New Energy Vehicle Market Development Prospects and Sales Short-Term Forecast

Junyang Zhou[a]
Reading Academy, Nanjing University of Information Science and Technology, Nanjing, Jiangsu, 210044, China

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Abstract: With the increasing global focus on sustainable energy and reducing greenhouse gas emissions, the new energy vehicle market is developing rapidly. Technological innovation, government policy support, and increased consumer awareness of environmental protection and cost-effectiveness have contributed to the growth of NEV sales. Based on the monthly sales data for 2023 and 2024 provided by the China Association of Automobile Manufacturers, this paper conducts linear regression analysis and seasonal time series analysis to predict the sales trend in the coming months. The study found that the new energy vehicle market shows strong growth potential, although there is a little fluctuation, but it is expected that sales will continue to rise in the short term, the overall increase over last year, the end of the year is predicted to reach nearly two million. However, market participants should pay close attention to industry dynamics and changes in the external environment to adapt to any market volatility that may arise. With technological advances and intensified global efforts to reduce emissions, the new energy vehicle market is expected to achieve significant growth in the coming years.

1 INTRODUCTION

China's new energy vehicle market is rapidly expanding because the country's establishing a 'dual carbon' goal and transformative energy structure (Zeng et al., 2025). Due to the popularity of new energy cars, urban dwellers will enjoy a better living environment, which will somewhat enhance green space and decrease urban noise pollution (Sun, 2024). After several years of development, new energy has made significant breakthroughs in power batteries, drive motors, charging technology, and assisted driving (Lu, 2023). However, the quantity of new energy vehicle brands is increasing, and the competition in the Chinese market is fierce. Therefore, relevant personnel need to have a deep understanding of consumer demand and accurately forecast the market to make effective response measures. Based on a mathematical model, Wu (2024) examines the development trend of new energy electric vehicles in China and concludes that, as a result of the combined influence of numerous factors, the sales volume of new energy vehicles will continue to maintain a positive development trend over the next ten years, and its market share will continue to grow. Zhang, Xiang & Yang (2024) conducted Research on the future development prospects of new-energy electric vehicles based on the trend determination method, which shows that the industry's development is influenced by market dynamics, such as the increase in sales and expanding market share of new-energy vehicles. Zhou, Wang & Zhang (2024) present a study on the development of new energy vehicles and the forecast of power demand using the Random Forest model, the results show that by 2030, it is anticipated that China will see a sharp increase in the number of new energy cars, accounting for 25% of all vehicles. For firms, these researches can quickly modify the research and development direction of new goods and optimize the production plan through short-term prediction to satisfy the market demand and increase the economic efficiency and market competitiveness of enterprises. The government can also formulate corresponding preferential policies and reasonable supporting facilities according to market forecasts to promote the development of new energy vehicles and technological innovation to achieve the purpose of

[a] https://orcid. org/0009-0009-8709-4452

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energy saving, emission reduction, and environmental protection (Xu & Sun, 2024).

Based on this, this paper uses regression analysis and seasonal time series analysis to analyze the monthly sales data of new energy vehicles in 2023 and 2024 collected from China Association of Automobile Manufacturers in combination with market development prospects, and makes a prediction of new energy vehicle sales for the next year and performs a straightforward analysis. It is designed to help consumers choose wisely and producers better prepare for the next year's market.

2 NEW ENERGY VEHICLE MARKET DEVELOPMENT PROSPECTS

The new energy vehicle market is ushering in a new stage of rapid development, and its development prospects are jointly promoted by three major factors: technological progress, government policies, and market competition.

At the technical level, the improvement of battery energy density and endurance of new energy vehicles is a key trend. Future models are expected to have a significantly improved battery life due to the use of new technologies like solid-state batteries, and the battery life of some models is expected to exceed 1, 000 kilometers. The progress of assisted driving technology will also become a highlight of new energy vehicles, Zhang Yongwei said at the China Electric Vehicle 100 Forum media communication conference that the penetration rate of L2 level assisted driving is expected to reach 65%. Consumers are also paying attention to enhancing safety performance and developing fast-charging technology.

The new energy vehicle industry's progress is aided by government support, which involves improving infrastructure, providing car purchase subsidies, and offering industrial planning guidance. Government subsidies can promote enterprises' research and development investment. In the case that the market regulation mechanism has not played a significant role, the government can actively regulate and guide the market through some guiding fiscal policies to improve enterprises' confidence in independent research and development investment (Yan & Chen, 2023). The government has increased the amount of new energy car charging infrastructure being built, charging stations have been supported, and social capital has been encouraged to participate. Since 2010, there has been a policy in place to provide financial subsidies to eligible new energy vehicles. Since 2019, subsidy policies have gradually shifted to technological innovation-oriented financial incentive policies, which will further promote consumer acceptance of new energy vehicles (Tian, Wang & Zhu, 2024). In the future, the government will encourage core technology research and development, shift vehicle subsidies to technology research and development subsidies, and promote the transformation of research results from universities and scientific research institutions to the automobile production end (Liu, 2023).

