Construction Method Of E-commerce Of New Energy Enterprises

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A B/C e-commerce management model integrated with a Label Propagation Algorithm (LPA) is developed to enhance the management efficiency and development potential of new energy enterprises. Enterprise databases and network monitoring platforms are employed to collect operational data, which are then labeled and classified using LPA. Wind, hydropower and solar energy data are processed within the B/C framework to enable comprehensive comparison, mapping and logical association. The proposed model supports unified data integration, correlation analysis and predictive decision-making for renewable energy management. Experimental results indicate that the e-commerce platform achieves a data integration rate of 92% across multiple energy sources and a prediction accuracy of 82% for future development trends. In addition, the structural optimization rate of new energy development reaches 90.6%. The results show that the B/C-LPA framework improves energy allocation, reduces waste and supports sustainable energy management.

Keywords: New Energy Enterprises, E-Commerce, Energy Optimization, Development Expectations

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1. Introduction

The rapid growth of renewable energy has led to inefficiencies in wind and solar utilization and inadequate energy management, limiting future development potential. The emergence of e-commerce platforms has introduced new momentum for renewable energy integration [1, 2], supported by the 2021 National Standardization Development Outline, which promotes digital platforms for wind and photovoltaic energy [3]. However, some studies argue that e-commerce has limited impact on the energy sector due to the decentralized and variable nature of renewables [4, 5]. Gattupalli et al. proposed a cloud based big data framework integrating AI and AES encryption to ensure secure and scalable data processing, which can be extended to renewable energy e commerce platforms for advanced analytics, secure transactions and efficient management of large-scale energy data [6]. The B/C e commerce model links enterprise energy output with real time demand, enabling accurate scheduling and stable renewable energy integration [7–12]. Harikumar emphasizes optimizing wind and solar energy performance with environmental considerations, and this study adopts those strategies by integrating renewable energy data into an e-commerce platform to improve efficiency, resource utilization and sustainability [13]. Regulatory changes, market instability, energy storage, and smart grids affect renewable energy e-commerce platforms, requiring flexible models [14, 15]. The B/C e-commerce model addresses this by centralizing energy data for optimization, enabling real-time monitoring and adjustments based on demand [16–18]. This paper also introduces a cloud-based searchable encryption system using MD5 and MECC to improve data security and enable fast keyword searches on cloud servers. It explores lowenergy harvesting methods for long-term power supply in underwater systems. The LPA in the e-commerce platform helps manage and coordinate wind and solar energy data, supporting sustainable energy development. The B/C framework can be adapted to different regions and enterprise sizes. The

B/C framework optimizes energy management, while the DMDN model, using Sydney data, outperforms traditional forecasting. Digital e-commerce ensures sustainability and long-term stability by using resources efficiently and integrating data.

2. Materials and methods

2.1. Mathematical relationship between new energy enterprises and e commerce

2.1.1. Data collection of wind, light and electrical energy

Wind and solar energy are used to model energy allocation based on their features. Time series methods like ARIMA and LSTM improve forecasting by capturing seasonal trends. The LPA labels and integrates energy data using a similarity graph, where nodes are data points and edges show similarity. The model achieves efficient large-scale processing with stable label updates, ensuring consistent integration of different energy data types. Hypothesis 1 models energy allocation in new energy enterprises, where Y_{it} denotes the wind energy output share of enterprise i at time t, a represents energy consumption reduction and β_1 captures the marginal interaction between wind and solar energy. X_{it} reflects grid-connected energy integration parameters and Z_{it} denotes B/C platform construction, as defined in Eq. (1) (See Eq. (1) in supplementary file). The error term ε_{it} captures random environmental and operational fluctuations. Hypothesis 2 decomposes internal energy structure using latent factors $F_1 - F_n$ and load coefficients $\lambda_1 - \lambda_n$, as expressed in Eq. (2) (See Eq. (2) in supplementary file). These factors are synthesized into a panel model with enterprise and time fixed effects, γ_i and δ_t, respectively, as formulated in Eq. (3) (See Eq. (3) in supplementary file). LPA integrates and classifies renewable energy data in real-time, optimizing energy flow and improving predictions. The model adapts to weather and grid changes for stable integration.

