1 The source for the values in Table 1.

- B_i, 25KWh: according to [1], the average battery pack size across electric light-duty vehicles sold (including battery electric vehicles and plug-in hybrid electric vehicles) continues an upwards trend; it is now 44 kWh, up from 37 kWh in 2018. Combining with other kinds of storage, we choose to set the capacity to 25 KWh.
- $a_{\max}$: In China, it takes 8-10 hours to fully charge if a slow charging station is installed. Therefore, the speed of the slow charging station is used here. At the same time, it is also because the distribution of slow charging station is the widely adopted in the world.
- μ, σ: According to the law of large numbers, we assume that the distribution of electric vehicles when they arrive at the charging station satisfies the Gaussian distribution. At the same time, because most electric vehicle owners have range anxiety. Therefore, we set the variance to be 1.2.
- T: We examine the effects of blowdown control over the day.
- γ: Typical battery cycles are 500 cycles. The price of a lithium battery is about 900 Yuan per kWh. When we use the maximum charge and discharge speed to charge and discharge for 10,000 hours, the battery needs to be retrieved. At this time, the loss corresponding to the maximum charge and discharge per hour is 0.09 RMB which means $\gamma = 0.015$. However, in practice, fast charging causes more losses, while slow charging basically brings no losses. Hence, we set γ to be 1.

2 Proof of Lemma 1

For any two admissible control action $a_{i,1}(t)$ and $a_{i,2}(t)$, the linear combination can be constructed

$$a_{i,3}(t) = \epsilon a_{i,1}(t) + (1-\epsilon)a_{i,2}(t),\ 0 \le \epsilon \le 1 \tag{1}$$

Then the SoC will be as follows:

$$S_{i,3}(t) = \epsilon S_{i,1}(t) + (1-\epsilon)S_{i,2}(t) \tag{2}$$

So $a_{i,3}(t)$ is also a admissible control and $\mathcal{A}_i$ is a convex set.

References

[1] "Global ev outlook 2020." `https://www.iea.org/reports/global-ev-outlook-2020`. Accessed April 4, 2022.

Table 1: Parameter Table

parameter	value	parameter	value	parameter	value
B_i	25KWh	μ_s,σ_s	12.5, 1.2	T	24
$a_{\min}$	-2.5KW	λ	0	γ_i	1
$a_{\max}$	2.5KW	S_{tgt}	25KWh	N	10^3