At the level of enterprise competition, the transformation of traditional automobile manufacturers and the rise of emerging forces jointly shape the market competition pattern. The establishment of a strong after-sales service system, including maintenance and parts supply, is crucial for improving user experience (Gao, 2024). Traditional car companies like BYD and Geely have been able to transform the field of new energy with remarkable results, while the entry of new forces such as Huawei and Xiaomi has brought new vitality to the market with its advantages in intelligence and technological innovation.

Overall, the new energy vehicle market has broad prospects for development. Technological innovation, government policy support, and competition among enterprises will drive the market forward. It is anticipated that new energy cars will significantly increase their market share in the global auto industry, and the trend of comprehensive intelligence will be more obvious. A prosperous future is expected to be brought about by the continued progress of technology and the continuous support of policies in the new energy vehicle market.

3 SHORT-TERM FORECAST OF NEW ENERGY VEHICLE SALES

3.1 Data Analysis Method

3.1.1 Regression Analysis Method

To analyze the relationship between sales volume and multiple influencing factors, new energy vehicles are analyzed using the unitary linear regression model. The construction of the model involves identifying variables that affect sales volume, such as price, policy support, technological progress, etc., and then

estimating the model parameters through historical data. The general form of a linear regression model is:

$$Y = \beta_0 + \beta_1 X + \varepsilon \quad (1)$$

Where Y is the dependent variable (sales volume), X is the independent variable (time), β_0 is the intercept, β_1 is the slope, and ε is the error term.

3.1.2 Seasonal Time Series Analysis

SARIMA model is a commonly used method in time series analysis, which is suitable for time series data with seasonal fluctuations. The steps to build a SARIMA model include determining the model's parameters (p, d, q) and seasonal parameters (P, D, Q)s, and then using historical sales data for model fitting and parameter optimization. SARIMA (p, d, q) (P, D, Q)s, where p represents the number of terms in the non-seasonal autoregressive part of the model. d represents the number of differences needed to make the non-seasonal part stationary. q represents the number of terms in the non-seasonal moving average part of the model. P represents the number of terms in the seasonal autoregressive part of the model. D represents the number of seasonal differences that need to be made to make the seasonal part stationary. Q represents the number of terms in the seasonal moving average part of the model. s stands for seasonal repeating cycles.

3.2 Data Preprocessing

The data source is mainly the 2023 and 2024 data collected by the China Association of Automobile Manufacturers. As a permanent member of the World Automobile Organization, the data source has high reliability. This paper collected monthly New Energy Vehicle (NEV) sales in 2023 and 2024 as sample size and variables.

3.2.1 Regression Analysis Method

Through calculation, it can be obtained that in the regression analysis model of 2023, the intercept (β_0) is 34. 0515, the slope (β_1)is 4. 6857 and the value R^2 is 0. 9582.

The following are the results of the model test in 2023, the independence test (Figure 1) and normality test (Figure 2), from which it can be seen that the applicability and reliability of the regression model are relatively high.

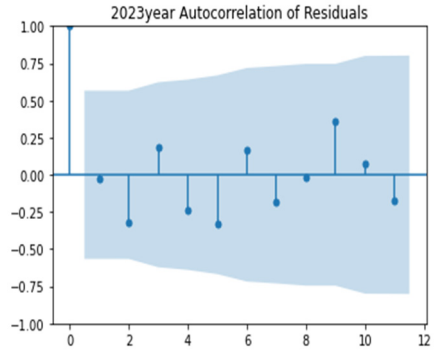

Figure 1: Independence test. (Photo/Picture credit: Original).

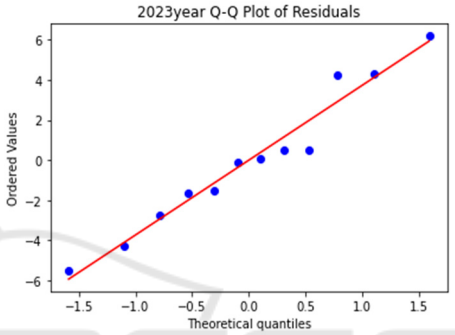

Figure 2: Normality test. (Photo/Picture credit: Original).

