

# Research on Central Air-Conditioning's Patent Strategic Layout of Gree

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## ABSTRACT

Based on the patent search results of Gree's central air-conditioner from the Patsnap global patent database, this paper takes Gree's central air-conditioner patent strategy layout as the starting point, applies theories of corporate innovation, intellectual property(IP) management and IP audit, analyzes its central air-conditioner patent status and patent strategy layout, addresses the problems of internationalization, diversification and international cooperation in its central air-conditioner patent strategy layout, combines Gree's development strategy, patent strategy, competitors' situation and industry development trend, and discusses and proposes the implementation of an offensive patent strategy layout for overseas market-oriented regions, the national situation of production and operation and the industry development situation. In view of Gree's internationalisation, diversification and international cooperation in the strategic layout of Gree's central air-conditioning patents, Gree explores and proposes corresponding countermeasures and suggestions for the implementation of an offensive strategic layout of patents in overseas market-oriented regions, the strategic layout of patents in countries or regions of production and operation, and the strategic layout of patents in the fields of intelligence, intelligent housekeeping and artificial intelligence(AI), taking into account the development strategy of Gree, its patent strategy, the situation of its competitors and the development trend of the industry, and with regard to the problems in its patent strategy.

**Keywords:** central air-conditioning, patent, layout of patent strategy, intellectual property management.

## 1. INTRODUCTION

At the early stage of its establishment, Gree mainly relied on the assembly and production of household air conditioners, which lacked core competitiveness. The beginning of Gree's determination to innovate independently was originated from the incident in 2000 when a huge sum of money was spent to purchase the core technology of Japanese central air conditioners, which made Gree deeply understand the importance of mastering core technology, and innovation and creation. As President Xi Jinping pointed out in his speech at the 19th General Assembly of Academicians of the Chinese Academy of Sciences and the 14th General Assembly of Academicians of the Chinese Academy of Engineering, "key core technologies cannot be asked for, bought or begged for". Different patent strategies differ in their research and development direction and focus, and the resulting patent layout often reflects their strategic objectives. It is necessary for enterprises to make

forward-looking strategic layouts in core technologies to enhance international competitiveness, realise the great change from "Made in China" to "intelligent manufacturing in China" and to "Created in China", and bring about the great rejuvenation of the Chinese nation.

With the domestic epidemic situation stabilising, the market economy gradually recovers and residents' consumption power gradually increases, and the market gradually stepped into a rebounding and rebounding phase. At the same time, the growth rate of real estate investment has increased, and the number of new properties has also picked up relatively. Stimulated by this series of factors, the overall central air conditioning industry is facing rising demand in the market, and various home appliance companies have developed patent strategies based on their actual situation. Gree, as a leading brand in the central air-conditioning industry, has also developed a patent strategy to ensure sustainable development in the "post-epidemic era".

This paper attempts to study Gree's patent strategy layout for central air-conditioning and provide reference for the patent strategy layout of enterprises.

## **2. ANALYSIS OF GREE'S CENTRAL AIR-CONDITIONING PATENT STRATEGY LAYOUT**

Gree has carried out two major tasks in the strategic layout of central air-conditioning patents: the management of corporate intellectual property rights and the patent strategy model, which together constitute a complete process of patent strategy layout for Gree in the field of central air-conditioning, one without the other. The importance of corporate IP management is self-evident if an efficient patent strategy model for central air-conditioning is to be implemented throughout the enterprise. Therefore, Gree has made the management of intellectual property rights an important part of the strategic layout of its central air-conditioning patents and playing a role in guaranteeing it. The following is an analysis of the strategic layout of Gree's central air-conditioning patents.

### **2.1. Strategic Model Analysis of Patents**

The strategic model adopted by Gree in the field of central air-conditioning is a hybrid strategy of "offensive + defensive", which will be analysed as follows.

#### **2.1.1. Offensive –Basic Patent Strategy**

Gree is on the list of the TOP 10 companies with invention patents from 2015 to 2020. There are only two home appliance companies on the list, and Gree is one of them. In the midst of fierce competition from the TOP 10 communication and information industry enterprises, the number of patent inventions of Gree exceeded that of Tencent Technology, Lenovo and Midea Group, fully demonstrating its strong strength in patents.

