INTRODUCTION

With the promulgation and implementation of a large number of renewable energy policies in China, the rapid development of renewable energy is accompanied by the prominent phenomenon of renewable energy abandoning wind and light. Energy storage technology is the key technology to promote the consumption of renewable energy. The government can promote the energy storage technology through the incentive policy of energy storage industry. Firstly, content analysis method is used to analyze China's energy storage policy, and five incentive policies for promoting energy storage technology are obtained. Secondly, built a game model of energy storage technology promotion based on the evolutionary game theory. Finally, use MATLAB software for numerical simulation. Numerical simulation results show that: (a) When the local government chooses to promote less, energy enterprises will eventually adopt the nonconfigure strategy; (b) when the local government chooses to promote more vigorously, energy enterprises will finally adopt the configure strategy; (c) increase in the total electricity sold by energy enterprises with energy storage devices, the sales price of energy stored per unit, the compensation price of energy stored per unit, tax relief standards, and incentive costs of local governments can promote energy enterprises to choose configure strategies; and (d) the reduction of unit energy storage cost, configure cost, and comprehensive tax rate can promote energy enterprises to choose configure strategy.
as wind and light." With the announcement of a series of energy storage policies, the continuous completion and operation of energy storage demonstration projects, and the continuous breakthroughs in the research and development of energy storage technology, local governments, and energy enterprises pay more and more attention to energy storage technology.

Energy storage technology is used to store different forms of energy via specific devices or physical media and release them when needed. Energy storage technology can cost-effectively balance fluctuations from renewable generation. It is a system integration technology that can upgrade the supply and demand management level of electrical energy. To help understand the diverse approaches currently being deployed around the world, we have divided them into five main categories:

1. Electrochemical storage technology—one of the oldest storage technology, which stores the electrical energy in the form of chemical energy, including lithium-ion battery\(^6\) and zinc–air battery.\(^7\)
2. Mechanical storage technology—including pumped hydroelectric system, compressed air energy storage system, and flywheel energy storage systems.\(^8\)
3. Thermal storage technology—including low-temperature and high-temperature technology.\(^9-11\)
4. Electrical storage technology—including supercapacitors and superconducting magnetic energy storage technology.\(^12,13\)
5. Chemical storage technology—including the production of hydrogen or synthetic natural gas as a secondary energy carrier.\(^14,15\)

Research on energy policies in China, Canada, the United States, and European Union has conducted and had a positive effect in factual situations. In recent years, the energy storage industry has been developed, with the issuance of energy policies by China's central and local governments. However, they only made suggestions from the qualitative perspective.\(^16-18\) Hence, modelling research and simulation analysis on the promotion mechanism of energy storage technology are absent under the positive circumstances of energy policies. Therefore, how to quantify research on the promotion mechanism of energy storage technology under energy storage policy is a hot issue concerned by the government, enterprises, and society.

The paper consists of six parts as a whole: Section 1—an introduction to energy storage technology development; Section 2—energy storage policy and literature review; Section 3—building an evolution game model of energy storage technology promotion mechanism; Section 4—a discussion on the evolution game model; Section 5—the numerical simulation calculations; and Section 6—conclusions and future research directions.

## 2 | ENERGY STORAGE POLICY AND LITERATURE REVIEW

### 2.1 | Energy storage policy review

To facilitate the study of China's energy storage industry, a literature survey was conducted on China's energy storage policy. In this paper, the energy storage policy includes the policy documents published by the central, ministerial, provincial, and municipal governments, and the policy text is mainly derived from the government website. As there are many policy documents related to the development of the energy storage industry, to ensure the authority and relevance.

The collected energy storage policy text is selected as follows:

1. The publishing department is the government department above the municipal level and its constituent institutions;
2. The publication date is from 2015 to now;
3. The content is the energy storage-related presentation document in the policy text;
4. The form of publication is standard text, such as opinions, laws, regulations, methods, regulations, and notices, not included in the text of talks, speeches, meetings, etc.

According to the principle of energy storage policy selection, 72 copies of energy storage policy documents were finally sorted out, including three copies at the central level, 27 copies at the ministry level, 38 copies at the provincial level, and four copies at the municipal level. The coding of energy storage policy files is shown in Table 1. Due to limited by space, only part of the coding contents of energy storage policy files is listed.

