Hindawi
Journal of Advanced Transportation
Volume 2021, Article ID 6664115, 9 pages
https://doi.org/10.1155/2021/6664115

Research Article

Layout Methods for Integrated Energy Supply Service Stations from the Perspective of Combination Optimization

Zhenjun Zhu,[1] **Chaoxu Sun**,[2] **Yudong He**,[1] **Jiayan Shen**,[3] **and Jingrui Sun**[1]

[1]*College of Automobile and Traffic Engineering, Nanjing Forestry University, Nanjing 210037, China*
[2]*Zhejiang Provincial Petroleum Co., Ltd., Hangzhou 310006, China*
[3]*School of Transportation, Southeast University, Nanjing 211189, China*

Correspondence should be addressed to Jiayan Shen; 230149532@seu.edu.cn

Received 26 October 2020; Revised 1 April 2021; Accepted 29 April 2021; Published 7 May 2021

Academic Editor: Ruimin Li

Integrated energy supply service stations (IES) are a new type of transportation energy infrastructure offering the advantages of comprehensive functions and intensive land use while providing more convenient and efficient energy supply services. Through the analysis of service station characteristics, this study regards the IES as a spatially superimposed combination of various energy supply services, proposes a layout method from the perspective of combination optimization, and establishes a station optimization model for energy supply stations. This method aims to further coordinate and optimize the combination of various energy supply stations to achieve global optimization of the energy supply service system. Finally, this study uses a hypothetical situation for example analysis to verify the validity and rationality of the method. The layout plan proposed in this study has important theoretical and practical significance for how to achieve the optimal layout of an IES.

1. Introduction

China's new energy vehicle industry has developed rapidly in recent years, driven by policies for national clean transportation energy development. Sales of new energy vehicles have steadily grown, with an increase of more than 1 million vehicles for two consecutive years. However, its supporting infrastructure is affected by problems such as land use restrictions, low cost efficiency, and poor experience, which has resulted in relatively lagging development [1, 2]. At present, the geographical distribution of existing domestic gas stations, charging piles, refuelling stations, and other infrastructures is uneven, with too few charging and refuelling stations other than gas stations. This has become a major shortcoming that restricts the development of transportation energy infrastructures [3, 4]. In this context, in order to promote the integrated development of the transportation and energy fields, Zhejiang Provincial Energy Group Company Ltd. took the lead in proposing a new concept of "integrated energy supply service stations" (IES) in the field of public infrastructures. This concept integrates energy supply services such as refuelling, gas filling, charging, and hydrogenation. This project is conducive to saving existing scarce land resources, achieving efficient land development and utilization, meeting the increasingly diversified automotive fuel needs, and providing car owners with more diverse, convenient, and improved "one-stop" energy supply services. In 2019, the government of Zhejiang Province established 300 IES, which are listed as one of the top ten practical matters of people's livelihood. Zhejiang Provincial Energy Group Company Ltd. is responsible for the construction of IES throughout the province. However, many difficulties have been encountered in the implementation process due to factors such as permission notes for locations, land acquisition, and multimarket competition, resulting in slow progress in the construction of IES. China aims to raise its global competitiveness in the transport sector by optimizing the structure of transportation energy and promoting the application of new and clean energy. To ensure smooth implementation and establish a transportation energy service system with optimal layouts and intensive elements during the upcoming golden period of construction, it is of great theoretical and practical significance to study the optimal layout of IES.

As a new mode of transportation energy service field, there is no complete theoretical system for locating IES. However, there is abundant research regarding locating gas stations, charging piles, hydrogen stations, and so forth. Earlier research on the layout of gas stations is from the perspective of locating commercial outlets, where scholars proposed representative P-median and P-central problems. For example, Hakimi studied the location of P network points with the goal of minimizing the sum of the distance between demand network points and the quantity of demand [5, 6] and the maximum distance from any demand point to the nearest network point [7, 8]. On the basis of these two kinds of location problems, some scholars have evolved and expanded in various ways, proposing a variety of location methods such as dynamic location and coverage problems [9, 10]. Scholars mainly elaborated on the locating process, principles, and influential factors at the conceptual level. They also proposed the use of an analytic hierarchy process (AHP), fuzzy comprehensive evaluation method, or Delphi method [11, 12] for the location of refuelling stations. Scholars formalized the location of charging piles as an optimization problem, with the goal of minimizing construction costs and maximizing social benefits. This research is mainly carried out by establishing geospatial, multiobjective, and bilevel programming models [13–15]. With the popularization and application of hydrogen energy technology in recent years, scholars have conducted much research in optimizing the location of hydrogen refuelling stations. Based on the difference between the characteristics of hydrogen refuelling stations and other energy supply stations, some scholars focused on flow capturing location-allocation and endurance location models [16, 17].

