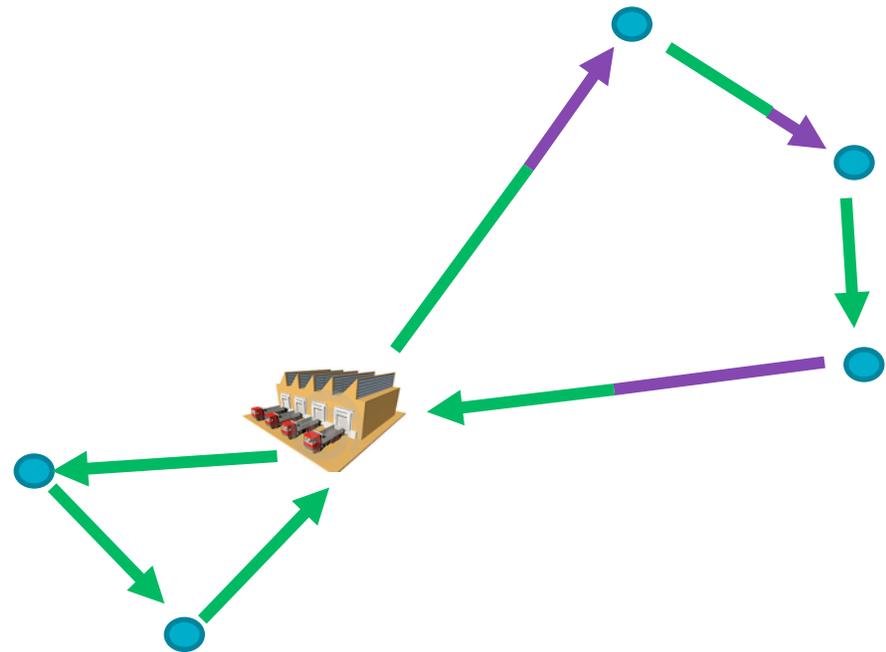
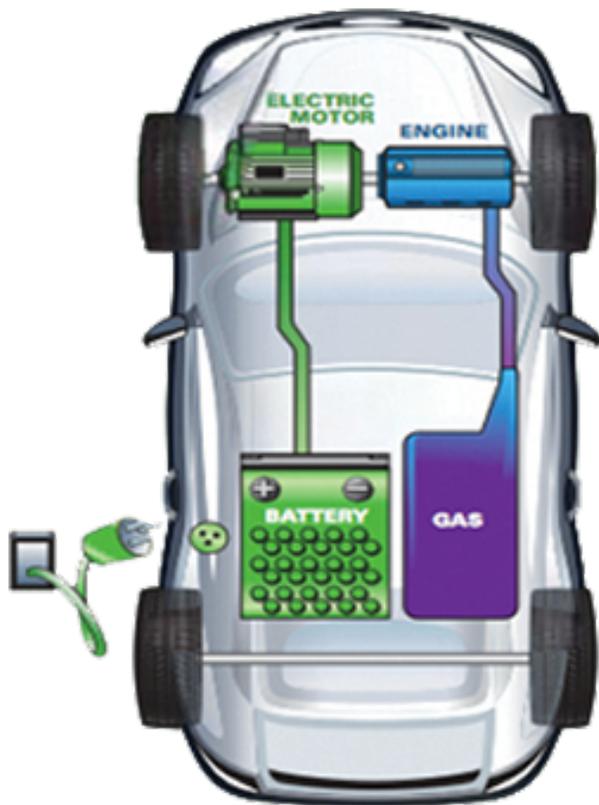
Battery Electric