This has laid the foundation for Gree's continuous source of innovation in the field of central air conditioning. A search of the Patsnap global patent database shows that Gree has a total of 628 patents in the field of central air-conditioning, including many fundamental technologies in F24F (air conditioning; air humidification; ventilation; application of airflow as shielding), which is the result of the implementation of intellectual property rights. In terms of the patent layout of Gree's central air-conditioners, Gree takes basic technologies as its foundation. In addition to applying for patents for the basic central air-conditioning technologies Gree has successfully developed, the company has also put forward the goal of "mastering core technologies", closely linking its innovation

capabilities with its core technologies. In the analysis of Gree's patent layout, we can see those core technologies such as load prediction, abnormal condition detection, model selection modeling and remote monitoring system for master-slave control of Gree's central air-conditioners have been widely used and most frequently cited by other companies. Gree has also successfully applied for patents for these core technologies, and the top ten most cited patents have all been granted, thus gaining patent rights for the technologies and protection of intellectual property rights, which in turn motivates Gree to actively innovate, forming a virtuous circle.

#### **2.1.2. Offensive –Peripheral Patent Strategy**

Gree filed dozens of peripheral patent applications around a few essential patents while marketing a particular central air conditioner. It made full use of its rudimentary patents to create a patent network and applied for patents for these peripheral technologies related to the basic patents. This effectively prevents competitors from using technologies similar to the fundamental patents, avoiding the loss of patent protection for the basic technologies, and preventing infringement of the patentee's exclusive rights to the core technologies.

#### **2.1.3. Offensive –Peripheral Patent Strategy**

Gree Electric's responsible person in charge stated: Gree Electric respects others' intellectual property rights while also protecting its lawful rights and interests. It is intended that patent litigation will prevent improper borrowing and imitation in the sector, as well as raise awareness of independent air conditioning enterprise innovation, including central air-conditioning goods. In the face of an increasing number of central air-conditioning devices on the market that purportedly infringe on Gree's patent rights on central air-conditioning technology, Gree remains unfazed and has launched many patent cases to resolutely defend its rights. Gree has filed 109 patent cases against patent infringement in central air-conditioning-related technology, significantly more than its main competitors Midea and Haier, according to the Patsnap worldwide patent database.

Gree's litigation team actively investigated and researched relevant information retrieved from the internet, the current patent legal system, and relevant materials from the library to compile more detailed evidential materials when dealing with these infringements and preparing for litigation. A system formed by such specialized and professional process has ensured the smooth development of Gree Electric's patent rights protection litigation.

Since Gree Electric's central air-conditioning technology frequently encounters patent litigation, the best way for the company is to establish a complete set of patent litigation strategies. Therefore, the patent litigation strategy has become the embodiment of Gree Electric's greater awareness of patent protection.

**2.1.4. Offensive–Patent Assignment for a Fee Strategy**

Gree Electric has created a "three-step" strategy for its core business chain, the "step" of which is to provide patent assistance to upstream enterprises.<sup>[1]</sup> In the field of central air-conditioning, Gree prioritized two key technologies and litigation-prone dimensions to find core suppliers that could help its own central air-conditioning core technology, retain ownership of its patents, and provide patent licensing and other services to the suppliers. After the two sides have reached a cooperation, Gree will license its own central air conditioning patents to these companies for a certain area or a certain period with a fee. Another "step" is the implementation of patent licensing to competitors. In addition to the patent litigation strategy, Gree takes the initiative to resolve disputes by signing patent licensing agreements in the face of infringement of its competitors' patents related to central air-conditioning.<sup>[1]</sup> Gree has signed long-term patent licensing agreements with some manufacturers in the field of central air-conditioning and has charged high royalties.

**2.1.5. Defensive –Strategy to Bypass Patent Barriers**

As aforementioned, Gree has built a peripheral patent network when promoting a central air conditioner. Not only that, Gree has adopted a circuitous strategy to bypass the patent barrier strategy and avoid the tight patent blockade built by foreign enterprises using dozens of patents when facing the severe situation of foreign competitors' patent rights of central air conditioner-related technologies that constitute a constraint on Gree.