Generally, these quantitative methods are relatively objective, considering the location characteristics, and are carried out with the help of certain algorithms. The result depends on whether the selection of algorithms is appropriate or not. However, the service characteristics of IES are somewhat similar but not completely the same as those of the existing stations due to the integration of multiple energy supply types. It is difficult to achieve optimal locations by using traditional methods because existing research is mostly based on a single energy supply type and the corresponding service characteristics. To fill in these knowledge gaps, this study regards the IES as a combination of many different types of energy supply services in space, analyzes the service characteristics of the IES, and proposes layout planning methods for the IES based on split-combination optimization. This is accomplished by establishing an optimized layout model for energy supply stations, combining and spatially optimizing the layout results of various types of energy supply stations, and determining the optimal location scheme of the IES. This approach can achieve a reasonable layout of the energy supply service system and achieve an optimal global solution.

2. Layout Analysis of Integrated Energy Supply Service Station

2.1. Analysis of Service Characteristics. At present, there exists no unified standard for IES as a new mode for transportation energy service facilities in China. Only Zhejiang Province has compiled a local standard (Specifications for the Construction of Integrated Energy Service Stations - DB 33/T 2136-2018), which is used to guide the design and construction of IES. According to the standard, the general layout of the IES can be divided into three categories: energy supply service, nonenergy supply service, and technological facility areas. The energy supply service area can be further subdivided into refuelling, gas filling, charging, and hydrogenation areas on the basis of the type of energy supply. The nonenergy service area can be divided into station, parking, car-washing areas, and auxiliary houses on the basis of building type. Technological facility equipment matching the various energy supply services is provided in the technological facility areas. Facilities and equipment in each area should maintain a reasonable fire separation distance in accordance with standard requirements and maintain a certain safety distance from buildings (structures) outside the station such as railways, overhead power lines, and outdoor substations.

Figure 1 shows that the IES achieves the optimal combination of multiple types of energy supply in space. The refuelling, charging, and hydrogenation energy supply service areas in the IES are relatively independent in the layout. Each energy supply area performs its duties during the operation. After the vehicle enters the IES, it can receive the corresponding service only by going to the designated area based on directional signage. Therefore, from the perspective of service characteristics, the IES can be regarded as a combination of various types of energy supply services. The process for using various energy supply services in the IES is the same as for other existing energy supply stations.

2.2. Location Analysis of IES. The process of locating an IES is affected by factors such as traffic locations and land use restrictions, and its energy supply type is similar to existing gas stations, charging piles, and other energy supply stations. On one hand, it is difficult to acquire lands if new construction is completely adopted. On the other hand, overlap with the service scope of existing energy supply stations may result in multimarket competition, which is not conducive to coordinated development. Therefore, the principles of adapting to local conditions, coordinating multiagent collaboration, and encouraging win-win scenarios should be followed when locating an IES in a region. Gas stations, charging piles, and other infrastructures that are eligible for renovation and expansion can be converted into an IES based on the land supply in the region and the distribution of existing energy supply stations. The energy supply type for the newly built IES should be reasonably configured to avoid overlapping service scopes between stations in order to maximize efficient and intensive utilization of land resources in the region. This study adopts the combination

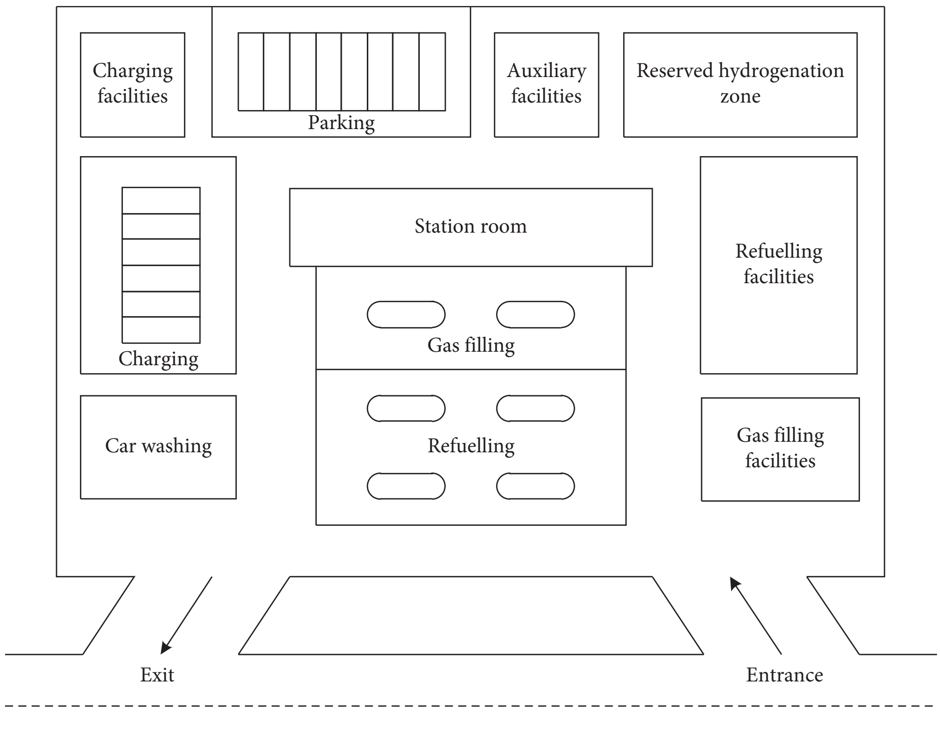

Figure 1: Schematic diagram of the general layout of the IES.