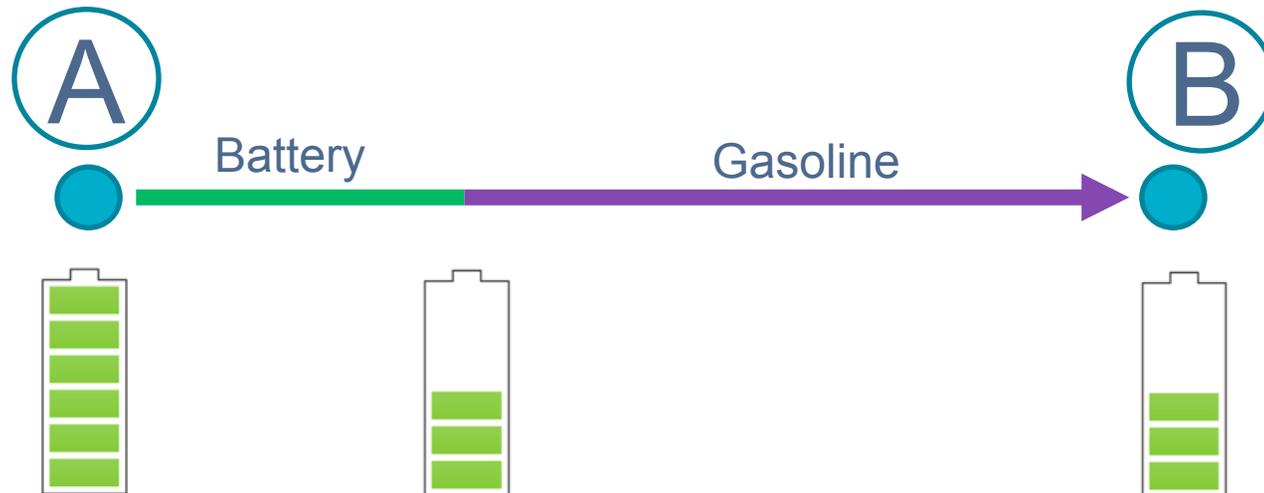
Battery Electric

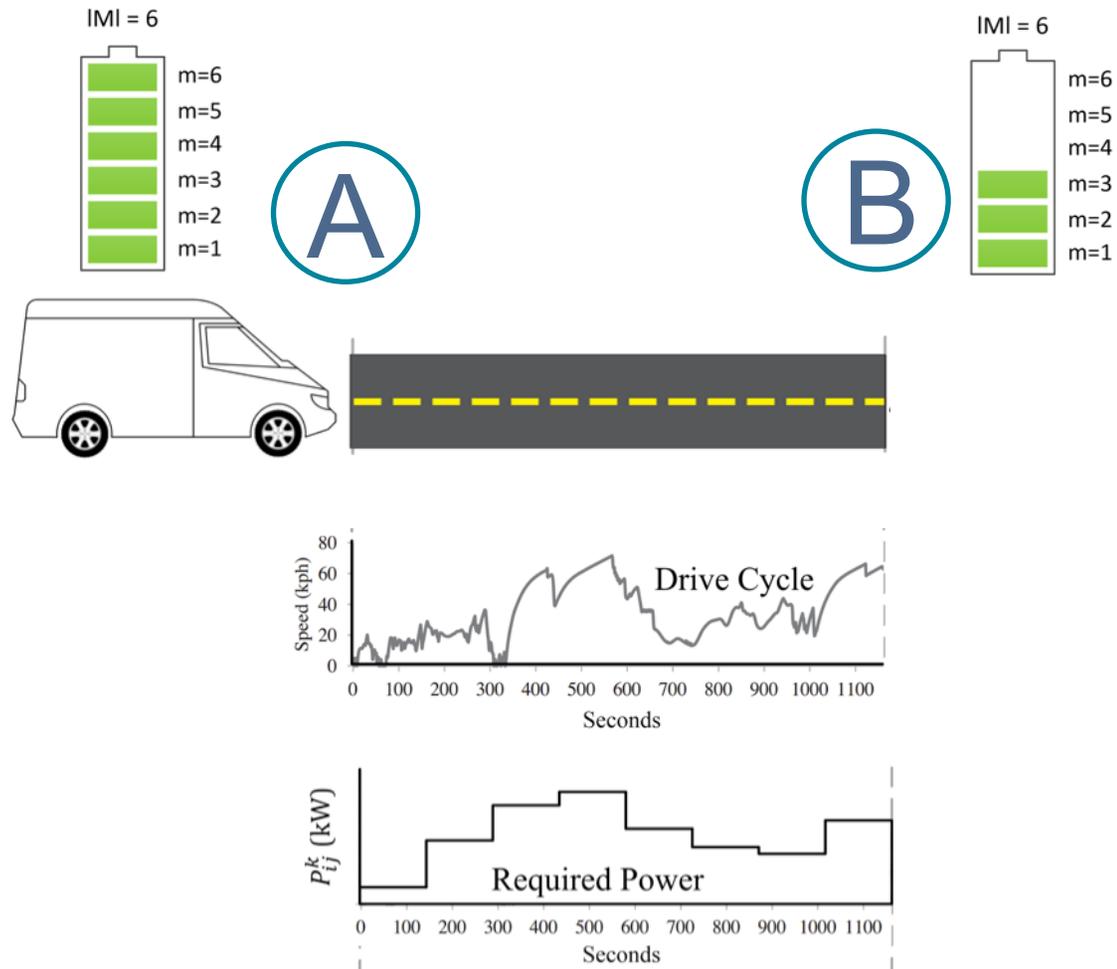


