```
%winterPV(HBC)
nEV=input('Enter the No of Vehicles: ');
Array_BEV_40PHEV_30PHEV = zeros(1,nEV); % elements 1=>BHEVs 2=>BEVs

%........ BEV=>50%=>'1'____PHEV-40=>30%=>'2'____PHEV-30=>20%=>'3'[HBC]
    for i=1:nEV
       if i<=round(nEV*50/100)
           Array_BEV_40PHEV_30PHEV(i)=1;
       elseif i>round(nEV*50/100) && i<=round(nEV*80/100)
           Array_BEV_40PHEV_30PHEV(i)=2;
       elseif i>round(nEV*80/100) && i<=nEV
           Array_BEV_40PHEV_30PHEV(i)=3;
       end
    end


type=Array_BEV_40PHEV_30PHEV(randperm(length(Array_BEV_40PHEV_30PHEV)));
%Shuffle-> To indicate each element of Array

DM = normrnd(32,6,[1,nEV]);  % Daily Mileage following Normal Distribution
                             % Mean=55, S.D.=10, No of Random Variables
supposed to be generated=10
FTD = normrnd(11,3.41,[1,nEV]);  % 1st Trip Distance following Normal
Distribution

Tin = normrnd(11,1.2,[1,nEV]);  % Arrival Time following Normal Distribution
Tout = normrnd(17,1.2,[1,nEV]); % Departure Time following Normal
Distribution

while max(Tout)>24    % Tout shouldn't go beyond 24hrs
    Tout = normrnd(22,1.2,[1,nEV]);  %if goes, again generates Random
Variable
end

rate_USEP_MWh1 = [73.059       67.79325       61.803  57.9075 55.58175
55.11975       55.17225       54.83625       52.5945 52.542  55.10925
55.13025       55.5345 59.3985 67.69875       48.7445 53.13   70.273
73.3005 59.4335 57.526  53.116  51.2365 48.6045 45.122  48.7515 48.776
48.4575 53.33475       44.78775       70.1085 74.97525       74.97525
76.44525       79.6425 190.548 210.624 250.008 367.764 367.776 367.716 367.8
```

```
283.644 221.772 181.98  171.264 167.388 167.28
];
rate_USEP_MWh = zeros(nEV,48);
for i=1:nEV
    for j=1:48
         rate_USEP_MWh(i,j)=rate_USEP_MWh1(j);
    end
end

rate_USEP_kWh = rate_USEP_MWh/1000;
%type1 = rate_USEP_kWh(randperm(length(rate_USEP_kWh)));

for i=1:nEV
    % <--------------1st Objective: To Find ENERGY REQ.(of all individual
BHEVs & BEVs)---------------------->
    if type(i)==1  %BEV
        AER=117;
        Bc=24;
    elseif type(i)==2  %PHEV-40
        AER=40*1.6;
        Bc=18.4;
    elseif type(i)==3   %PHEV-30
        AER=30*1.6;
        Bc=13.8;
    end

    STD(i)=DM(i)-FTD(i);
    SOCa(i)=1-FTD(i)/AER;
    SOCd(i)= STD(i)/AER+0.2;
    if SOCd(i)>1
        SOCreq(i)=1-SOCa(i);
    elseif SOCa(i)<SOCd(i) && SOCd(i)<1
        SOCreq(i)=SOCd(i)-SOCa(i);
    elseif SOCd(i)==SOCa(i)
        SOCreq(i)=0;
    elseif SOCd(i)>0.2 && SOCd(i)<SOCa(i)
        SOCreq(i)=-(SOCa(i)-SOCd(i));
    end
    Ereq(i)=SOCreq(i)*Bc/0.9;    % Energy req while Charging----------------
--------
```

```
    % we can use 'disp(Ereq(i));' as well to print values

% <------------2nd Objective: To find TOTAL NO OF SLOTS.----------------->

    if Tin(i)>round(Tin(i))
        Nin(i)=floor(Tin(i))*2+1;
    elseif Tin(i)<round(Tin(i))
        Nin(i)=floor(Tin(i))*2+2;
    end

    if Tout(i)>round(Tout(i))
        Nout(i)=floor(Tout(i))*2+1;
    elseif Tout(i)<round(Tout(i))
        Nout(i)=floor(Tout(i))*2+2;
    end

    Nslot(i)=Nout(i)-Nin(i)+1;  % No of Slots----------------------->


end

cost = zeros(nEV,48);
for i=1:nEV
    fprintf('\n\n\n _____________________Vehicle-%d_____________________\n',i);
    if Ereq(i)<0
        Ereq(i)=Ereq(i)*0.9*0.9; % Energy req while Discharging-------------
-----------
    end
    fprintf('Energy Req for Vehicle-%d = %.7f\n',i,Ereq(i));%Print Ereq
Values as Output
    fprintf('Entering Slot of V-%d = %d\n\n',i,Nin(i));
    fprintf('Outgoing Slot of V-%d = %d\n\n',i,Nout(i));
    fprintf('No of Slots for Vehicle-%d = %d\n\n',i,Nslot(i));

    % <------------3rd Objective: Last Slot Adjustment.----------------->
    m=Ereq(i); %---store the value of Energy req in variale 'm'
    condition=true;
     array = zeros(1, Nslot(i));  %.................. to indicate amount of
charging/discharging
```

```
charging/discharging
     arrayCHorDIS = zeros(1, Nslot(i));  %..... to indicate whether
charging(1)/discharging(-1)/idle(0)

    while condition
        total_power = 0; % Initially charged power

    % Loop upto (n-1) slots
        j=0;
        for slot = Nin(i):Nout(i)-1
            j=j+1;
            action = randi([1, 3]);   % 1: charge, 2: discharge, 3: idle

         switch action