optimization method to locate the IES [18, 19] through the analysis of the service characteristics of stations. First, the IES is divided into various types of energy supply stations to be built for refuelling, gas filling, charging, hydrogenation, and so forth on the basis of the type of energy supply. The location of various alternative energy supply stations is determined based on the available land and various existing energy supply stations. Second, the location optimization model is established to determine the optimal location of various energy supply stations. Third, the layout results of various energy supply stations are combined and spatially optimized, and the locations where multiple types of energy supply stations overlap are rebuilt, expanded, or newly built into an IES with corresponding energy supply types. This methodology aims at coordinating and optimizing various types of energy supply stations in the region. It is possible to build a comprehensive and functionally intensive energy supply service system to achieve global optimization by determining the optimal location of various types of energy supply stations, further optimizing the combination of services, and rationally determining the location and energy supply type of the IES.

3. Methodology

Through service characteristics and location analyses of the IES, this study establishes energy supply station choice models based on driver choice behaviours. Then, location optimization models are established, which consider optimization goals and actual capacity constraints. Finally, the application steps of the optimal location method for the IES are proposed.

3.1. Modeling Station Choices. The drivers' choice behaviours with respect to energy supply service stations can be regarded as an intermediate link in the travel process [20, 21]. That is, the driver determines the travel destination, starts driving, chooses the energy supply service station, receives services, continues to the destination, and completes the trip, as shown in Figure 2.

During this process, the driver will always try to complete the trip with the shortest travel path or time [22–24]. Therefore, when choosing a certain energy supply service station, the driver will consider the type of energy supply service that the station can provide, the distance between stations and origin-destinations, and the time required to receive the service. We improve the travel efficiency of drivers by reducing the time they spend at energy supply service station, so that they can reach their destinations with the shortest travel time. According to the above analysis, the utility functions of choosing an energy supply service station are established as follows:

$$U_{ijk}^{z} = A_{ik} + S_k + D_{kj}, \tag{1}$$

$$A_{ik} = \alpha_1 t_{ik}, \tag{2}$$

$$S_k = \alpha_2 t_k, \tag{3}$$

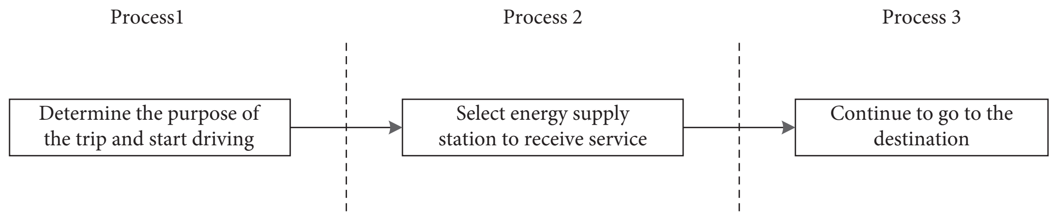

Figure 2: Schematic diagram of choice behaviour.

$$D_{kj} = \alpha_3 t_{kj}, \tag{4}$$

where U_{ijk}^z is the utility function of the vehicle from traffic areas i to j in order to choose service station k to receive the z-type energy supply service. A_{ik} is the utility function for vehicles arriving at service station k from traffic zone i, which can be measured by the travel time of the shortest path. S_k is the utility function for vehicles receiving services at service station k, which can be measured by the time it takes the vehicle to receive services. D_{kj} is the utility function of the vehicle arriving at traffic zone j after receiving services at service station k, which can be measured by the travel time of the shortest path. t_{ik} is the shortest travel time for the vehicle to reach service station k from traffic area i. t_k is the time required for the vehicle to receive services at service station k. t_{kj} is the minimum travel time for the vehicle to reach traffic zone j from service station k. α_1, α_2, and α_3 are the influencing weight coefficients of the utility functions α_1, α_2, and $\alpha_3 > 0$, respectively.

Based on the principle of maximum utility, the service station choice model [25–27] can be derived as

$$\begin{aligned} P_{ijk}^z &= \frac{\exp\left(-\theta U_{ijk}^z\right)}{\sum_{k\in M}\exp\left(-\theta U_{ijk}^z\right)} \\ &= \frac{\exp\left[-\theta\left(\alpha_1 t_{ik} + \alpha_2 t_k + \alpha_3 t_{kj}\right)\right]}{\sum_{k\in M}\exp\left[-\theta\left(\alpha_1 t_{ik} + \alpha_2 t_k + \alpha_3 t_{kj}\right)\right]}, \end{aligned} \tag{5}$$

where P_{ijk}^z is the utility function of the vehicle from traffic areas i to j in order to choose service station k to receive the z-type energy supply service. A is a set of traffic zones. M is a set of z-type energy supply service stations, including existing and alternative stations. θ is the model parameter that can be used to calibrate our utility function.