$$Y_{it} = \alpha + \beta_1 X_{it} + \beta_2 Z_{it} + \epsilon_{it} \tag{1}$$

$$Y_{it} = \lambda_1 F_1 + \lambda_2 F_2 + \cdots + \lambda_n F_n + \epsilon_{it} \tag{2}$$

$$Y_{it} = \alpha + \beta_1 X_{it} + \gamma_i + \delta_t + \epsilon_{it} \tag{3}$$

2.2. E-commerce processing of new energy data

The step controls wind-solar differences for accurate management estimates. Eq. (4) (See Eq. (4) in supplementary file) models energy efficiency, considering generation, integration, regulation, and wind-solar interaction. Real-time data are updated via LPA label propagation, and peak-load delays from dispersed energy streams are mitigated through temporary data buffering to maintain continuous data flow. Eq. (5) (See Eq. (5) in supplementary file) evaluates the indirect effect of e-commerce construction on energy integration. Eq. (6) (See Eq. (6) in supplementary file) quantifies the impact and interaction between e-commerce and new energy structure. Eq. (7) (See Eq. (7) in supplementary file) measures new energy utilization outcomes through integration efficiency and overall planning indicators. Energy storage balances wind and solar power, though limited capacity reduces efficiency.

$$ROA_{it} = \alpha + \beta_1 E_{it} + \beta_2 M_{it} + \beta_3 \left(E_{it} \times M_{it}\right) + \gamma Z_{it} + \epsilon_{it} \tag{4}$$

$$RD_{it} = \alpha_1 + \beta_1 F_{it} + \gamma_1 M_{it} + \epsilon_{1it} \tag{5}$$

$$I = \beta_1 \times \beta_2 \tag{6}$$

$$ET = \frac{E}{YT} \tag{7}$$

2.3. Construction and constraints of e-commerce platforms for new energy enterprises

New energy and e-commerce operations are constrained and standardized to reflect energy consumption, performance indicators and power parameters, as defined in Eq. (8) (See Eq. (8) in supplementary file). In Eq. (8), BR_i denotes wind and hydropower energy input, NUM_i measures the proportion of integrated clean energy and YT_i represents the substitution rate of traditional energy through e-commerce. The efficiency impact of e-commerce on new energy promotion is evaluated through constraint analysis in Eq. (9) (See Eq. (9) in supplementary file), where PT_i reflects integration efficiency constraints, EMI_i denotes market oriented new energy penetration and TPI_i represents the new energy mode, including grid connection, energy type, consumption and stability. Moreover, large digital platforms increase data security risks and energy use, creating environmental trade-offs.

$$INN_i = \frac{BR_i \times NUM_i}{YT_i} \tag{8}$$

$$PT_i = \frac{EMI_i}{TPI_i} \tag{9}$$

2.4. Analysis Steps

Data from wind, solar and hydropower sources are collected to identify key patterns and correlations. The LPA is integrated with an e-commerce platform to build the energy system, monitor power flow, voltage and current and detect abnormalities. These abnormalities are analyzed using platform results and system logs to diagnose issues and optimize the system. If the results are unsatisfactory, the process is repeated.