Through text analysis of the above-mentioned energy storage policy documents, S-20, S-71, and S-72 have the highest correlation with the development of energy storage industry and contain the most incentive policies. Therefore, three energy storage policy documents S-20, S-71, and S-72 are taken as the analysis basis, and the remaining 69 energy storage policy documents are tested for policy saturation. The content analysis process is shown in Table 2.

Through Table 2, it can be concluded that there are five types of incentive policies for the promotion of energy storage technology in China, including guiding policies, cost reduction policies, market-oriented transaction policies, fiscal award and subsidy policies, and tax preferential policies. The remaining 69 energy storage policy documents were used to conduct the policy saturation test. After the test, no new incentive policy types were analyzed, and the incentive policy for the promotion of energy storage technology was already saturated.

### 2.2 | Literature review

Through literature study and investigation, this paper combines regulatory policy with evolutionary game theory to...
research on promotion incentive policy and mechanism simulation model of energy storage technology.

2.2.1 | Regulatory policy literature

Regulatory policy is about achieving government’s objectives through the use of regulations, laws, and other instruments to deliver better economic and social outcomes and thus enhance the life of citizens and business. The history of regulation policy is not one of the coherent government strategies. Since the beginning of the new century, with increasing research on environmental pollution and development of new technologies, many countries have paid more and more attention to regulatory policies. Regulatory policy is widely used in multiple fields, such as noise pollution, carbon emissions, electric vehicles aggregator, clean heating, and renewable Energy. Michael discussed the implementation of US Federal Energy Regulatory Commission’s (FERC) pay-for-performance regulation order at all independent service operators (ISOs) in the United States under FERC regulatory authority, it only discusses the operational performance of independent service operators (ISOs). Zhang et al considered that the regulatory policies limited the effective utilization of pumped storage hydroelectricity (PSH) capacity and discouraged investment in new one; however, they only studied regulatory strategies of the PSH without wide applications of electrochemical energy storage. Based on the above literature, this paper will study the promotion mechanism of energy storage technology under regulatory policy.