Through calculation, it can be obtained that in the regression analysis model of 2023, the intercept (β_0) is 40. 1379, the slope (β_1)is 8. 6762 and the value R^2 is 0. 9176.

The following are the results of a model test in 2024, the independence test (Figure 3) and normality test (Figure 4), from which it can be seen that the applicability and reliability of the regression model are relatively high.

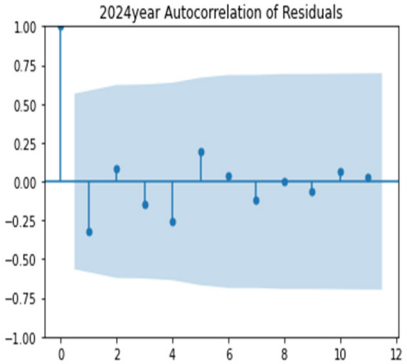

Figure 3: Independence test. (Photo/Picture credit: Original).

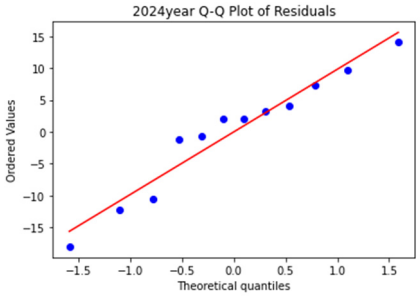

Figure 4: Normality test. (Photo/Picture credit: Original).

Based on the error analysis of the constructed regression analysis model, the mean square error (MSE) and Root Mean Square Error (RMSE) in 2023 are 11. 425 and 3. 380, and the MSE and RMSE in 2024 are 80. 508 and 8. 973, respectively.

3.2.2 Seasonal Time Series Analysis

In this paper, the stationarity test of the data was first carried out, and it was found that the original data (Figure 5) was unstable, so the first-order difference was performed. As shown in the result (Figure 6), the data was stable after the first-order difference was tested.

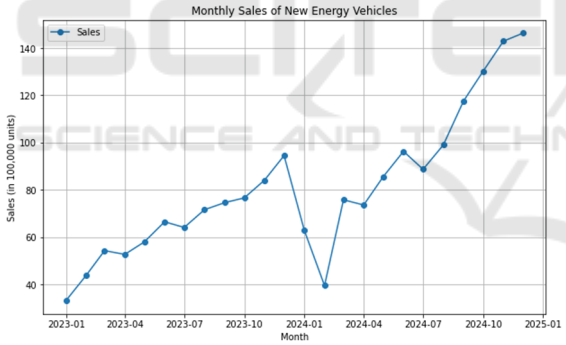

Figure 5: Raw data. (Photo/Picture credit: Original).

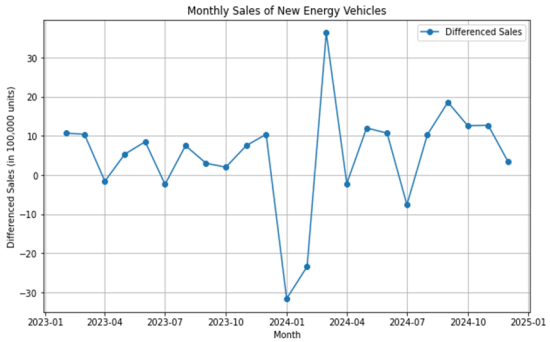

Figure 6: Data after first difference. (Photo/Picture credit: Original).

Using the autocorrelation function (Figure 7) and the partial autocorrelation function (Figure 8) to establish the appropriate p and q, all parameters required by the model are determined: p=1, d=1, q=1, P=1, D=1, Q=1, s=12.

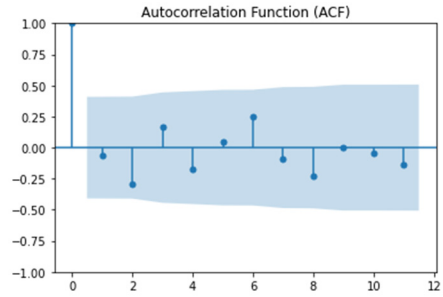

Figure 7: Autocorrelation Function. (Photo/Picture credit: Original).

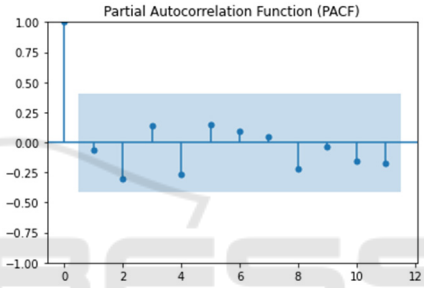

Figure 8: Partial Autocorrelation Function. (Photo/Picture credit: Original).