**2.1.6. Defensive –Cross-licensing Strategy**

In 2017, Gree Electric and Hengqin International Intellectual Property Trading Centre Limited, together with eight other air conditioning enterprises, jointly established the China Air Conditioning Industry Intellectual Property Alliance, which also formed a patent pool in the field of air conditioning.<sup>[2]</sup> The patent pool is essentially a patent licensing trading platform, through which Gree can use its patents in the field of air conditioning. Thus, Gree is capable of exchanging its patents with those of other members of the patent pool in this field, to obtain licenses to use their patents through the platform, creating a patent sharing

mechanism that effectively eliminates the licensing barriers in patent implementation and greatly saves costs.

**2.2. Analysis of The Management of Intellectual Property Rights**

The following is an analysis of Gree in terms of the management of intellectual property rights.

**2.2.1. The Organizational Structure of A Company’s IP Management**

Intellectual property rights are closely integrated with the overall development strategy of the company, and Gree insists on the integration of intellectual property rights into the entire operation of the company. Therefore, the organizational structure of Gree’s intellectual property rights(IPR) management is centralized, with the IPR Department setting up to manage the company's IPR in a unified and centralized manner. Figure 1 below shows the internal intellectual property management system of Gree.

Within Gree, an intellectual property management system has been formed with the established intellectual property department as the mainstay, research and development as well as staff training as the supplement. The three parts are interlinked and promote each other, forming a cycle that lays a strong foundation for the intellectual property-patent strategy layout formulated by Gree to be implemented smoothly.



**Figure 1.** Gree’s Internal IP Management System

### *2.2.2. The strategic model of a company's central air-conditioning patent from the perspective of its intellectual property management system*

To improve the level of intellectual property management, Gree has set up a special intellectual property department to formulate an intellectual property strategy in line with the company's development vision. In the field of central air-conditioning, a patent strategy layout (hybrid) has been formulated to match this management system, which further promotes Gree's central air-conditioning technological innovation. A batch of core technologies based on the basic technology emerges, and the most valuable patents is the one with the open number CN105318460B, according to the search results of the Patsnap global patent database. It is the technological innovation of these central air-conditioners that enables the basic patent strategy to play its true role, as patents are derived from independent innovation in technology.

Gree has developed a "Total Process IP Management System", which enables the electronic management of the entire life cycle of intellectual property rights, including patents, from the source to the end.<sup>[3]</sup> For instance, in the commercialization of IPR using Gree's patents in the field of central air-conditioning, one of the factors affecting the price of the technology is the life cycle of the technology, which can be obtained from the "Full Process IPR Management System" to determine the royalty that the technology recipient is willing to pay for the right to use the technology and that is acceptable to Gree on the supply side. This reduces the possibility of deviations from reality in the assessment of the lifecycle and advancement of the central air-conditioning patent in question and thus provides a clearer basis for the price of the technology. Similarly, patents in this field are also subject to such information management, which provides a guarantee that adequate evidence and information can be prepared to initiate patent litigation for the implementation of a patent litigation strategy.

Gree has also developed a "Science and Technology Innovation Platform", which contains nearly 8 million patent data related to its products. It updates the data in real-time<sup>[3]</sup>, including countless patents in the field of central air-conditioning, which largely facilitates Gree's central air-conditioning R&D staff to use the patent information to layout their technology and avoid infringing other companies' patented technology. The platform is the cornerstone of Gree's strategy of bypassing patent barriers, through which Gree adopts techniques to bypass patent barriers in its R&D after conducting patent information analysis.

Gree is the only enterprise in China's home appliance industry that does not set a cap on its

investment in scientific research. For research and development, Gree implements a need-based allocation system, which means that it invests as much as it needs. Gree has the world's largest air-conditioning research and development center and has been approved to build a national key laboratory.<sup>[4]</sup> The huge research and development system and R&D strength provide the basis for the strategic layout of Gree's central air-conditioning patents.

In terms of staff training, Gree's awareness of intellectual property rights protection runs from top to bottom in the minds of every Gree employee. Gree pays special attention to the cultivation of full-time IPR talents by providing training courses. Gree's intellectual property team is responsible for the application, maintenance, maintenance, and operation of Gree's central air-conditioning patents, of which the win rate is as high as about 90%.<sup>[5]</sup> This also shows that the patent litigation strategy is implementable due to the availability of a professional litigation team.