2.2.2 | Evolutionary game literature

Evolutionary game theory started with the problem of how to explain ritualized animal behavior in a conflict situation. As a new game theory research method, evolutionary game theory combines traditional game theory with animal evolution theory to analyze the game behavior of different participants. In recent years, evolutionary games are widely used in multiple fields, such as low-carbon supply chain, photovoltaic poverty alleviation, public–private partnership reconstruction of buildings, environmental pollution, and collaborative carbon emission reduction. However, the evolutionary game theory was rarely used in energy storage field. Guo et al analyzed its main body and its behavior of the electric heat storage technology using some evolutionary game theory models, but the evolutionary game analysis considered fewer factors. Chen et al proposed an evolutionary game model combined with real options to guide energy storage system subsidy policies for microgrid by applying to a small electricity network served by a regulated utility, but the evolutionary game analysis only considered subsidy policy. Through the analysis of the above literature, the evolutionary game
| Policy name | The original description | Core statement extraction |
|-------------|--------------------------|---------------------------|
| **Guide policy** | We will foster an open and inclusive environment for innovation and encourage innovation in all forms of technology, mechanisms and business models. (S-20) | Encourage |
| | We will strengthen publicity and expand demonstration efforts. (S-20) | Strengthen |
| | Priority should be given to policy training and coaching. (S-71) | Policy training |
| | To hold a symposium on promoting the development of energy storage industry attended by enterprises, scientific research institutes, relevant government departments, relevant districts, cities and counties. (S-71) | Symposium |
| | To build an internationally leading energy storage industry with the largest scale in the world. (S-72) | Build |
| | New configuration or need to replace the traditional battery, fuel generator, under the same conditions, promote the use of lithium titanate energy storage equipment. (S-72) | Promote |
| **Cost reduction policy** | Promote the concept of green design, study and establish the cascade utilization and recycling system of energy storage products, strengthen supervision and prevent pollution. (S-20) | Strengthen |
| | Energy storage products manufacturers are encouraged to adopt advanced manufacturing technologies and concepts to improve quality and efficiency, and to innovate investment and financing models to reduce costs. (S-20) | Reduce cost |
| | Financial innovation should be encouraged to lower the threshold and risk of energy storage development risk. (S-20) | Reduce … risk |
| | Improve key energy storage technologies for high-performance, low-cost all-vanadium liquid flow batteries. (S-71) | Low cost |
| | Significantly reduce energy storage production costs. (S-72) | Reduce cost |
| | Research and development of low cost, good cycle stability, the use of a fuel cell operating temperature of light element hydrogen storage materials. (S-72) | Low cost |
| **Market transaction policy** | We will gradually establish and improve the pricing mechanism for electricity market transactions and flexible resources. (S-20) | Pricing mechanism |
| | Form "pay by effect, who benefits who pays" market mechanism. (S-20) | Market mechanism |
| | Energy storage power demonstration application in different application scenarios of power supply side is carried out through power market bidding. (S-71) | Power market |
| **Fiscal award and subsidy policy** | Research on the establishment of renewable energy station side energy storage compensation mechanism. (S-20) | Compensation mechanism |
| | Energy storage will be included in the focus of special funding for smart grid and energy equipment manufacturing. (S-20) | Special fund |
| | It shall be provided with supporting funds of 50% of the amount allocated by the state, up to no more than 5 million yuan. (S-71) | Funds |
| | Production subsidies shall be given to the first (set) of approved technical equipment. (S-71) | Production support |
| | Make use of special funds for the construction of Dalian manufacturing innovation center. (S-71) | Special funds |
| | We will promote the establishment of an industry (entrepreneurship) investment guidance fund in Dalian. (S-71) | Investment funds |
| | Multi-angle, multi-channel and multi-way appeal to the relevant functional departments at the higher level to gradually introduce supporting policies such as energy storage electricity price, energy storage subsidy and capacity compensation. (S-72) | Subsidies |
| **Preferential tax policy** | Qualified energy storage enterprises can enjoy relevant preferential tax policies. (S-20) | Preferential tax |
| | Recognized enterprises shall enjoy relevant preferential tax policies in accordance with relevant provisions. (S-71) | Preferential tax |
| | Support energy storage equipment production enterprises and energy storage application promotion enterprises to apply for new and high technology enterprises, and enjoy the relevant preferential tax policies in accordance with the provisions after the recognition. (S-72) | Preferential tax |
| | Taxes and fees incurred during the construction of research and development and industrialization projects of energy storage equipment production enterprises and energy storage application promotion enterprises shall be reduced or exempted in accordance with the provisions of relevant laws and regulations. (S-72) | Tax fee reduced |
theory is very easy to solve the game problems of different subjects. Therefore, this paper will use evolutionary game methods to solve the game problems between local policies and energy companies in the promotion of energy storage technology.

2.3 | The novelty

In this study, compared with other published papers, the main advantages of this paper are as follows:

1. The perspective of promoting energy storage technology under China's current energy storage policies is novel. Collect the energy storage policies issued by the central government and local governments of China, and use content analysis method to analyze the incentive policies for the promotion energy storage technology in China;
2. The research method is novel, and the current research on the promotion of energy storage technology is mostly concentrated in the qualitative research stage. This paper uses qualitative research methods. Using evolutionary game theory can analyze the relationship between the choice strategies of two different stakeholders in local governments and energy storage companies;
3. Through the theoretical solution and numerical simulation of the evolutionary game model, it provides a good model support for the government to formulate energy storage policies to promote the development of energy storage technology.

3 | THE MODEL

Evolutionary game theory is an application of the mathematical theory of games to solve the dynamic evolution of multiple subjects. In this paper, evolutionary game theory is applied to the simulation study of energy storage technology promotion mechanism, because the incentive policy of energy storage technology promotion by local government will greatly affect the energy storage device configuration decision of energy enterprises. Under different initial conditions and different parameters, local governments and energy enterprises will present different game situations. For energy enterprises, they can decide whether to configure or nonconfigure energy storage devices according to the incentive policy of energy storage technology. For local governments, policies can be adjusted according to the implementation effect of incentive policies for promotion energy storage technology. Therefore, the promotion process of energy storage technology between local government and energy enterprises can be studied by applying evolutionary game theory.

3.1 | Factors affecting energy enterprises’ decisions

Expected profit \( \pi \): the main power of energy enterprise to configure energy storage device, where \( \pi = (p - h)Q \), \( p \) is the sales price of unit of energy stored, \( h \) is the cost of unit of energy stored, and \( Q \) is the total electricity sold by energy enterprise with energy storage device.

Configuration cost \( F \): It mainly includes equipment cost, construction cost, and technology transfer cost required for the configuration of energy storage device.