Based on the error analysis of the constructed seasonal time series analysis model, the MSE and RMSE in 2023 are 138. 934 and 11. 787, and the MSE and RMSE in 2024 are 577. 201 and 24. 025, respectively.

3.3 Sales Forecast and Analysis

Based on data processing, this paper uses a linear regression model and SARIMA model respectively to forecast the number of new energy vehicles sold in 2025, and Figure 9 and Figure 10 are obtained.

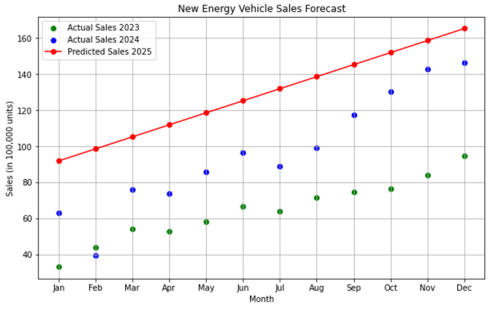

Figure 9: Regression analysis method. (Photo/Picture credit: Original).

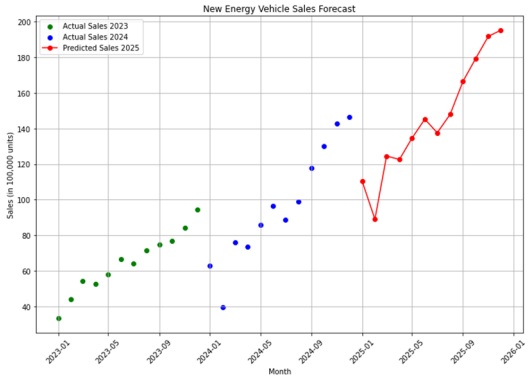

Figure 10: Seasonal time series analysis. (Photo/Picture credit: Original).

According to the forecast of the linear regression model (Figure 9), the monthly sales volume of new energy vehicles in 2025 shows a positive growth trend. In January, sales are expected to be 918, 100 units, and then rise month by month, to the end of December is expected to reach 1. 653 million units, reflecting the continued increase in consumer demand for new energy vehicles and the further release of market potential, indicating its important position in the future automotive market, but also for the development of the industry into a strong confidence.

According to the prediction of the time series model (Figure 10), the monthly sales volume of new energy vehicles in 2025 has a little fluctuation, but the overall trend is upward. Sales are expected to reach 1, 1005 400 units in January and 1, 951, 900 units in December. Among them, there may be a large reduction in February, and there will still be stable growth in the second half of the year. However, time series analysis may require more complex models and more data to improve the accuracy of the prediction. In subsequent studies, more factors can be considered to make more complex predictions.

According to the data processing, the MSE and RMSE of the linear regression model are significantly lower than that of the seasonal time series analysis model, and the fitting effect of the linear regression model is better. Jiang, Mei, Pan & Wang (2024) collected the sales volume of new energy vehicles in the past ten years to build the Autoregressive Integrated Moving Average (ARIMA) model. The amount of data is large enough, and the predicted result is more accurate. Zhang & Zhang (2024) predicted new energy vehicle sales of different brands and regions through the combination of ARIMA and LSTM models, and the construction of the combined model has higher prediction performance.

4 CONCLUSION

The sales volume of new energy cars is analyzed and forecasted in this research using regression analysis and seasonal time series analysis, respectively. The market for new energy vehicles has a very wide range of development prospects in the near future. Although there is a little fluctuation, the sales volume is expected to continue to rise. This is mainly due to the strong support of policies, many countries and regions have introduced subsidies and other policies to encourage consumers to buy. Consumers are becoming more aware of environmental protection, and the number of people who are aware and accept new energy vehicles is increasing. Moreover, technological progress has also increased the driving range of new energy vehicles, accelerated charging speed, and improved intelligence. Furthermore, new energy vehicles have low operating and maintenance costs, which encourages more consumers to choose them.

In the short term, the competition in the new energy vehicle market will be more intense, the market reshuffle will accelerate, and enterprises with technology, brand, and cost advantages will stand out. Intelligence and networking will become the focus of market competition, and the penetration rate of intelligent driving functions will be further improved. Plug-in and range extension technology will continue to advance, fostering the growth of the sales of new energy vehicles. The infrastructure will also be continuously improved, and the changing station will enhance the user experience of consumers. The hydrogenation station will be gradually increased. and encourage the expansion of the market for new energy vehicles.

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