## The Use and Data Utilization of Electric Vehicle Charging Stations

In recent years the use and data utilization of electric vehicle charging stations have become a key focus of national infrastructure construction, as new energy charging stations have been incorporated into new infrastructure. According to relevant statistical data, the increment of charging infrastructure in China in 2019 was 411000 units, an increase of 18.1% year-on-year. The ratio of new energy vehicles to charging piles reached 2.9:1. As of December 2019, the number of charging stations in China has reached 1.219 million, which is still far below the 1:1 planned in the Development Guidelines for Electric Vehicle Charging Infrastructure (2015-2020). In 2019, the construction of charging stations in China accelerated, but the total amount is still insufficient and needs to be vigorously developed. From the perspective of regional distribution, Guangdong, Jiangsu, Beijing, and Shanghai have a relatively high number of charging stations, all exceeding 50000 units, followed by Shandong, Zhejiang, Anhui and other regions. The proportion of public charging stations constructed in the top 10 regions in China reached 73.9%. The construction of public charging stations is relatively concentrated, and the number of ownership in first big cities is relatively high.

Material 1: From an operational perspective, the construction cost of DC fast charging piles is relatively high (about 30-80 times that of AC slow charging piles), and expanding the scale brings huge financial pressure to the construction party. From the perspective of energy supply, the national charging volume in 2019 was about 7.1 billion kWh, accounting for only 0.12% of the total electricity consumption in the country, with relatively small impact on the power grid. It is expected that by 2030, the annual charging capacity of new energy vehicles will reach 97.5 billion kWh, accounting for 1.3% of the national electricity consumption. Fast charging piles are mainly concentrated during the day, and the huge charging power will bring significant load fluctuations to the power grid. From the user's perspective, the priority for using fast charging is mainly due to insufficient charging infrastructure. With the popularization of charging stations, it is more convenient to park and charge immediately, which is more in line with the driving habits of most people.

Material 2: Post service market based on charging data. The traditional operating income of charging stations is mainly based on charging service fees, with a single source of income and limited growth potential. Charging stations can obtain a large amount of data while charging, providing value-added services and creating new profit channels for related enterprises, such as battery information of new energy vehicles, user usage habits, vehicle distribution, and other data. Through data mining technology, they can provide services such as used car evaluation, user profiling, and business district planning.

**Requirements**

Question 1: Combine Material 1 and collect relevant data to construct a mathematical model from the perspective of rational utilization of electricity to provide a reasonable quantity ratio of fast and slow charging stations, so that they can meet the needs of a living community of about 3000 households.

Question 2: Construct a mathematical model for a commercial center in a certain city based on Material 2, and evaluate the profit prospects of the commercial center through the setting and use of charging piles.