Energy storage compensation expense \( B \): In order to ensure the daily operation of energy enterprises equipped with energy storage devices, energy industry authority formulates compensation standards for energy storage power to compensate energy enterprises. The compensation standard is \( B = \delta Q \), where \( \delta \) is the compensation price per unit of energy storage power.

Tax deduction fee \( M \): In order to reduce the tax pressure on energy enterprises equipped with energy storage devices, the local government formulates tax relief standards for energy enterprises.

The tax deduction standard is \( M = \zeta T \), where \( \zeta \) refers to the tax deduction proportion, and \( T \) refers to the tax paid by energy enterprises equipped with energy storage devices.

Local government incentive expense \( R \): Energy enterprises receive financial incentive expense from the local government for installing energy storage devices.

3.2 | Factors affecting local governments’ decisions

Tax \( T \): The promotion of energy storage technology brings tax revenue to local governments, \( T = \beta pQ \), among which, \( \beta \) is the comprehensive tax rate including enterprise income tax, business tax, value-added tax, and other taxes.

Reward \( R \): local government expenditure for financial reward for the promotion of energy storage technology.

Environment \( V \): Through the application of energy storage technology, energy enterprises can improve the utilization rate of renewable energy in the energy selling process and obtain good environmental benefits, where \( V = \lambda Q \), and \( \lambda \) is the environmental income from the electricity sold by an energy enterprise with energy storage device.

Publicity expense \( C \): expenses incurred by local governments in the promotion of energy storage technology in terms of publicity, research, investigation, guidance, seminars, training, etc.

Time value \( H \): time value loss before and after the introduction of energy storage technology. Hypothesis: The promotion of local governments can enable energy enterprises to quickly deploy energy storage devices into operation.
3.3 Parameter settings

To facilitate the simulation of incentive policies for the promotion of energy storage technology, this paper uses the public policy theory. In combination with the actual situation of the energy storage industry, different parameters are set for the promotion incentive policies of different energy storage technologies. Through the influence of parameter changes on the promotion process of energy storage technology, the promotion mechanism of energy storage technology under the incentive policies is studied. The parameter settings are shown in Table 3.

The energy enterprise configure probability is $P_1$, the promotion intensity of local government is $P_2$, $L$: local government; $D$: energy companies equipped with energy storage devices. Game matrix is shown in Table 4.

1. The expected revenue function of energy enterprises is as follows

$$ E_{\text{Configure}} = P_2 \left[ (p-h+\delta + \zeta \beta p - \beta p) Q + R - F \right] + (1-P_2) \left[ (p-h-\beta p) Q - F \right] $$

$$ = P_2 \left[ (\delta + \zeta \beta p) Q + R \right] + (p-h-\beta p) Q - F $$

$$ = P_2 (\delta + \zeta \beta p) Q + P_2 R + (p-h-\beta p) Q - F, $$

$$ E_{\text{Non-configured}} = 0, $$

$$ E_{\text{Energy enterprises}} = P_1 E_{\text{Configure}} + (1-P_1) E_{\text{Non-configured}}, $$

2. The expected revenue function of local governments is as follows

$$ E_{\text{Promote}} = P_1 \left[ (\beta p - \zeta \beta p + \lambda - \delta) Q + H - R - C \right] + (1-P_1) (-C) $$

$$ = P_1 \left[ (\beta p - \zeta \beta p + \lambda - \delta) Q + H - R \right] - C, $$

$$ E_{\text{Local government}} = P_2 E_{\text{Promote}} + (1-P_2) E_{\text{Non-configured}}. $$

4 DISCUSSION

4.1 Energy storage enterprise

According to Equations (1-3), the replicated dynamic equation $F(P_1)$ of the enterprise can be obtained as follows:

$$ F(P_1) = \frac{dP_1}{dt} = P_1 \left( E_{\text{Configure}} - E_{\text{Energy enterprises}} \right) $$

$$ = P_1 (1-P_1) \left( P_2 (\delta + \zeta \beta p) Q + P_2 R + (p-h) Q - \beta p Q - F \right), $$

$$ F'(P_1) = \frac{dP_1}{dP_1} = 0, $$

Let $F(P_1) = \frac{dP_1}{dt} = 0$, we can get $P_1 = 0$, $P_1^* = 1$, $P_2^* = \frac{(p-h) Q - \beta p Q - F}{(\delta + \zeta \beta p) Q - R}$.

