## Implementation - Conversion and EPOS

In order to optimize global energy consumption by using EPOS engine, the conversion of the alternative plans into EPOS standard readable format becomes necessary.

As mentioned in the report above, the input data of each household should be several 1440 long vectors, where each vector represents the minute wise energy consumption of the alternative plan.

And also, EPOS can select plans based on the relative significance, which can be reflected by a weight scalar. Here, we set weight = 1.0 for every plans, assuming that every household have same preference on their plans.

Therefore, the final input data (.plan file) should be formatted as:

XXXX-XX-XX.plan (Usually can be a representative date)

1.0: 0, 0, 0, 9.6, …… (weight=1.0, followed by 1440 numbers, separated by comma, in kW/h)

1.0: 0, 9.6, 9.6, 0, ……

Etc.

The detailed steps are follows:

1. Construct EV pools and generate SOC profile

In order to better explain the effect of EV numbers and alternative plans patterns (schemes), other irrelevant variables, such as regions, day of travel, should be controlled.

In a single experiment, only households in the same state, such as Texas, are considered, based on assumption that the households in the same state are able to build up an EV neighborhood and share the same electricity price. Further, being aware that households usually have different driving patterns between weekdays and weekends, we only use the driving profile collected on weekdays.

Therefore, the implementation should be :

load TexasTable % loading data of Texas from NHTS

load CarModel

row= (table.TRAVDAY<=5); % only consider weekdays

subtable=table(row,:);

HHpool = unique(subtable(:,{'HOUSEID'})); % construct household pools

1. Detection and Exclusion of non-valid EVs

Some EV may have NaN’s as their SOC file (because of the negative values when generating SOC profile, see section 5.2). Also, some EV may be totally inactive during the day, which means SOC always remains 100% and has no interaction with the grid. These two kinds of EVs should both be excluded in our experiment.

count =1;

while count<=EV\_number

SOCori=FUNC\_SOC(subtable,HHpool.HOUSEID(i),model(car\_index,:));

if isnan(SOCori(1,1))==0 && range(SOCori)~=0

………%(codes for generating .plan file)

count = count+1;

end

1. Obtain alternative plans

if count<=plannedEV\_number

altMatrix=FUN\_SOCalter(SOCori,FUNC\_location(table,HHpool.HOUSEID(i)),model(car\_index,:),pattern);

else

altMatrix=SOCori;

end

1. Generate EPOS readable “.plan” file

The .plans

for j=1:length(altMatrix(:,1))

fileID = fopen(filename,'a');

fprintf(fileID,'1.0:');

fclose(fileID);

dlmwrite(filename,FUNC\_electricity(altMatrix(j,:),model(car\_index,:)),'-append','delimiter',',')

end

1. Generate auxiliary file, such as price signal

The price signal is a text file with 1440 lines, one price scalar on each line. Here we use the electricity price of EL PASO Electric Company in Texas.[[1]](#endnote-1)

On Peak: 0.15831 USD/kWh

Off Peak: 0.06743 USD/kWh

Where the on peak hours are define as 12:00-20:00

1. Run experiments on EPOS

The experiments are designed by controlling several parameters, which looks as the example below.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Experiment reference name | Number of Total EV | Number of flexible households | Scheme for Alternative plans | Car | State | Optimization goal | |
| 151130\_1k\_1k\_0135 | 1000 | 1000 | [0,1,3,5] | Tesla | Texas | robustness | cost minimization |

Number of Total households: The total number of EV, reflects the scale of a certain EV neighborhood.

Number of flexible households: The number of households who are willing to alter their EV charging profile and have alternative plans, reflects the collaboration and flexibility of the EV neighborhood.

Scheme for Alternative plans: The combination of alternative plans. For example, [0, 1, 3, 5] means each flexible household will have 4 alternative plans in total, one is original SOC (charge as arriving home), the rest are respectively generated by charging plan 1, 3 and 5.

Car model: battering statistics that we use in the experiment, based on the car model.

State: the location of households according to NHTS data set.

Optimization goal: the goal function. “Robustness” means to minimize the standard deviation. And the “cost minimization” means to minimize total cost based on the on/off peak price signal.

1. Schedule NO.1, residential service rate [↑](#endnote-ref-1)