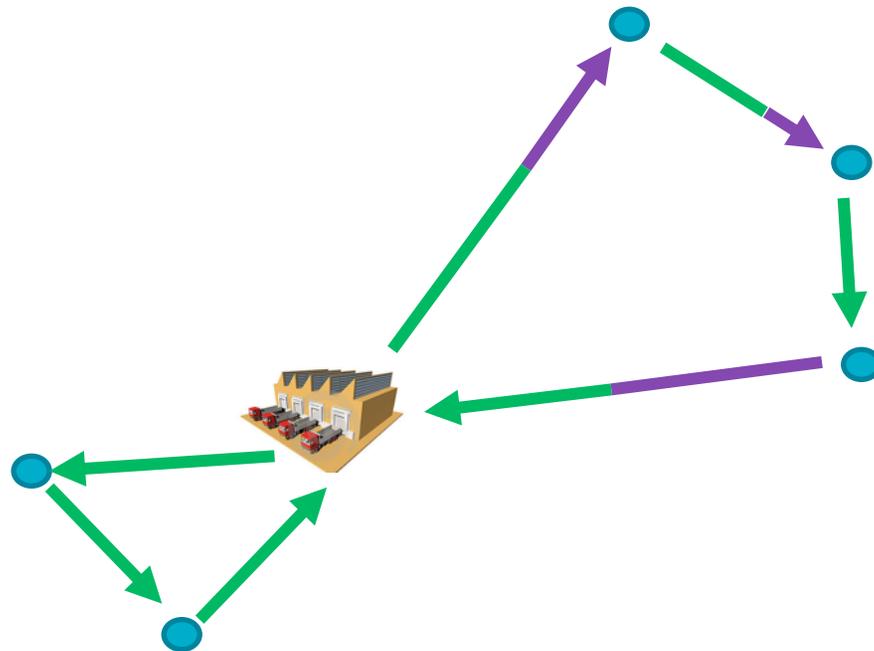
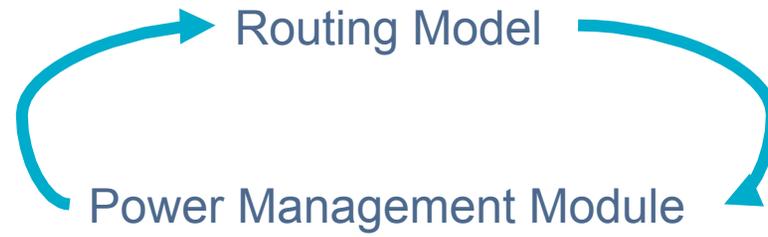
Plugin Hybrid Electric