When $P_2 = \frac{(p-h) Q - \beta p Q - F}{(\delta + \zeta \beta p) Q - R}$, the energy enterprise configuration energy storage device possibility is stable; when $P_2 = \frac{(p-h) Q - \beta p Q - F}{(\delta + \zeta \beta p) Q - R}$, the energy enterprise configuration energy storage device possibility gradually increases, and the final configuration of energy storage devices is the best choice for energy enterprises; and when $P_2 = \frac{(p-h) Q - \beta p Q - F}{(\delta + \zeta \beta p) Q - R}$, the energy enterprise configuration energy storage devices gradually decreases, and it is the best choice for energy enterprises not to configure energy storage devices. The dynamic evolution process of energy enterprises is shown in Figures 1-3.

4.2 Local government

According to Equations (4-6), the replicated dynamic equation $F(P_2)$ of local government can be obtained as follows:

$$ F(P_2) = \frac{dP_2}{dt} = P_2 \left( 1-P_2 \right) $$

$$ = P_2 \left\{ P_1 \left[ (\beta p - \zeta \beta p + \lambda - \delta) Q + H - R \right] - C \right\} $$

$$ = P_2 \left\{ P_1 \left[ (\beta p + \lambda) Q \right] + 0 = P_1 \left[ (\beta p + \lambda) Q \right] \right\}, $$

$$ F'(P_2) = \frac{dP_2}{dP_2} = (1-2P_2) \left[ P_1 \left[ (\beta p - \delta) Q + H - R \right] - C \right]. $$

| Table 3 | Incentive policy parameters setting |
|---------|-----------------------------------|
| Policy name | Parameter |
| Guide policy | Publicity expense $C$ |
| Cost reduction policy | Configuration cost $F$ |
| Market transaction policy | Total electricity sold by energy enterprise with energy storage device $Q$ |
| Fiscal award and subsidy policy | Reward $R$ |
| Preferential tax policy | Comprehensive tax $\beta$ |
| | Tax deduction proportion $\zeta$ |
Let $F(P_2) = \frac{dP_2}{dt} = 0$, we can get $P_2^* = 0$, $P_2^* = 1$.

When $P_1 = \frac{C}{H-(\zeta p + \delta)Q-R}$, the promotion intensity that local government takes is stable; when $P_1 > \frac{C}{H-(\zeta p + \delta)Q-R}$ and shows an increasing trend, which is the best choice for local governments to strengthen the promotion intensity; and when $P_1 < \frac{C}{H-(\zeta p + \delta)Q-R}$ and shows a decreasing trend, the promotion intensity of local government energy storage technology becomes smaller and smaller, which is the best choice for local government to reduce the promotion intensity. The dynamic evolution process of local government is shown in Figure 4-6.

### 4.3 | Local governments and energy storage enterprise

To sum up, the replication dynamic relationship between the two sides of the game is represented by a two-dimensional plane coordinate, as shown in Figure 3.

In Figure 7, $D (1.1)$ is Pareto optimal equilibrium. Local governments vigorously promote energy storage technology, and energy enterprises actively configure energy storage devices. $B (0,0)$ is Pareto inferior equilibrium, local
governments do not promote energy storage technology, and energy enterprises do not configure energy storage devices. Therefore, when \( P_1 > C \left( \zeta \beta p + \delta \right) Q - R \) and \( P_2 > (p - h) Q - \delta \zeta \beta Q - R \), the system converges to Pareto optimal equilibrium \( D(1,1) \) with the maximum probability. In order to achieve the above goals, from \( P_1^* = \frac{C}{H - \left( \zeta \beta p + \delta \right) Q - R} \) and \( P_2^* = \frac{(p - h) Q - \delta \zeta \beta Q - R}{- \left( \delta + \zeta \beta p \right) Q - R} \), that local governments can improve the standard of compensation costs, increase the intensity of tax reduction, and increase the government incentive costs and other methods to promote energy storage technology.

5 | NUMERICAL SIMULATION

In this paper, use MATLAB software to simulate the dynamic evolution process of energy storage technology promotion.