## **3. PROBLEMS WITH THE STRATEGIC LAYOUT OF GREE'S CENTRAL AIR-CONDITIONING PATENTS**

Although Gree has achieved good results because of a hybrid strategy of "offensive + defensive", there are still some problems in terms of patent types, International Patent Classification(IPC) ranking, and patent distribution. Especially in the face of the company's sales revenue growth slowdown, the company's shortcomings in the layout of central air-conditioning patents are also increasingly apparent (according to Gree's 2016-2020 annual report, sales revenue are 110.13 billion yuan, 150.20 billion yuan, 200.24 billion yuan, 2005.08 billion yuan, 170.497 billion yuan respectively).

### ***3.1. Insufficient Internationalization of Central Air-conditioning Patent Strategy Layout and Low Number of PCT Applications***

The search results from the Patsnap global patent database show that the number of Patent Cooperation Treaty(PCT) applications in the field of Gree's central air-conditioning technology only occupies a very small part of the total, at the same time, foreign countries such as the United States, Japan, Europe, Canada and other developed countries or regions, of which are comparable to China in the market size. The data shows that Gree started its PCT application work in 2006 and applied for a total of 5 PCT applications in that year, and the number was increased in 2014, reaching 115 applications. By 24<sup>th</sup> April, 2019, The number of patent applications in PCT, America, Europe, Japan were 872, 170, 120, 1016 respectively. It can be seen that Gree focuses on the Japanese market and has made

corresponding patent layouts, however, as a well-known international home appliance enterprise, Gree should not just stick to the domestic market, but think globally and actively promote a higher pattern of patent development strategy.

According to the annual financial report of Gree for 2016-2020, the situation of the Company's revenue from foreign sales and the percentage of foreign sales are displayed in Table 1. The sales of Gree are mainly concentrated in the domestic market, and the sales in the foreign market have averaged approximately 12.22% in the past five years, showing a fluctuating trend, with the gross profit margin of foreign sales being much lower than that of domestic sales. Probably due to the fact that the gross profit margin of the export market is much lower than that of the domestic market, and the pace of internationalization is relatively slow, the company's product sales in the international market and its foreign patent strategy layout are far lower than those of its major domestic competitors, Midea and Haier.

**3.2. Insufficient Diversification of The Central Air-conditioning Patent Strategy Layout and Innovation ability**

Although Gree was listed among the top 10 companies with invention patents from 2015 to 2020, the company's central air-conditioning patent layout mainly focuses on the field of control or security (all of which belong to the F24F group), which is relatively single. The patent strategic layout of intelligence, smart home and Artificial Intelligence (AI) is insufficient and there lack of patent strategic layout to meet the new needs of the "Internet +" era. The inadequacy of Gree's patent strategy in terms of internationalization and diversified layout, etc., has resulted in a lower overall rating in innovation than its two major domestic competitors, Midea and Haier. Figure 2 shows the innovation strategy radar chart of Gree and its rivals Midea and Haier based on the search results of Patsnap global patent database. Gree's sales and gross rates in overseas markets are also much lower than those of Midea and Haier, referring to the financial statements of Gree, Midea, and Haier for the past five years. For example, the year 2020 witnessed a disparity in the gross profit margin for export sales between Gree and other two competitors, with the proportion of 12.13%, while the other companies, Midea and Haier, showed 25.45% and 28.01% respectively.

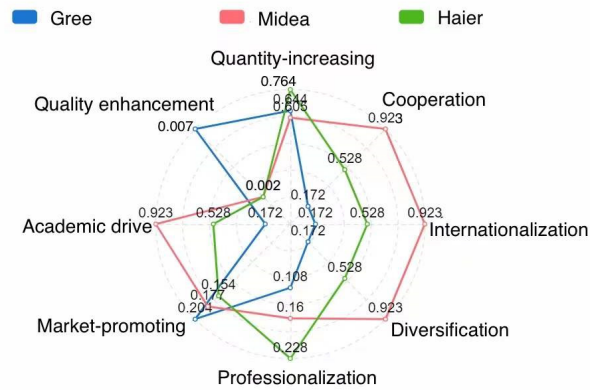


Figure 2. innovation strategy radar chart of Gree, Midea, Haier

**3.3. Inadequate strategic layout of international cooperation on central air-conditioning patents, facing serious challenges from domestic and international competitors**