3.2. Modeling the Optimal Layout. The goal of optimizing the layout of energy service stations is to minimize the total time required for the vehicle to travel and receive energy services, including the processes of arrival at the station, receiving energy services, and departure from the station. The model can be established as follows:

$$\min T^z = \min \sum_{i,j\in A}\sum_{k\in M}\left(V_{ij}^z P_{ijk}^z t_{ik} + V_{ij}^z P_{ijk}^z t_k + V_{ij}^z P_{ijk}^z t_{kj}\right), \tag{6}$$

where T^z is the total time required for vehicles to travel and receive z-type energy supply services. V_{ij}^z is the number of z-type vehicles from traffic zones i to j, which can be determined through the Origin-Destination (OD) survey.

In the actual location analysis process for the IES, the station construction has a maximum capacity limit due to factors such as traffic location and land use restrictions. In addition, station construction has a minimum capacity as there must be enough vehicles arriving to achieve reasonable benefits when stations are put into operation. Therefore, the influence of capacity limitation should also be considered when decomposing the IES into stations of different energy supply types such as refuelling, charging, and hydrogenation. That is, the layout optimization model should meet the following constraints:

$$C_{zk}^{\min} \leq \sum_{i,j\in A} V_{ij} P_{ijk}^z \leq C_{zk}^{\max}, \tag{7}$$

where $C_{zk}^{\min}$ and $C_{zk}^{\max}$ are the minimum and maximum capacities of the k-type energy service station k and they are determined based on the minimum and maximum capacity limits of the IES, respectively. At present, there is a lack of unified standards and specifications in the planning and design of IES in China and the stations built and put into operation are scarce. Therefore, it is recommended that the minimum and maximum capacity limits be investigated and determined based on actual conditions.

The layout optimization model established in this study is a mixed-0-1-integer programming problem. The optimal solution can be obtained through optimization methods such as the branch and bound method and cutting planes approach. However, the possible layout combinations will increase exponentially for large-scale layout problems when the numbers of alternative stations, constraints, or decision variables increase. Therefore, a satisfactory solution can only be sought through a heuristic algorithm [28–30]. Genetic algorithms are employed to solve the proposed model as they can solve a mixed-0-1-integer programming problem with capacity limitation [31–33]. The process is as follows:

Step 1: Coding for Variables. This study adopts the 0-1 coding method, and the number of alternative stations (N) is regarded as the length of chromosomes. 0 indicates that a station is not selected, and 1 indicates that it is selected.

Step 2: Randomly generating the initial population.

Step 3: Constructing the Fitness Function. This study aims to minimize the total weighted time and thus assigns $F(i) = W - T(i)$. $F(i)$ represents the fitness of the i^{th} individual, $W > \max T(i)$ represents the adequately large constant value, and $T(i)$ is the objective function value of the i^{th} individual.

Step 4: Constraint Processing. This study randomly selects two individuals from the group, determines whether the individual is a feasible solution, and, if so, calculates the fitness value. Otherwise, the extent to which the constraint is exceeded is calculated and compared within the rule as follows: (1) When feasible solutions are compared, it is more likely for a high value to enter the next generation. (2) When feasible solutions are compared with infeasible solutions, it is more likely for the former to enter the next generation. (3) When infeasible solutions are compared, it is more likely for the solution with the lower degree of exceeding the constraint to enter the next generation. (4) The solution with highest degree can replace the lowest degree in next generation.

Step 5: Genetic Operation. (1) Selection—rank the fitness from highest to lowest among all individuals, rank infeasible solutions from lowest to highest based on the extent to which it exceeds the constraint, and then select the next generation based on the roulette method. (2) Crossover—set crossover probability and perform a single-point crossover operation to create a new individual. (3) Mutation—according to the mutation probability, randomly select one chromosome and any chromosome position for mutation.

Step 6: Stopping Criteria. This study designs two criteria: (1) Define calculator G, and when min (TG) < min $(TG+1)$, min $(TG+1) = \min$ (TG), and $G = G + 1$, return to the calculation. Otherwise, the algorithm ends. (2) Define the minimum number of iterations X, and when the number of offspring exceeds S, the algorithm ends.

3.3. Process of Layout Optimization. The optimal station selection model is established in this study by taking capacity limits into consideration. The optimal layouts of various energy supply stations in the region are determined by solving the minimum time for vehicles to travel and receive the energy supply services. On this basis, the combined optimization method is used to determine the layout of the IES. The specific proposed steps for determining the optimal layout of the IES are outlined below and shown in Figure 3.

Step 1: split the type of energy supply station. According to factors such as the types of vehicles and new energy development regulations, the proposed IES can be divided into various energy supply stations such as refuelling, gas filling, charging, and hydrogenation.