Suppose that each parameter value in the game payment matrix is as follows:

- Total electricity sold by energy enterprises with energy storage devices \( Q = 5 \times 10^6 \) kWh.
- Sales price per unit of energy stored \( p = 0.6 \) yuan.
- Cost per unit of energy stored \( h = 0.2 \) yuan.
- Configuration cost \( F = 2 \times 10^6 \) yuan.
- Compensation price per unit of energy stored \( \delta = 0.1 \) yuan.
- Comprehensive tax rate, including enterprise income tax, business tax, value‐added tax, and other taxes \( \beta = 0.3 \).
- Tax reduction ratio \( \zeta = 0.1 \).
- Publicity expense \( C = 7 \times 10^5 \) yuan.
- Local government reward expense \( R = 1 \times 10^6 \) yuan.

5.1 | Influence of different initial states

From the formula \( P_1^* = \frac{C}{H - \left( \zeta \beta p + \delta \right) Q - R} \) and \( P_2^* = \frac{(p - h) Q - \delta \zeta \beta Q - R}{- \left( \delta + \zeta \beta p \right) Q - R} \), substituting the parameter values can calculate that \( P_1^* = 0.5 \).
and $P^*_2=0.6$. Simulation of dynamic evolution process by different initial states is as follows:

1. When $P_2 < P^*_2$, this example takes $P_2=0.3$, and the dynamic evolution process of energy enterprise configuration strategy changing with time is shown in Figure 8. Under the initial probability of each energy storage device configuration strategy, energy enterprises eventually converge to 0, that is, when the local government chooses to promote energy storage devices less vigorously, energy enterprises will finally adopt the strategy of nonconfiguration.

2. When $P_2 > P^*_2$, this example takes $P_2=0.9$, and the dynamic evolution process of energy enterprise configuration strategy changing with time is shown in Figure 9. Under the initial probability of each energy storage device configuration, the configuration strategy of energy enterprises finally converges to 1, that is, when the local government chooses to promote vigorously, energy enterprises will finally adopt the configuration strategy.

5.2 | Influence of different parameters

In combination with the actual development of energy storage industry, most energy storage projects are demonstration projects at present, and many energy enterprises are still in a wait, so they have little enthusiasm to configure energy storage devices. In this case, $P_1=0.3$ is taken as the example. In the context of a series of energy storage incentive policies of governments at all levels, local governments have made great efforts to promote technology. In this case, $P_2=0.9$ is taken as the example.

5.2.1 | Total electricity sold $Q$

Figure 10 shows the dynamic evolution process of energy enterprises’ selection configure strategy when total electricity sold at different $Q$ of 0 to 10 000 000 kWh. When the total electricity sold by energy enterprises with energy storage devices is low, energy enterprises choose nonconfigure strategy. The lower the total electricity sold by energy enterprises with energy storage devices, the faster the evolution of the decision nonconfigure. When the total electricity sold by energy enterprises with energy storage devices is high, energy enterprises choose the configuration strategy. The higher the total electricity sold by energy enterprises with energy storage devices, the faster the evolution of the configuration decision.

5.2.2 | Sales price per unit of stored electricity $p$

Figure 11 shows the dynamic evolution process of energy enterprises’ selection configure strategy when sales price
When the sales price of unit energy storage is low, the energy company chooses nonconfigure strategy, the lower the sales price of the unit energy storage, the faster the evolution rate of the nonconfiguration decision; when the sales price of the unit energy storage is at a higher level, energy companies choose configuration strategy. The higher the sales price of unit energy storage, the faster the configuration decision evolution.

5.2.3 | Unit energy storage cost $h$

Figure 12 shows the dynamic evolution process of energy enterprises’ selection configure strategy when unit energy storage cost at different $h$ of 0-1 yuan. The cost of unit energy storage is 0, 0.25, 0.5, and 0.75, respectively. The dynamic evolution process of energy enterprise configure strategy selection is shown in Figure 12 (the value of the curve increases successively from top to bottom). When the cost of energy storage per unit is low, the energy enterprise chooses the configuration strategy. The lower the cost of the unit energy storage, the faster the evolution of the configuration decision; when the cost of the unit energy storage is higher, energy companies choose nonconfigure strategy, the higher the cost of energy storage per unit, the faster the evolution of nonconfiguration decisions.

5.2.4 | Configuration cost $F$

Figure 13 shows the dynamic evolution process of energy enterprises’ selection configure strategy when configuration cost at different $F$ of 0-4 000 000 yuan. When the configure cost is low, energy enterprises choose the configure strategy. The lower the configure cost, the faster the evolution of configure decision. When the configure cost is high, energy enterprises choose the nonconfigure strategy. The higher the configure cost is, the faster the nonconfigure decision evolves.

