# 7 Summary and outlook

In the current era of fast development in electrical vehicles application, the simultaneous charging demand of electric vehicles becomes a new challenge for conventional grid to guarantee its stability and capacity.

Therefore, to tackle this raising challenge by using demand response, a model of smart micro grid of EV’s is built in this paper. The microgrid model, which represent a certain socially cooperated community with only electric vehicles, collects local power consumption information and determines when each of its member EVs should be charged.

To construct the model, we first simulate the original energy consumption of households based on the driving profile of NHDS database. The flexibility of households are introduced by generating different charging plans with/without randomness. Then we optimize the total energy consumption of the EV grid in EPOS using robustness and cost as goal respectively.

Finally, the following key conclusion can be drawn from the experiment.

(1) In smart microgrid, alternative plans with randomness can reach a more stable total electricity consumption and alleviate conventional power grid along the whole day, by shifting non-urgent demand into non-busy hours. And the random charging plans with different charging steps, will have similar improvement on the robustness of the grid.

(2) Increase of the flexible household percentage can improve the robustness of smart microgrid, by near-linearly decreasing the standard deviation of total energy consumption. Therefore, every marginal individual who joins the micro grid, can have a similar contribution to the grid robustness.

(3) when a fixed peak/off-peak price signal is given, the higher the flexible household percentage in smart microgrid, the lower the total energy cost. Therefere, by implementing smart microgrid, economic benefit can be achieved. However, cost minimization may sacrifice the grid robustness, especially a highly flexible smartgrid may not alleviate but shift the peak load into the cheap hours.

The result above can be seen highly promising. And the following work are expected in the future.

(1) The Infrastructure deployment in real life

Seeing the advantage of smart microgrid on improving the grid robustness and economic performance, also the advantages of privacy and speed during optimization process, we are looking forward to implementing the model into real community.

(2) Optimization of combined objective in cost and robustness

It is preferred to both consider cost saving and grid robustness in one optimization process, so that the economic and operating benefit of smart micro grid can be simultaneously achieved. This requires a sophisticated and well-designed objective function, which guarantee the optimization can be completed with both feasibility and low-calculating cost.