Even though Gree is gradually implementing its diversification strategy, air conditioners are still the absolute source of sales revenue. The lack of the company's overseas market-oriented geographically offensive patent strategy layout and the low level of international cooperation have made Gree face fierce competition and challenges from two major domestic competitors, Midea and Haier, as well as international companies.

As presented in Figure 2, Gree scored lower than rivals on the internationalization and cooperativeness dimensions, suggesting that Gree's multinational R&D and cooperative R&D capabilities in the central air-conditioning sector are both becoming a disadvantage, potentially losing opportunities to capture profits from overseas markets, as well as being weak in containing the competitiveness of potential overseas competitors at home.

The search results of the Patsnap global patent database exhibit that the number of PCT applications in central air-conditioning of Gree only occupies a small part, facing fierce competition from foreign companies, such as LG and Samsung, as shown in Table 2.

**4. SUGGESTIONS FOR IMPROVING THE STRATEGIC LAYOUT OF GREE'S CENTRAL AIR-CONDITIONING PATENTS**

Given the problems in the strategic layout of Gree's central air-conditioning patents, the following measures can be taken to improve the strategic layout of the company's patents, enhance its competitiveness in the international market, and expand its competitive advantages in the domestic market, so as to achieve the

company's long-term strategic goal of sustainable and healthy development.

#### ***4.1. Implementing overseas market-oriented geographical attack patent strategy layout and enhancing the internationalization of patent strategy layout***

In the implementation of overseas market-oriented geographical attack patent strategy layout, the first thing is to select countries or regions with a more developed economy, large market demand, or high potential for patent strategy layout. Secondly, Gree can select companies with strong R&D strength and willingness to carry out international cooperation. It should strengthen international exchanges in R&D of central air-conditioning technology and transnational cooperation, integrating international R&D resources, obtaining complimentary technical support from foreign enterprises, achieving mutual benefit and win-win, and accumulating experience for enterprises to apply for the strategic layout of patents abroad, so as to complete strategic layout of patents in these more developed overseas countries or regions with large market demand for central air-conditioning as soon as possible. The company will be able to establish its patent barriers, increase the protective barrier for central air-conditioning patents and enhance overseas market share and profitability.

#### ***4.2. Implementing national or regional patent strategies for production and operation to enhance the core power of patent competition***

Apart from implementing a market-oriented geographical offensive patent strategy layout, Gree is supposed to consider a national or geographical patent strategy layout for production and operation in countries or regions with the potential to produce central air-conditionings with cutting-edge technology. Gree needs to make full use of its advantage of highly sophisticated patented technologies in central air-conditioning, in addition to laying out a production-oriented geographical application patent strategy against domestic competitors at home, transforming the technologies that have been granted in China into patent results overseas as well, and make an attempt to select developed and more developed countries or regions such as Japan, the United States, Europe, Canada, and South Korea where there are more international patent applications, and then form a production-oriented geographical patent application strategy for these countries or regions, so as to improve the company's ability to transform its patents into productivity and profitability in these countries or regions and ameliorate its core patent competition.

#### ***4.3. Implementing patent layouts in the areas of intelligence, smart housekeeping, and AI, in line with the trend towards networking, intelligence, and Greening***

In this era of high technology, nothing has so great an effect as keeping abreast of the trend, which is towards networking, intelligence and Greening. The company should take the strategic layout of patents in the field of communication, circuit and network technologies into consideration. On the one hand, Gree is supposed to take multi-mode and smart communication technologies seriously, to achieve the perfect integration of network freedom, remote technology and unmanned operation. Gree should combine the "remote smart scene" technology with the operation control and health degree technology to realize the intelligent removal of aldehyde and automatic operation of the ventilation function according to the indoor environment at any time.<sup>[6]</sup> On the other hand, Gree should take AI technologies into overall arrangement, implementing innovative ideas in central air-conditioning technologies such as commissioning method, operation control, perspective, temperature-setting, and the indoor temperature. For instance, embed AI technologies such as efficient data collection and cloud big data computing into these technologies to construct an AI smart housekeeper scene for central air conditioners. This can realize the visualization of indoor temperature, environmental data and intelligent unmanned debugging operations, and link central air conditioners with other Gree electrical products (such as floor heating, fresh air fan) through big data algorithms.

