

## The Opportunity and Requirement of Commerce and Technology Cooperation

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The development of air conditioning industry must be in excellent economic environment and relies on the development of construction industry which is listed as the national corner stone industry. And the dwelling house constructing will be put in the first place. APEC Meeting was successfully held in Shanghai this year. New types of buildings and the reconstruction of the old city which are mostly using central air conditioning system attracted the eyeball of the whole world. By the reason of the grand area and greatly different climate, with the development of economic, it is the main requirement to perfect the public and living environment. It is not in other countries and regions does it have so big air conditioning market which offers good opportunities for air conditioner heat pump research and manufacturers.

### 1. More open and flourish economic situation

China economic is becoming more prosperous every day with reforming, and has gained great development. In recent years, China economic has gone through the serious difficulties and successfully tided over Asia financial crisis in spite of serious international economic environment, and it makes national economic develop continually and speedily. During “the ninth five-year plan”, economic running quality and efficiency has been improved, comprehensive national power has been strengthened, GDP annual growth rate has been up to 8.3%. The people’s living standard and social development level has been improved due to strengthened economic power. And the people’s general living standard has been up to comparatively well off. The demand for house, automobile and travelling which were unreal dreams in times of economic shortage became a large market and attracted the huge amount of investment. Real estate investment kept strong increasing trend of 28.2% in the first half of this year mainly pulled by dwelling house. And the main body of the purchasing group has been changed from companies to civilians. The sale of commercial houses was 95,530,000 m<sup>2</sup> from January to November in 2000, increasing 35% which showed the coming of the commercial house times and the ending of 40 years’ welfare house allocation system. For example, from 1997 to 2000, the proportion of individual buyers in Shanghai increased 30% to 93.6%.

It is required to carry out urbanization strategy into execution deeply and promote city and village developed together in “the tenth five-year”

plan. The step of urbanization strategy has been quickly with economic increasing and social progress since economic reform. From 1978 to 2000, the number of cities increased from 193 to 663, the number of towns increased from 2173 to 20312, the proportion of population in city and town increased from 17.9% to 36.1%. With the development of economic in city and town, by the end of 2005, it will increase 9 billion natural gas for civil used, fulfill 2.7 billion areas in dwelling house construction, residential living area per person up to 22 m<sup>2</sup>.

Summing up, pulled by the economic and real estate investment increasing, especially from 1980s', with the remarkable improvement of people's living standard, the residence condition and electric power supply as well as the marketplaces and multi-floor buildings' construction, the air conditioning and heat pump industry has been greatly promoted. The yearly production of room air conditioners including heat pumps was up to 15 million (including packaged ones), 60% of them were heat pumps. At the same time, the packaged heat pumps and heat pump type chillers has been developing, it has been already in large country in number which heat pumps were used in air conditioner in the world. At the time of planned economy, it was focus on the dressing warmly and eating one's fill, so people were not able to pay attention to the problem of cooling in summer and heating in winter in many of regions. But now, with living standard upgrading, people desire the household heating and air conditioning equipment which is environment protecting and energy saving. In recent years, the inflow of foreign investment and technology as well as national production level has been improved. The appearance of mini-type air conditioners, efficient and safe boilers using natural gas or oil, auto controllers enabled the air conditioning and heating equipment to develop to mini-type, familylized, intelligence and environment protection. It is possible to solve the problems of low temperature in winter, high humidity and uncomfortable living environment in the regions of south of Yellow River and middle end of Yantze River besides North China. In despite of the many choices of commercial and household air conditioning and heating system, it exists the problems about the information and technology condition, marketing development, engineering practice. But with our modern life coming, commercial, household construction and air conditioner and heater must have been developed. It will become the main part of construction and residence industry in 21 century.

