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 demand of each car (kWh).

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

Variables

$P_{i,j}$: Load on a charger at a given 15 min chunk (kW).

Objective

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

Constraints

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

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

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

$$U(15,35)_j+5<B_j=40 \tag{5}$$

Boundaries

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