Team Control Number

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Problem Chosen

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2018

MCM/ICM Summary Sheet

Construct all-electric network

The transformation from gas vehicles to electric vehicles becomes a hot topic all over the world. In order to get the schedule of the location of charging stations and predict the process of transformation tendency, we establish several models to solve the questions.

For question 1, we firstly establish a model based on queuing theory. Furthermore, we construct a multi-objective programming model based on information of the current Tesla charging network in the US. With the help of Matlab, we find that Tesla is on track to allow a complete switch to all-electric in the US. We obtain that the number of charging stations needed is about 1.7million when all gas vehicles transform to electric vehicles, and the distribution proportions of charging stations in urban, suburban and rural areas are 67:23:10.

For question 2, we establish the site selection models of charging station for urban, suburban and rural areas of South Korea, separately. Combining with the programming model which we established in problem 1, we obtain the number, location and distribution of charging stations in Korea. We get the key factors that affect our plan are the building cost of chargers and the government investment. By considering six indexes, we establish a logistic model. Using this model, we firstly give the timeline of the full evolution to electric vehicles. We find that the key factor for this situation is policy orientation. Then we further predict the number of the electric vehicles of urban and rural areas in South Korea separately. Through the logistic model, we obtain that South Korea should give preference to build charging station in cities. Similarly, we find that the two key factors which influent our model most are wealth distribution and government investment. Additionally, we introduce a concept called lag index to measure the relationship between the car and the charging station.

For question 3, we establish a classification system through Q-type clustering model. According to different national conditions, we divide the countries into three categories. Through some analysis of the Q-type clustering model, we find out that the key factors that trigger the selection of different approaches to growing the network are policy orientation, wealth distribution and government investment. According to these factors, a targeted electric network development plan has been proposed.

For question 4, to study the influence of various new technologies, we set several indicators to establish our models, such as GDP and OPH. By analyzing our evaluation model, we find that these technologies impact the growth rate of electric vehicles, which contributes to the growing popularity of electric vehicles. Besides, the population of electric vehicles will be driven by these technologies.

For question 5, we prepare a one-page handout for the leaders identifying the key factors which they should consider as they return to their home country to devel lan to migrate personal transportation towards all-electric cars and set a gas te for different countries.

Key words: site selection model, logistic model, Q-type clustering model, electric network