Step 2: divide traffic zones and collect basic data. Divide traffic zones based on the regional geographic environment, topographic features, administrative divisions, and other factors. Obtain the location of various types of energy supply stations and alternative stations through field surveys. Conduct OD surveys to determine V_{ij}^{z}, t_k, the number of z-type vehicles from traffic zone i to j, and the time required for the vehicle to receive services at service station k.

Step 3: calibrate the model parameters. Determine the following with reference to the actual operation or the planned CES: the shortest travel times (t_{ik}, t_{kj}) based on the road network situation and location of the energy supply station; model parameters such as α_1, α_2, α_3, and θ through the investigation of driver behaviours; and minimum $C_{zk}^{\min}$ and maximum $C_{zk}^{\max}$ capacity of the energy supply service station.

Step 4: apply the model and obtain the station layout results. Input the basic data and parameters into the model to obtain the optimal layout results of various energy supply stations. Subsequently, spatially combine and optimize the layout results and set the overlapping locations of various energy supply stations as the CES to ensure that the station has a corresponding energy supply type.

4. Results and Discussion

This study uses a hypothetical situation for example analysis because the planning and construction of IES in China is still in its infancy and there are limited materials for references. In the study, we made assumptions about the existing energy supply station. Firstly, the scenario considers the integration of existing station functions and, secondly, considers the addition of new station functions. Based on the consideration of different functionally located stations, the six following areas were selected.

In Figure 4, $1^{\#}$, $2^{\#}$, . . ., $6^{\#}$ represent the traffic zones of the study area. There are three types of vehicle energy supply services: refuelling, charging, and hydrogenation. A, C, and E are existing gas stations, and the value of z is 1. D and F are existing charging stations, and the value of z is 2. B is the existing hydrogenation station, and the value of z is 3. B, E, and F have the potential to be improved and expanded into an IES.

The assumed minimum travel times from each traffic zone to each station and the OD data of various vehicles between traffic zones are listed in Tables 1 and 2, respectively.

The model parameters can be obtained from a survey of driver behaviour and intention. The values of each model parameter are shown in Table 3.

It is assumed that the average times of refuelling, gas, charging, and hydrogen refuelling services at each station are 5, 10, 30, and 30 min, respectively. In the process of station selections, factors such as economic benefits and land use restrictions are considered. The assumed capacity limits of each alternative station are shown in Table 4.

Substituting the above-mentioned basic data and parameters into the model established in this study, various types of IES are obtained, as shown in Figure 5.

The optimal layout results of the IES are finally obtained based on combination optimizations in space. Stations B, E, and F will be rebuilt into comprehensive energy supply service stations, with Station B expanding into an IES with

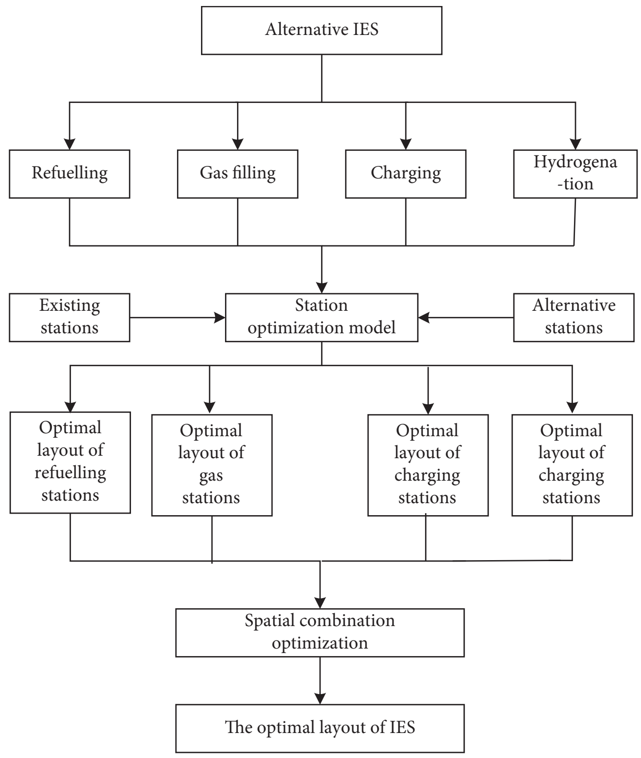

FIGURE 3: Process of determining the optimal layout of the IES.