## 2. Application and the future of heat pump technology

In recent years, heat pumps developed quickly, the cooling capacity of heat hump units is 60% account for general air conditioning equipment cooling capacity in our country. More and more heat pumps are applied in industry product course. There are following points that promoting the development of heat pumps in our country:

- (1) For the perfect energy saving effect, the development of heat pumps was promoted by the promulgation and implementation of “the law of energy saving”.
- (2) The environment protection policy of reducing the CO<sub>2</sub> release and the phase out of CFCs refrigerant in due time.
- (3) The implementation of “the design standard of energy saving in civil construction”, which reduced the energy consumption and the cost of heat pumps in heating period, strengthen the competition edge of heat pumps and central heating system.
- (4) The adjustment of the energy framework to solve the problems of mass energy consumption and pollution in big and middle cities provides the condition for application of heat pumps.
- (5) More reasonable energy price after adjustment and plenty of investment and electricity promoted the development of heat pumps.

There are different types of heat pumps according to medium and pipeline: air-air heat pump units (suitable for resident), air-water heat pump units (suitable for middle China where the result temperature is higher in outside in winter), water-water heat pump units ( steady performance, high COP) and water-air heat pump units (water source heat pump units). There are three directions of development of heat pump units: the type of air cooled heat pump units developed rapidly and are utilized popularly; the type of absorption chillers developed quickly with wholly owned patent advanced technology; room air conditioners is the main product. China is the important production country in the industry. The products account for 20% in total export and the technology begin to be exported. There are some problems in the technology. air cooled heat pump units are big in size and high in noise. Defrosting technology is unripe; The efficiency of absorption chillers are low; room air conditioners' problem is the pollution of noise, heat and refrigerant. In the future, the tendency of heat pump is to develop high efficient heat pump and super heat pump system. The tendency of reciprocating heat pump is control in refrigerant side, compressor's energy control, design of compressor and new refrigerant technology. The tendency of absorption heat pump and heat exchanger is the utilization of new operation cycle (e.g. multi-step cycle) and the development of new refrigerant to solve the defects of Libr and water or ammonia mixed refrigerants. Compress-absorption heat pump combines the vapor compressing cycle and absorption cycle. Its tendency is the application of new operation cycle to raise the temperature and develop the new refrigerant better than ammonia-water mixed

refrigerant. High temperature heat pump is also the important tendency of the development of heat pump technology.

View the development of heat pump market, our country's policies on energy saving and environment protection, huge construction market, abundant industry disposal heat resource, will promote greatly the development of heat pump market. The proper regions for using heat pump are Changjiang River drainage area and part of the North China, where demand for huge amount of heating supply in all types of construction, especially for heat pump units in dwelling house. It estimated that air cooled integrated units, air cooled heat pump units and water source heat pump units would be increased rapidly. Additionally, there is great potential the heat pump utilization in the industry. In recent years, with the rapid development of air conditioning technology, new production and new technology appeared in the market constantly, but there was still a long way to go to reach the aim of safety operation, high efficiency and environment protection. It may enhance the level with the help of overseas advanced technology and management. But only those technologies that are suitable for Chinese situation can it promote the development of Chinese manufacture industry.

China has great population, broad land and different climate from latitude 3 degree north to latitude 53 degree north. The climate in Changjiang River area that are different from other countries in the same latitude is hot in Summer and cold in Winter. Most part of this area, which is between latitude 24~33 degree north and longitude 100~120 east, along Changjiang River, accounts for 15% the nation areas, is the most developed region. The main climate characteristic of the region is mugginess in summer and clammy in winter. We have been solving the uncomfortable problems by using variable air conditioning and heating method in recent years. It is our main objective to choose the best system and equipment to solve the different problems in utilization. The main problems are: defrosting control in high humid area in winter, enhancing energy efficiency solving shortage of heat supply when temperature is low in winter; reducing the cost and individual measurement, charging reasonably in individual residence regions which using central cooling and heating system.

