Problem Formulation

Sets

I= {i | i is an integer, and 0 $\leq$ i $\leq$ 96 }. Set of time chunks in a given day

J: {j | j is an integer, and 0 $\leq$ j $\leq$ 3 }. Set of cars/chargers.

Parameters

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

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.

Variables

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

Objective

$$min(Bill) = \left(\sum_{i=0}^{95} \sum_{j=0}^{3} (P_{i,j} + BL_i).Trf_i.t_i + max(\sum_{j=0}^{3} P_{i,j} + BL_i).DC \right) \tag{1}$$

Constraints

$$Trf_i = \begin{cases} 0.4 & if \quad 9AM < t_i < 4PM \\ 0.1 & otherwise \end{cases} \tag{2}$$

$$Eff_{i,j} = \begin{cases} 0.7 & if \quad P_i \leq 5 \\ 0.9 & if \quad P_i > 5 \end{cases} \tag{3}$$

$$E_j = \sum_{i=0}^{55} P_{i,j}.Eff_{i,j} = U(15,35)_j - 5 \tag{4}$$

$$E_j < B_j = 40 \tag{5}$$

Boundaries

$$P_{i,j} = \begin{cases} 0 & if \quad 12AM < t_i < 10AM \\ [0,7] & otherwise \end{cases} \tag{6}$$