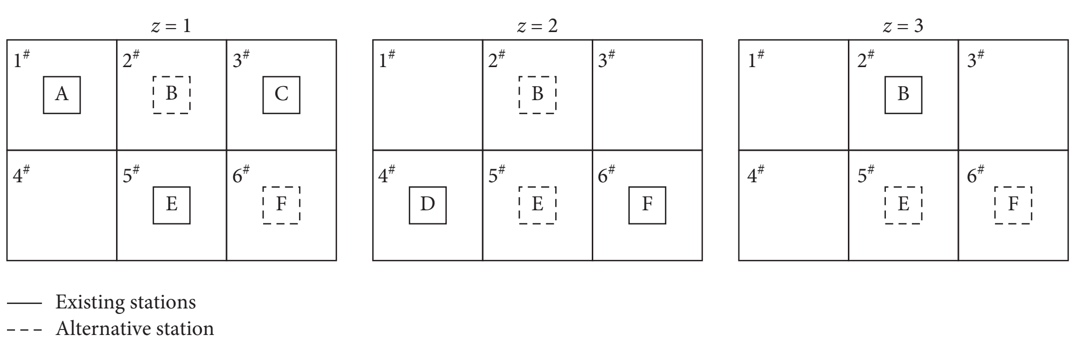

FIGURE 4: Schematic diagrams.

TABLE 1: The shortest driving time between traffic zones and stations.

Traffic zones	A	B	C	D	E	F
1	4	12	12	8	16	8
2	8	8	8	12	12	4
3	12	12	4	16	8	8
4	8	8	16	4	12	12
5	12	4	12	8	8	8
6	16	8	8	12	4	12

refuelling, charging, and hydrogenation functions. Station E is expanded to an IES with refuelling and hydrogenation functions. Station F is expanded to an IES with charging and hydrogen, as shown in Figure 6.

It can be seen from the example in Figure 6 that the genetic algorithm method established in this study produced an optimal layout result of various energy supply stations in the region. Subsequently, the layout of the IES and energy supply type configuration was determined through further combination and optimization. Finally, the global optimal solution of the energy supply service system in the region was obtained. Although the global optimal solution has been

Table 2: OD of vehicles between traffic zones.

Traffic zone	1			2			3			4			5			6		
	$z=1$	$z=2$	$z=3$	$z=1$	$z=2$	$z=3$	$z=1$	$z=2$	$z=3$	$z=1$	$z=2$	$z=3$	$z=1$	$z=2$	$z=3$	$z=1$	$z=2$	$z=3$
1	100	50	20	200	100	10	200	100	10	200	100	10	200	100	10	200	100	10
2	200	100	10	100	50	20	200	100	10	200	100	10	200	100	10	200	100	10
3	200	100	10	200	100	10	100	50	20	200	100	10	200	100	10	200	100	10
4	200	100	10	200	100	10	200	100	10	100	50	20	200	100	10	200	100	10
5	200	100	10	200	100	10	200	100	10	200	100	10	100	50	20	200	100	10
6	200	100	10	200	100	10	200	100	10	200	100	10	200	100	10	100	50	20

Table 3: Model parameters.

Parameter	θ	α_1	α_2	α_3
Value	1	1	0.5	0.5

Table 4: Capacity limits of alternative stations.

Stations	B		E		F	
	$z=1$	$z=2$	$z=2$	$z=3$	$z=1$	$z=3$
Minimum capacity	200	80	80	50	200	50
Maximum capacity	500	200	200	100	500	100

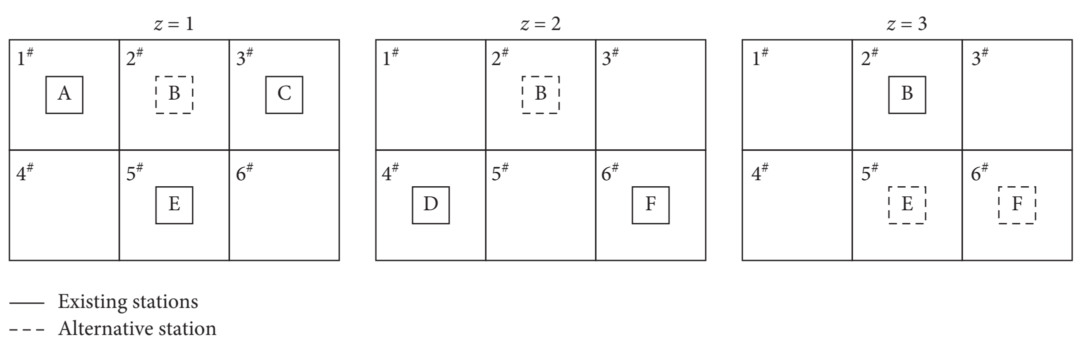

Figure 5: Layout results of supply service stations.

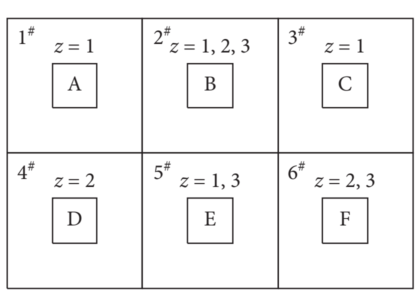

Figure 6: Layout results of IES.

obtained for the station layout, more adjustments are needed in how to apply it in more complex situations.

5. Conclusions

A method was proposed to combine and spatially optimize the layout of IES through the analysis of IES service characteristics. This model was designed to determine the optimal location of various energy supply stations, minimize the time for travelling and receiving services, and simultaneously establish an optimization model for energy supply stations. The method regards the IES as a parallel combination of different energy supply types in space and optimizes energy supply stations to produce an ideal global solution.