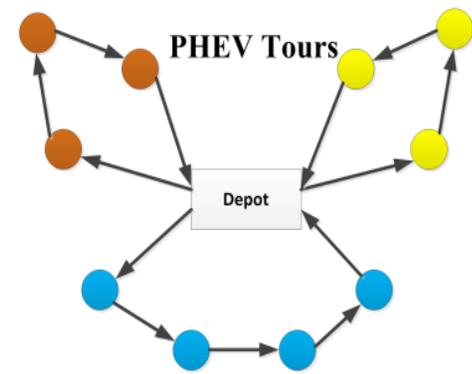


Power Management Modules



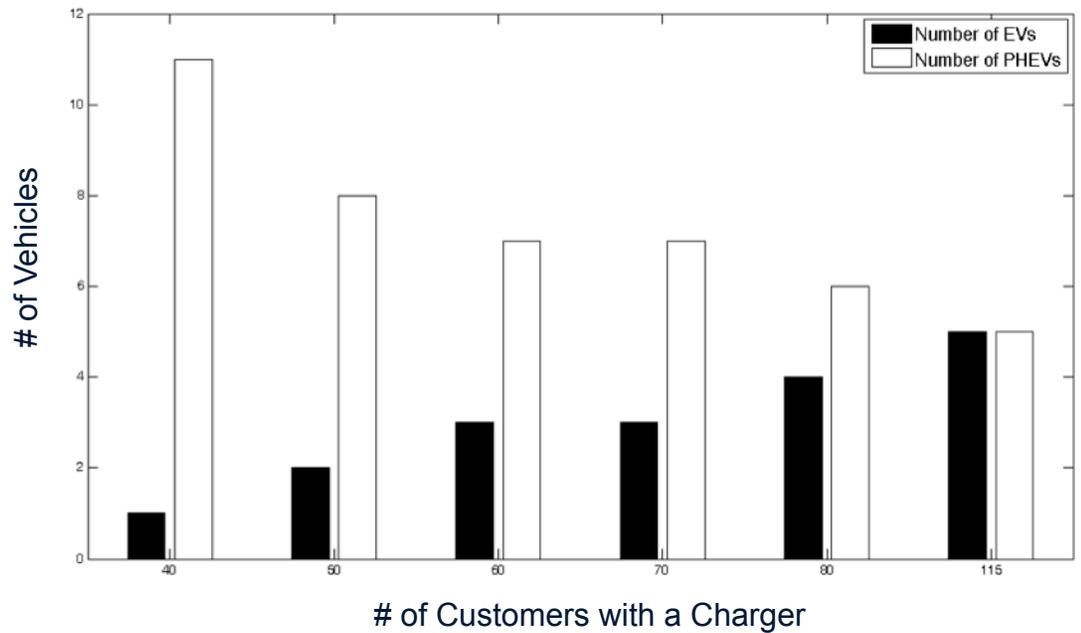


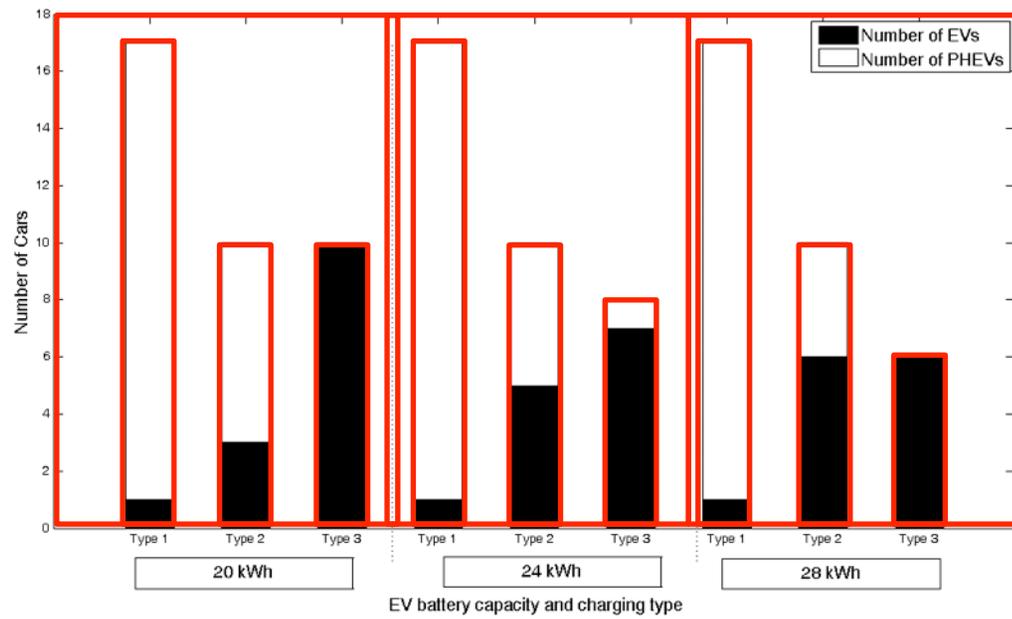


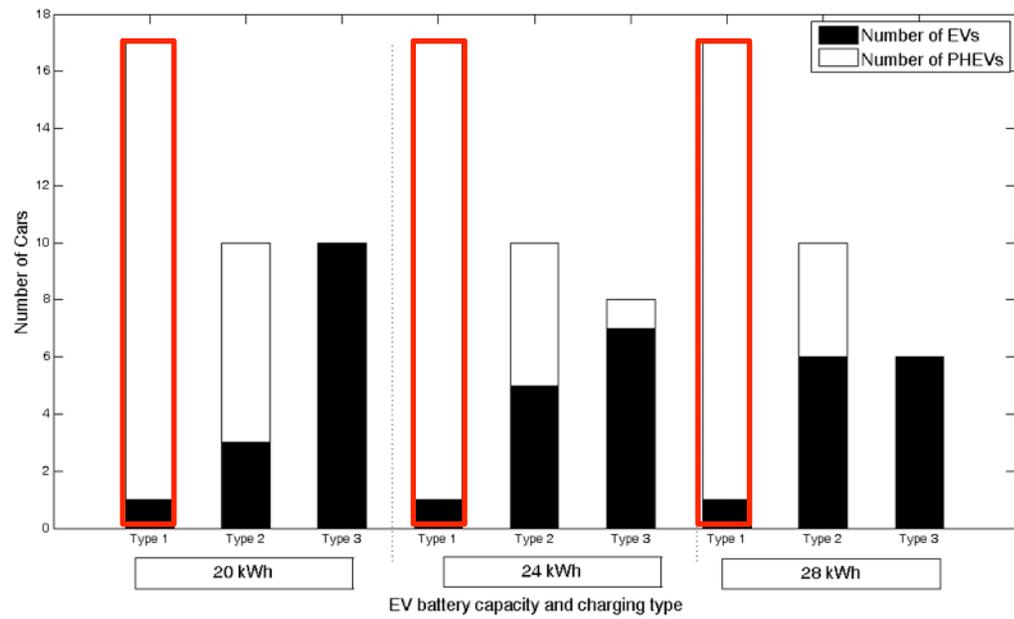