2.5. Case study of e-commerce construction of new energy enterprises

2.5.1. Case study of new energy enterprises

This case study examines a new energy company using a B/C e-commerce platform to integrate wind, solar and hydropower. The company uses a hybrid generation mode with a 10 kV grid connection and real-time data collection from wind turbines and solar panels for optimization, as shown in Figure 1 (See Fig. 1 in supplementary file). The study shows how the company integrates multiple energy sources, improving coordination and decision-making, making it a strong example of efficient energy management. Wind power comes from mountains, hydropower from water-rich areas, and solar from plains. As shown in Fig. 2 (See Fig. 2 in supplementary file), the platform has layers for data collection, analysis using the LPA algorithm and efficient energy distribution. The monitoring results in Table 1 (See Table 1 in supplementary file) show no missing data and stable current fluctuations. Photovoltaic generation is more variable due to light, while wind power contributes less overall. The model includes geothermal and other renewables, optimizing energy management with real-time data. Monitoring of wind, solar and hydropower ensures grid stability, while energy storage handles demand fluctuations and enhances reliability.

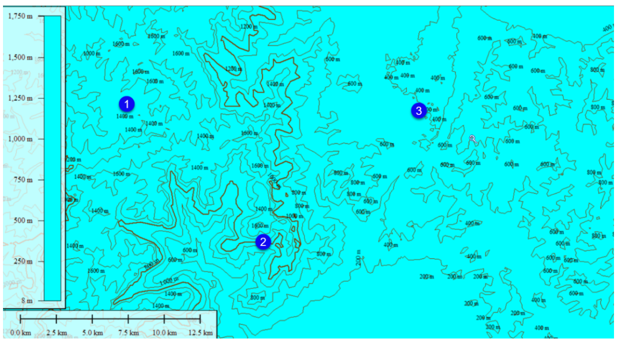

Fig. 1. Distribution area of new energy sources

2.6. Accuracy of new energy integration

Table 2 (See Table 2 in supplementary file) shows 90%+ energy integration, with component differences under 1% and correlations above 0.7 , confirming the LPA algorithm's effectiveness. The B/C e-commerce framework supports real-time bidirectional data interaction and maintains high integration accuracy under changing conditions, confirming its robustness. Fig. 3 (See Fig. 3 in Supplementary file) shows that overall optimization accuracy exceeds 80%, with consistent and reliable performance across regions.

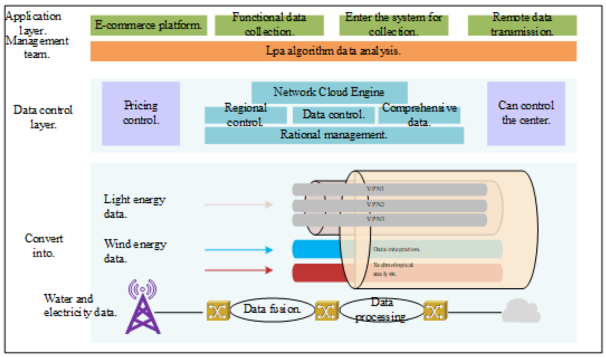

Fig. 2. The logical relationship between the construction of the new energy e-commerce platform

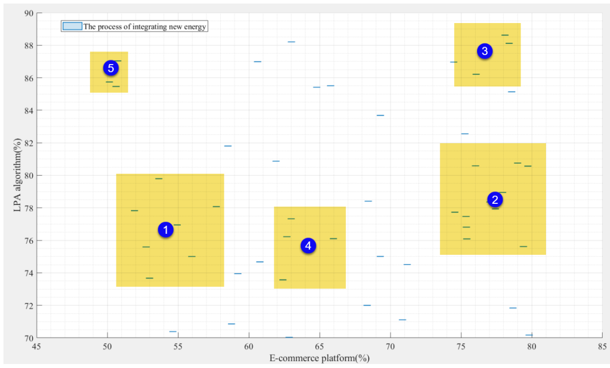

Fig. 3. A comprehensive analysis method of e-commerce for new energy

3. Results and discussion

3.1. The rationality of the optimization of the internal structure of new energy

Wind, hydro and solar energy have different generation patterns, requiring coordinated matching for stable grid connection and efficient use, as evaluated through indicators like optimization ratios and energy fusion relationships in Table 3 (See Table 3 in supplementary file). Real-time e-commerce data feedback improves energy forecasting and resource allocation. The B/C model with LPA enables real-time fusion of multi-renewable data, optimizing energy, scalability and distribution. The integrated e-commerce framework enables coordinated energy dispatch, enhances complementarity among renewables and supports stable grid operation, with detailed results illustrated in Fig. 4 (See Fig. 4 in supplementary file). The model uses Monte Carlo simulations to handle energy uncertainties and scale with real-time data. Tested with real-world data, it's effective for large-scale renewable energy integration. The e-commerce platform with LPA improves energy balance and efficiency, while ensuring data privacy and supporting