With the implementation of China's new transportation strategy, the construction of the IES will usher in a golden period. The proposed methodology in this study has fully considered factors such as the mutual influence between various energy supply stations and the limitation of land use capacity. This solution could provide technical support to optimize the layout of IES construction and contribute to intensive transportation energy service systems.

In this study, from the perspective of retrofitting and expanding energy supply service stations, the scale and layout of IES is somewhat limited compared to the equipment planning scheme of new integrated energy supply service stations, and the influencing factors to be considered in the planning process are more complicated. Although some achievements have been made in Zhejiang Province for IES construction, the scale and number of stations actually built are small, leading to simpler data sources in the study process. Despite the fact that the solution proposed in this study is highly practical, the following challenges should be further studied in the actual application process:

(1) Currently, domestic transportation energy supply services mainly consist of refuelling and charging, but the market for automobile refuelling is gradually shrinking. In addition, hydrogen-powered vehicles have not been popularized in China, and vehicle hydrogenation technology requires further research and development. Therefore, when applying the methodology to optimize the location of the IES, it is necessary to consider the strategic planning for local energy development, reasonably determine the type of energy supply service, and appropriately reserve the new energy service area in qualified stations.

(2) The construction of the IES in China is still in its infancy. The stations actually built and put into operation are scarce and station operation data lacks a reference basis, leading to difficulties in determining the maximum and minimum capacity limitations of stations. Zhejiang Province is leading the planning and construction of domestic IES and has divided stations into four categories based on scale: flagship, standard, basic, and guarantee stations. These classification design standards could be considered when determining the limitation of station capacities for IES.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

Acknowledgments

This work was supported by the Scientific Research Foundation for Advanced Talents of Nanjing Forestry University (no. 163106041), the General Project of Philosophy and Social Science Foundation of the Jiangsu Higher Education Institutions of China (2020SJA0125), and the General Program of Natural Science Foundation of the Jiangsu Higher Education Institutions of China (20KJB580013).

References

[1] F. Kley, C. Lerch, D. Dallinger et al., "New business models for electric cars-a holistic approach," *Energy Policy*, vol. 39, no. 6, pp. 3392–3403, 2011.

[2] S. H. Chung and C. Kwon, "Multi-period planning for electric car charging station locations: a case of Korean Expressways," *European Journal of Operational Research*, vol. 242, no. 2, pp. 677–687, 2015.

[3] I. Rahman, P. M. Vasant, B. S. M. Singh, M. Abdullah-Al-Wadud, and N. Adnan, "Review of recent trends in optimization techniques for plug-in hybrid, and electric vehicle charging infrastructures," *Renewable and Sustainable Energy Reviews*, vol. 58, pp. 1039–1047, 2016.

[4] I. Rahman, P. M. Vasant, B. M. Singh, and M. A. A. Wadud, "Optimisation of PHEV/EV charging infrastructures: a review," *International Journal of Energy Technology and Policy*, vol. 10, no. 3/4, pp. 280–296, 2014.

[5] S. García, M. Labbé, A. Marín et al., "Solving largep-median problems with a radius formulation," *Informs Journal on Computing*, vol. 23, no. 4, pp. 546–556, 2011.

[6] J. M. Hartman and R. K. Kincaid, "*P*-median problems with edge reduction," in *Proceedings of the Systems and Information Engineering Design Symposium*, pp. 159–161, Charlottesville, VA, USA, April 2014.

[7] T. Sim, T. J. Lowe, B. W. Thomas et al., "The stochastic-hub center problem with service-level constraints," *Computers & Operations Research*, vol. 36, no. 12, pp. 3166–3177, 2009.

[8] T. Davidovic, D. Ramljak, M. Selmic et al., "Bee colony optimization for the *P*-center problem," *Computers & Operations Research*, vol. 38, no. 10, pp. 1367–1376, 2011.

[9] P. N. Thanh, N. Bostel, O. Péton et al., "A dynamic model for facility location in the design of complex supply chains," *International Journal of Production Economics*, vol. 113, no. 2, pp. 678–693, 2008.

[10] R. Z. Farahani, N. Asgari, N. Heidari, M. Hosseininia, and M. Goh, "Covering problems in facility location: a review," *Computers & Industrial Engineering*, vol. 62, no. 1, pp. 368–407, 2012.

[11] A. Boostani, R. Ghodsi, A. K. Miab et al., "Optimal location of compressed natural gas (CNG) refueling station using the arc demand coverage model," in *Proceedings of the Asia International Conference on Mathematical/Analytical Modelling and Computer Simulation*, pp. 193–198, Kota Kinabalu, Malaysia, May 2010.

[12] L. Guanmin, "Based on fuzzy analytic hierarchy process of CNG fueling station location research," *Technology and Economy in Areas of Communications*, vol. 13, no. 3, 2011.

