The the average power consumptions with different schemes are illustrated in Figure 1. For the original power consumption where no alternative plans are included, there is a significant peak between *ca.* 16h00 to *ca.* 22h00 with a power load higher than 300KW and the top reaches 662KW while a valley where the power consumption is negligible occurs between *ca.* 1h00 to *ca.* 8h00. Such a drastic fluctuation has adverse effects on the robustness of the power gird. At the same time, when off/peak electricity pricing is applied, the power price during peak hours which is usually between 12h00 to 20h00 would be higher while it is showed in the simulation result that the peak of consuming electricity to charge EVs is exactly located in the peak price range. As a result, the cost for the customers would also increase. Therefore, there are two goals for our optimization of the charging behaviors, *i.e.,* increasing the robustness of the grid and minimizing the cost of the customers. The optimization is only needed for the peak and valley hours because power consumption is showed to be very stable during day time. Moreover, the trips in day time are less predictable so people would tend to charge as soon as it is available for charging. Therefore, we also expect that our alternative plans would not have much effect on the charging behavior in day time.



Figure 1 Power consumption using different schemes with alternative plan 1, 2, 4

We first evaluated the optimization of robustness using ‘MIN-DAVIATIONS’ as the selection function. As is shown in Figure 1, schemes that provide the agents with alternative plans can significantly restrain the violent fluctuation of power load. Particularly with scheme 1, the peak load during 16:00 to 22:00 is perfectly shaved and these part of power consumption is redistributed to fill the power valley during 1:00 to 8:00. Throughout the day, the power consumption with scheme 1 is fluctuated mildly within the range of 100KW to 300KW. With scheme 2 and 3 respectively, there is still a peak starting around *ca.* 16:00, though the amplitude and duration have decreased. The cause of the peak can be explained as that EVs with alternative plan 2 and 4 will start charging the batteries to a certain amount of capacity immediately when arrive home. As is expected, all of the three schemes have very similar curve during day time showing our alternative plans has litter effect at this time period.

From the result of first experiment, we have verified that our alternative plans are effective to redistribute the energy consumption with little effect on people’s driving behavior during day time. But the alternative plan 2 and 4 should be modified to further shave the peak by introducing randomness to the starting point of charging.