Table 1. Sample distribution of monitoring data of new energy enterprises

Name	Missing sample size	Current	Voltage	Tidal current	Deviation	Stochastic fluctuations	Abnormality
Wind power generation	0	0.119	3.810	1.879	1.357	2.118	No
Physical power generation	0	0.069	4.909	2.202	1.382	1.998	No
Photovoltaic power generation	0	0.869	4.989	2.652	1.374	2.980	No
E-commerce platform	0	0.512	4.617	2.695	1.588	3.350	No

Table 2. Accuracy of e-commerce platform construction for new energy enterprises

Type of energy	Integration rate (%)	Build difference	Logic of wind, light, and electricity	Grid-connection difference
Wind power generation	91.553	0.261	0.757	0.346
Physical power generation	90.335	0.770	0.773	0.477
Photovoltaic power generation	94.354	0.065	0.705	0.166
E-commerce platform	91.598*	0.016	0.833**	0.005
LPA Algorithm	96.134*	0.035	0.751*	0.020

Table 3. Optimization process of the internal structure of new energy

New energy type	Platform	Rationality	Energy structure optimization	Energy distribution	Convergence between energy sources
LPA Algorithm	E-commerce platform	91.148	0.108	10.629	0.918
Photovoltaic power generation	E-commerce platform	90.250	0.099	2.521	0.216
Physical power generation	E-commerce platform	90.076	0.098	0.780	0.066
Wind power generation	E-commerce platform	90.032	0.099	-0.325	-0.028

Table 4. List of Acronyms

Acronym	Definition
B/C	Business-to-Consumer
LPA	Label Propagation Algorithm
ROA	Return on Assets
EMI	Energy Management Integration

sustainable energy management.

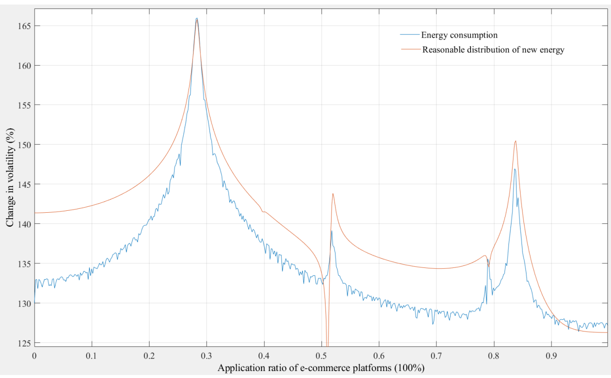

Fig. 4. A comprehensive analysis method of e-commerce for new energy

4. Conclusion

This study examines e-commerce development from both construction and application perspectives, analyzing its effect on enterprise innovation. By integrating e-commerce classification, technological standards, and innovation outcomes into a unified framework, it clarifies how standards influence innovation behavior. The findings show that effective ecommerce reform, backed by appropriate standards and resource allocation, can significantly improve innovation performance. Using new energy enterprises as a case study, the research demonstrates how optimized e-commerce structures and cooperative networks contribute to successful integration, providing valuable insights for improving e-commerce management and fostering sustainable innovation in enterprises.

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6. Declarations

7. Funding

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8. Conflict of interest

The authors declare that they have no conflicts of interest regarding this work.

9. Data availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

10. Code availability

Not applicable.

11. Author contributions

Bai Haiyan contributed to the design and methodology of this study, the assessment of the outcomes, and the writing of the manuscript.

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