[13] A. Namdeo, A. Tiwary, and R. Dziurla, "Spatial planning of public charging points using multi-dimensional analysis of early adopters of electric vehicles for a city region," *Technological Forecasting and Social Change*, vol. 89, pp. 188–200, 2014.

[14] C. H. Dharmakeerthi, N. Mithulananthan, and T. K. Saha, "A comprehensive planning framework for electric vehicle charging infrastructure deployment in the power grid with enhanced voltage stability," *International Transactions on Electrical Energy Systems*, vol. 25, no. 6, pp. 1022–1040, 2015.

[15] W. Jing, K. An, M. Ramezani et al., "Location design of electric vehicle charging facilities: a path-distance constrained stochastic user equilibrium approach," *Journal of Advanced Transportation*, vol. 2017, Article ID 4252946, 15 pages, 2017.

[16] M. Kuby, L. Lines, R. Schultz, Z. Xie, J.-G. Kim, and S. Lim, "Optimization of hydrogen stations in Florida using the flow-refueling location model," *International Journal of Hydrogen Energy*, vol. 34, no. 15, pp. 6045–6064, 2009.

[17] I. Capar and M. Kuby, "An efficient formulation of the flow refueling location model for alternative-fuel stations," *IIE Transactions*, vol. 44, no. 8, pp. 622–636, 2012.

[18] Y. Boykov and V. Kolmogorov, "An experimental comparison of min-cut/max-flow algorithms for energy minimization in vision," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 26, no. 9, pp. 1124–1137, 2004.

[19] C. Blum and A. Roli, "Metaheuristics in combinatorial optimization," *ACM Computing Surveys*, vol. 35, no. 3, pp. 268–308, 2003.

[20] Y. Yue, T. Lan, A. G. O. Yeh, and Q.-Q. Li, "Zooming into individuals to understand the collective: a review of trajectory-based travel behaviour studies," *Travel Behaviour and Society*, vol. 1, no. 2, pp. 69–78, 2014.

[21] S. Kelley and M. Kuby, "On the way or around the corner? observed refueling choices of alternative-fuel drivers in Southern California," *Journal of Transport Geography*, vol. 33, no. 4, pp. 258–267, 2013.

[22] J. ZhaoC. Tian et al., "Understanding temporal and spatial travel patterns of individual passengers by mining smart card data," in *Proceedings of the IEEE International Conference on Intelligent Transportation Systems*, Qingdao, China, October 2014.

[23] L. Yang, L. Hu, Z. Wang et al., "The built environment and trip chaining behaviour revisited: the joint effects of the modifiable areal unit problem and tour purpose," *Urban Studies*, vol. 56, no. 4, pp. 795–817, 2019.

[24] M. T. Islam and K. M. N. Habib, "Unraveling the relationship between trip chaining and mode choice: evidence from a multi-week travel diary," *Transportation Planning and Technology*, vol. 35, no. 4, pp. 409–426, 2012.

[25] F. Heiss, "Discrete choice methods with simulation," *Econometric Reviews*, vol. 35, no. 4, pp. 688–692, 2016.

[26] J. Bragge, P. Korhonen, H. Wallenius, and J. Wallenius, "Bibliometric analysis of multiple criteria decision making/multiattribute utility theory," *Lecture Notes in Economics and Mathematical Systems*, vol. 634, pp. 259–268, 2010.

[27] G. Tychogiorgos and K. K. Leung, "Optimization-based resource allocation in communication networks," *Computer Networks*, vol. 66, pp. 32–45, 2014.

[28] S. Hanafi, J. Lazić, N. Mladenović, C. Wilbaut, and I. Crévits, "Hybrid variable neighbourhood decomposition search for 0-1 mixed integer programming problem," *Electronic Notes in Discrete Mathematics*, vol. 36, pp. 883–890, 2010.

[29] C. Wilbaut and S. Hanafi, "New convergent heuristics for 0-1 mixed integer programming," *European Journal of Operational Research*, vol. 195, no. 1, pp. 62–74, 2009.

[30] M. Fischetti and M. Monaci, "Proximity search for 0-1 mixed-integer convex programming," *Journal of Heuristics*, vol. 20, no. 6, pp. 709–731, 2014.

[31] I. Zelinka, D. Davendra, J. Lampinen et al., "Evolutionary algorithms dynamics and its hidden complex network structures," in *Proceedings of the IEEE Congress on Evolutionary Computation (CEC)*, pp. 3246–3251, Beijing, China, July 2014.

[32] M. A. Mohammed, M. K. Abd Ghani, R. I. Hamed, S. A. Mostafa, M. S. Ahmad, and D. A. Ibrahim, "Solving vehicle routing problem by using improved genetic algorithm for optimal solution," *Journal of Computational Science*, vol. 21, pp. 255–262, 2017.

[33] M. K. Thompson, G. Moroni, T. Vaneker et al., "Design for additive manufacturing: trends, opportunities, considerations, and constraints," *CIRP Annals*, vol. 65, no. 2, pp. 737–760, 2016.