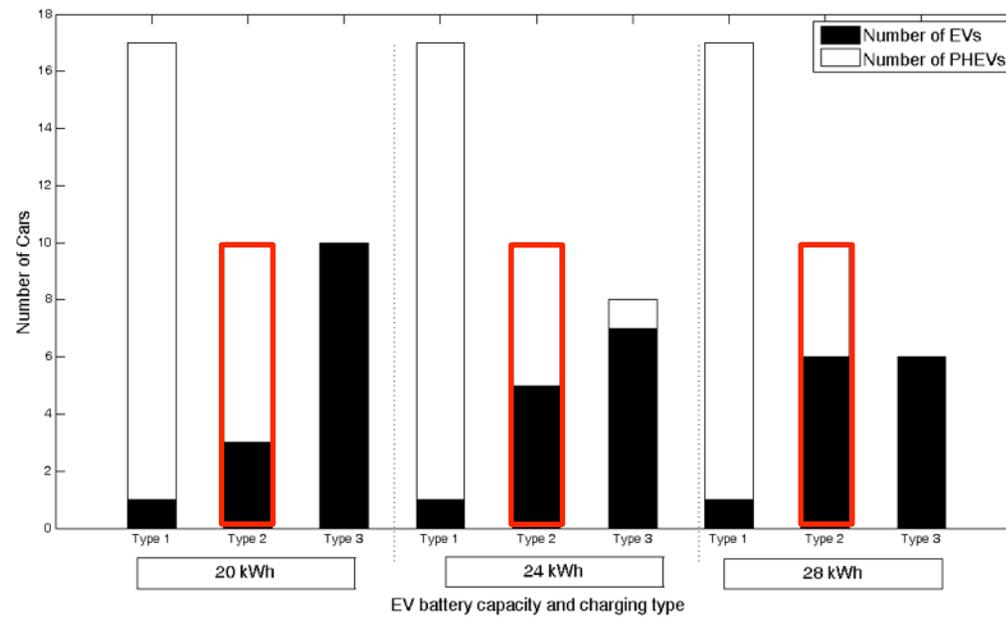
Case Study

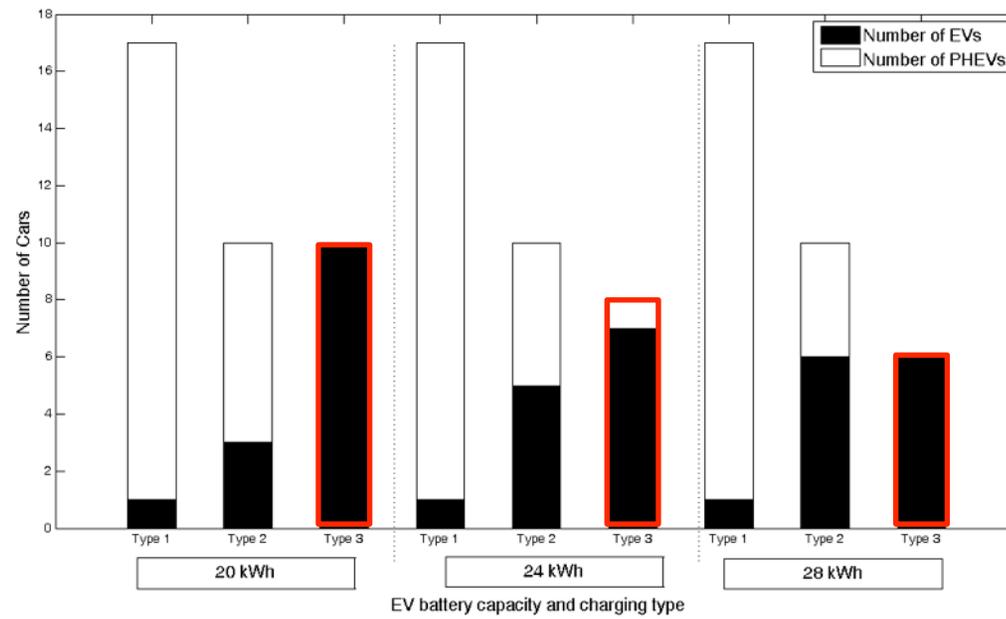


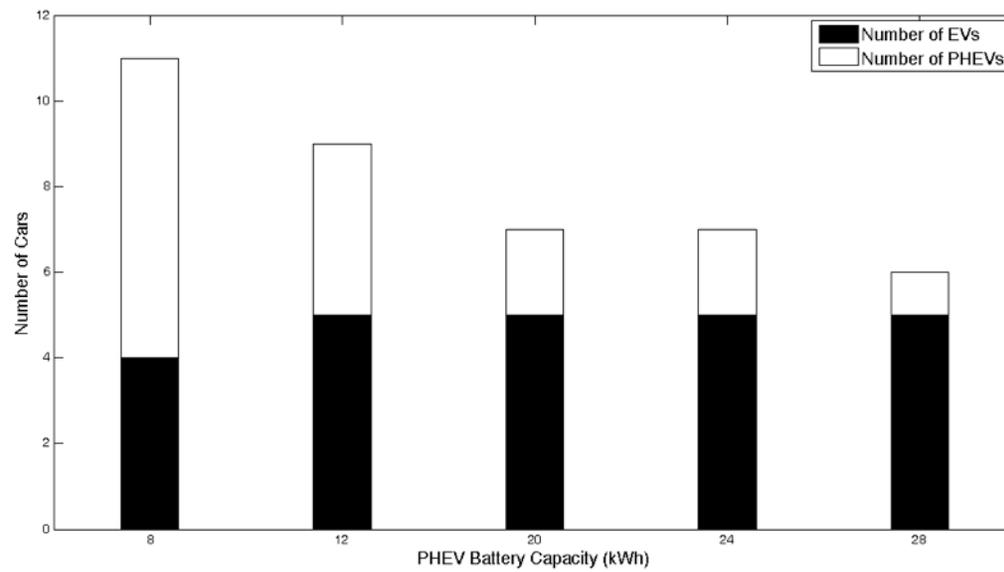


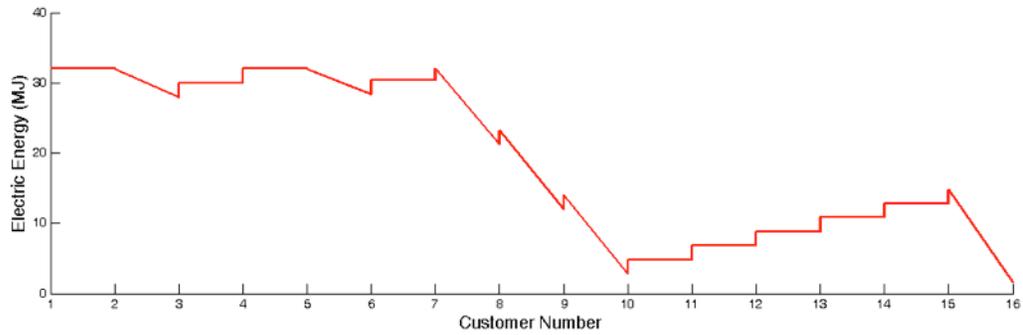