            case 1    %---------Charging
                c1=3;  %-------Charging range: 3 to 8kW
                c2=8;
                charge_power = c1+(c2-c1)*rand;  %---------- random
generation
                total_power = total_power + charge_power;
                cost(i,slot)= charge_power;
                array(j)= charge_power;
                arrayCHorDIS(j)=1;   %........charging(1)
                %fprintf('Slot-%d -----> Charging: %f kW.  Total Charged
Power: %.2f kW\n', slot, charge_power, total_power);

            case 2    %.........Discharging
                d1=0;  %-------Discharging range: 0 to 2kW
                d2=2;
                discharge_power = d1+(d2-d1)*rand;  %---------- random
generation
                total_power = total_power - discharge_power;
                cost(i,slot)= -discharge_power;
                array(j)= -discharge_power;
                arrayCHorDIS(j)=-1;   %........Discharging(-1)
                %fprintf('Slot %d -----> Discharging %f kW.  Total Charged
Power: %.2f kW\n', slot, discharge_power, total_power);

             case 3    % Idle
                 array(j)= 0;
```

```
                arrayCHorDIS(j)=0;
               %fprintf('Slot %d -----> Idle.  Total Power: %.2f kW\n',
slot, total_power);
        end
       end       % End operation of (n-1)th slot

 % nth(last slot) calculation & Range
checking_____________________________________________

    if total_power > m    % DISCHARGING NEEDED
        final_discharged_power = total_power-m;
        if (final_discharged_power>2)
            %fprintf('\n.....NEW SCHEDULE.....\n');
        elseif (final_discharged_power>=1 && final_discharged_power<=2)
             k=0;
             tp=0;
            for slot=Nin(i):Nout(i)-1
                k=k+1;
                if  arrayCHorDIS(k)==1
                     fprintf('Slot-%d -----> Charging: %f kW.  Total Charged
Power: %.2f kW\n', slot, array(k), tp+array(k));
                     tp=tp+array(k);
                elseif arrayCHorDIS(k)==-1
                    fprintf('Slot %d -----> Discharging %f kW.  Total
Charged Power: %.2f kW\n', slot, array(k), tp+array(k));
                    tp=tp+array(k);
                elseif arrayCHorDIS(k)==0
                    fprintf('Slot %d -----> Idle.  Total Power: %.2f kW\n',
slot, tp);
                end
            end
            fprintf('Slot %d(last slot) ----->Need of Discharging,
Discharged Power = %f',Nout(i),final_discharged_power);
            fprintf('\n   So, finally Total Energy Charged = %f kWh\n\n',
(total_power-final_discharged_power));
            cost(i,Nout(i))= -final_discharged_power;
            condition = false;
        end

    elseif total_power<m  % CHARGING NEEDED
```

```
        final_charged_power = m-total_power;
        if (final_discharged_power>8 && final_discharged_power<3)
        %fprintf('\n.....NEW SCHEDULE.....\n');
        elseif (final_charged_power>=3 && final_charged_power<=8)
 % for printing 1st to n-1 slot detals..............
             k=0;
             tp=0;
            for slot=Nin(i):Nout(i)-1
                k=k+1;
                if  arrayCHorDIS(k)==1
                     fprintf('Slot-%d -----> Charging: %f kWh.  Total
Charged Energy: %.2f kWh\n', slot, array(k), tp+array(k));
                     tp=tp+array(k);
                elseif arrayCHorDIS(k)==-1
                    fprintf('Slot %d -----> Discharging %f kWh.  Total
Charged Energy: %.2f kWh\n', slot, array(k), tp+array(k));
                    tp=tp+array(k);
                elseif arrayCHorDIS(k)==0
                    fprintf('Slot %d -----> Idle.  Total Energy: %.2f
kWh\n', slot, tp);
                end
            end

% for printing last slot details..................
            fprintf('Slot %d(last slot) ----->Need of Charging, Charged
Energy = %f kWh',Nout(i),final_charged_power);
            fprintf('\n   So, finally Total Energy charged = %f kWh\n\n',
(total_power+final_charged_power));
            cost(i,Nout(i))= final_charged_power;
            condition = false;
        end
    end
end



end

cost=cost.*rate_USEP_kWh;
disp(cost);
```

```
for i=1:nEV
    sum=0;
    for j=1:48
        sum=sum+cost(i,j);
    end
    fprintf('\n\n Total Cost for Vehicle-%d = %f',i,sum);
end
```