### **5. CONCLUSION**

Based on the strategy of specialization and technological entrepreneurship, Gree not only attaches great importance to research and development, but also invests a large amount of human and financial resources, which has achieved superb results. The number of invention patents of Gree from 2015 to 2020 ranked among the TOP 10 domestic enterprises, fully demonstrating that it is in a leading position in the domestic central air-conditioning industry. However, there are deficiencies in the international cooperation of patents and the layout of internationalization strategies, which detrimentally affect Gree's ability to develop international markets and international competition. Particularly, Gree's sales revenue has shown a slowdown or even a decline in the past three years when encountering intense competition in the domestic market and inadequate development of the international market. The gross sales margin also described a downward trend, and the inadequacy of Gree's original strategic layout of central air-conditioning patents becomes increasingly apparent: (1) Low degree of



internationalization of the strategic layout of patents; (2) Low degree of diversification of the strategic layout of patents; (3) Low degree of strategic layout of international cooperation of patents.

Given the problems in the strategic layout of GREE's central air-conditioning patents, the following measures can be taken to improve the strategic layout of the company's patents, enhance its competitiveness in the international market, and expand its competitive advantages in the domestic market, so as to achieve the company's long-term strategic goal of sustainable and healthy development. The specific suggestions for improvement are: (1) Implementing overseas market-oriented geographical attack patent strategy layout and enhancing the internationalization of patent strategy layout; (2) Implementing national or regional

patent strategies for production and operation to enhance the core power of patent competition; (3) Implementing patent layouts in the areas of intelligence, smart housekeeping, and AI, in line with the trend towards networking, intelligence, and Greening.

In conclusion, enterprises should adjust their patent strategy layout regarding the changes in the internal and external environment. Otherwise, the company's original competitive advantages may be transformed into disadvantages, and may even be eliminated by the market. Therefore, only if enterprises continuously adjust patent strategy layout, integrating domestic and international innovation and market resources can they actualize sustainable development of core competitiveness in relation to innovation-driven.

**Table 1.** Gree's 2016-2020 Export Value and Fixed Export Ratio

Year	2016	2017	2018	2019	2020
Export value(billion yuan)	162.30	184.94	222.70	208.15	200.21
Fixed export ratio(%)	15%	12.47%	11.24%	10.51%	11.90%
Gross profit margin for export sales(%)	17.15%	10.53%	13.34%	13.50%	12.13%
Gross profit margin for domestic sales(%)	41.21%	39.91%	37.23%	37.02%	36.30%

(Source: Based on data from the Company's annual financial statements)

**Table 2.** Indicators of patent in central air-conditioning of Gree and its competitors

Company	Patentability	Characteristic degree	Novelty	Degree of patents granted	Degree of authorization characteristics	Withdrawal rate	Rejection rate
Gree	11.23	12.13	163.66	9.93	19.05	3%	3%
LG	17.25	15.22	88.81	13.43	20.28	11%	3%
Samsung	13.30	14.92	87.91	10.78	19.01	28%	2%

(Source: Patentics patent database)

**AUTHORS' CONTRIBUTIONS**

Kexin Zhang, Limin Fan contributed significantly to analysis of central air-conditioner patent strategy layout. In view of Gree's internationalisation, diversification and international cooperation in the strategic layout of Gree's central air-conditioning patents, Gree explores and proposes corresponding countermeasures and suggestions for the implementation of an offensive strategic layout of patents in overseas market-oriented regions, the strategic layout of patents in countries or regions of production and operation, and the strategic layout of patents in the fields of intelligence, intelligent housekeeping and artificial intelligence(AI), taking into account the development strategy of Gree, its patent strategy, the situation of its competitors and the

development trend of the industry, and with regard to the problems in its patent strategy.

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