

## Problem Formulation

$i$ : Index for each 15 min chunk of a day. There are 96 chunks of 15 min in a day. So,  $i$  goes from 0 to 95.

$t_i$ : Time interval for a given chunk of the day, which is 15 min = 1/4 hr.

$j$ : Car index.

$P_{i,j}$ : Power used from any charger at a given 15 min chunk (kW).

$Trf_i$ : Customer's electricity tariff at a given 15 min chunk (\$/kWh).

$BL_i$ : Building load at a given 15 min chunk (kW).

$Eff_j$ : Efficiency of the AC/DC converter in each car.

$B_j$ : Battery capacity of each car (kWh).

$E_j$ : Energy required for a given car (kWh).

$DC$ : Demand cost for the maximum power used during the day, which is given as 16 \$/kW.

$$\text{minimize} \left( \text{Bill} = \sum_{i=0}^{95} \sum_{j=0}^3 (P_{i,j} + BL_i) \cdot Trf_i \cdot t_i + \max \left( \sum_{j=0}^3 P_{i,j} + BL_i \right) \cdot DC \right) \quad (1)$$

S.T.

$$0 < P_{i,j} < 7 \quad (2)$$

$$Trf_i = \begin{cases} 0.4 & \text{if } 9AM < t_i < 4PM \\ 0.1 & \text{otherwise} \end{cases} \quad (3)$$

$$Eff_{i,j} = \begin{cases} 0.7 & \text{if } P_i \leq 5 \\ 0.9 & \text{if } P_i > 5 \end{cases} \quad (4)$$

$$E_j = \sum_{i=0}^{55} P_{i,j} \cdot Eff_{i,j} = U(15, 35)_j - 5 \quad (5)$$

$$E_j < B_j = 40 \quad (6)$$

$$P_{i,j} = \begin{cases} 0 & \text{if } 12AM < t_i < 10AM \\ [0, 7] & \text{otherwise} \end{cases} \quad (7)$$