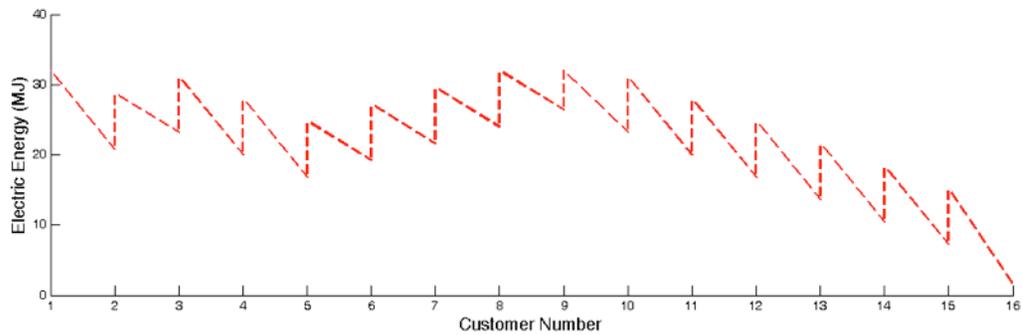








Type II Chargers



Type III Chargers

Key Findings

- Type I chargers do not influence the fleet composition
- PHEVs are better when distances are long
- EVs are better when distances are short
- Charger availability increases the number of EVs

Thank You

Questions?



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