5.2.5 | Compensation price of unit of stored electricity $\delta$

Figure 14 shows the dynamic evolution process of energy enterprises’ selection configure strategy when compensation price of unit of stored electricity at different $\delta$ of 0-1 yuan. When the compensation price per unit of stored energy is low, the energy enterprise chooses nonconfigure strategy, the lower the compensation price of the unit energy storage, the faster the evolution rate of the nonconfiguration decision. When the price is high, the energy enterprise chooses the configuration strategy. The higher the compensation price of the unit energy storage, the faster the configuration decision evolution.
5.2.6 | Comprehensive tax rate $\beta$

Figure 15 shows the dynamic evolution process of energy enterprises’ selection configure strategy when comprehensive tax rate at different $\beta$ of 0-1. When the comprehensive tax rate is low, the energy companies choose the configure strategy. The lower the comprehensive tax rate, the faster the configuration decision evolution. When the comprehensive tax rate is higher, the energy companies choose nonconfigure strategy. The higher the comprehensive tax rate, the faster the nonconfigured evolution decision.

5.2.7 | Tax reduction ratios $\zeta$

Figure 16 shows the dynamic evolution process of energy enterprises’ selection configure strategy when tax reduction ratios at different $\zeta$ of 0-1. When the tax reduction ratio changes, the energy companies choose the configure strategy, but with the increase in the tax reduction ratio, the configuration decision evolution speed becomes faster.

5.2.8 | Publicity expense $C$

Figure 17 shows the dynamic evolution process of energy enterprises’ selection configure strategy when publicity expense at different $C$ of 0-1 000 000 yuan. When the publicity cost changes, energy enterprises all choose the configuration strategy, but with the decrease in publicity cost, the configuration decision evolution speed becomes faster. In this case, due to multiple incentive policies, decreasing publicity costs can accelerate the evolution of configure decisions.

5.2.9 | Local government reward expense $R$

Figure 18 shows the dynamic evolution process of energy enterprises’ selection configure strategy when local government
reward expense at different $R$ of 0-1 000 000 yuan. When the local government incentive fee is low, the energy enterprise chooses nonconfigure strategy, the lower the local government incentive fee, the faster the nonconfiguration decision evolution rate; when the local government reward fee is higher, the energy enterprise chooses to configure strategy, the higher the local government incentive fee, the faster the configuration decision.

In a certain sense, this study reveals the research on the promotion mechanism of energy storage technology under incentive policies and provides a certain reference basis for local governments to formulate and improve energy storage policies.

6 CONCLUSIONS

1. Investigate the energy storage policy documents issued by the Chinese government and finally select 72 copies of energy storage policy documents, including three copies at the central level, 27 copies at the ministry level, 38 copies at the provincial level, and four copies at the municipal level. Using content analysis method, this paper analyzes the energy storage policy in China and obtains five kinds of incentive policies for the promotion of energy storage technology. It can be classified as follows: (a) guide policy; (b) cost reduction policy; (c) market transaction policy; (d) fiscal award and subsidy policy; and (e) preferential tax policy.

2. During the establishment of the energy storage technology promotion mechanism model, firstly, analyze the influencing factors affecting energy enterprise and local government decision-making; secondly, combined with the analysis of the energy storage policy, settings include total electricity sold, sales price per unit of energy stored, cost per unit of energy stored, configuration cost, compensation price, comprehensive tax rate, tax reduction ratio, publicity expense, and local government reward expense to represent different energy storage incentive policies; and finally, build game matrix based on evolutionary game theory.

3. Through evolutionary game analysis and simulation results, it was shown that: (a) When the local government chooses to promote less vigorously, energy enterprises will eventually adopt the strategy of nonconfigure; (b) when the local government chooses to promote more vigorously, energy enterprises will finally adopt the configure strategy; (c) the increase in the total electricity sold by energy enterprises with energy storage devices, the sales price of energy stored per unit, the compensation price of energy stored per unit, tax relief standards, publicity costs, and incentive costs of local governments can promote energy enterprises to choose configure strategies; and (d) the reduction of unit energy storage cost, configure cost, and comprehensive tax rate can promote energy enterprises to choose configure strategy.

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