After 1995, some products were marketed from Changjiang River area to Yellow River area and have been used in Beijing, Tianjin, Shandong and northwest provinces. It is practicable that using air source heat pump in north China in winter not only in the technology but also in the cost. With the continually researching, heat pump units will be more popular and developed. Now, the research on water circle heat

pump system and air source heat pump and water source heat pump coupling 2-class heat pump system using in most cold region is also starting.

Water source and geothermal source heat pump can not only satisfy the clean heating but also is much better than air source heat pump and in the respect of higher energy efficiency and application range. However, the research and development and production is slowly in our country. So under the conditions of water and energy resource of our country, it has great market foreground and opportunity to research and promote the production of water source and geothermal source heat pump.

### 3. Optimizing Energy Framework, promoting sustainable development

The production system of national energy industry has been in third in the world. According to the energy development plan of the country and “the tenth five-year plan”, national first-time energy production volume will reach 1.32 billion tons of standard coals by the year of 2005. The annual growth rate will be 3.87%, among which, 13.19% for natural gas, 8.38% for water and electricity, 29.67% for nuclear electricity. The installed capacity in China will be up to 0.37 billion kW and the total generation capacity will be 1730 TWh, the annual growth rate will be 3.2% and 5.08% respectively.

From energy construction, the first-time consumption volume of coal will be reduce 3.88%, the clear energy like natural gas and water source electricity will be increasing 5.6% and up to 17.88% in 2005 comparing that in 2000.

From energy efficiency, it will be up to 36% in 2005 increasing 4% comparing that in 1997, the energy consumption will be reduced 15~17% in unit production value.

In the next five-year-plan, optimizing framework will be the very most important point in energy work, changing the situation quickly that coal is 70% in first energy. At the same time, try to increase energy efficiency, protect environment, realize sustainable development. With the accomplishment of “carrying natural gas from west to east, electricity from west to east” project, the government of Shanghai plan to reduce the proportion of coal to less 55% and increase natural gas to 10% in 2010. The Beijing government will increase the proportion of high quality energy in end energy consumption to 75% in 2005 and 83% in the future. Refrigeration and air conditioning heat pump industry must be along with the situation, adjust the product construction, realize the diversification of cooling and heating source of air conditioners. Using natural gas in air conditioning heat pump besides in absorption chillers,

the research and application of gas heat pumps and dehumidifying air-conditioner (absorption air conditioning systems) has been listed into the schedule. The experts point out that it has high efficiency on one-time energy consumption and the large market and good research condition in our country is ready, we should strengthen the research work. Besides this, the development of household central air conditioning system, promoting regional heating and cooling technology and applications of energy saving methods are the new concept and technology that Chinese market is urgent demands in the future.

#### 4. Cooperation—Technology and Investment

International finance flow into our country is more than 40 billion US dollars every year, that makes China become the No. 1 developing country which attracts foreign directly investment. The inflow of investment and technology directly stimulates the economic continually increasing. The foreign investment enterprises accelerate the steps of industry construction adjustment of our country. The introduction of the advanced technology, equipment and management experience promotes the improvement of the relative industry. It is in research, the proportion is up to 45%, that the foreign investment machinery and electronic enterprises which has their own R&D department. The export of the foreign investment enterprises has been 50% of the total export volume and 52.1% of the total import volume of the country by the year of 2000. They are playing more and more important role in import and export trade.

Refrigeration and air conditioning industry in China is more open and globalized in machinery industry. From solely introduction of technology and equipment in early 1980s to the cooperative enterprises to JV and wholly foreign owned enterprises introducing foreign investment, as well as the state owned and private enterprises, there are many types of enterprise with different ownership. The market share of Chinese refrigeration and a/c industry is 10% account for that of the whole world. The production quality, performance and technology has been improved a lot and the distance with advanced level has been reduce gradually. According to the statistics of CRAA in 1999, there were about 120 foreign investment enterprise, the total investment was nearly 1 billion dollars, 55% of the total investment. 9 of them were the wholly foreign owned enterprises. The cooperative partners were including almost all the world famous multinational enterprises, the product range covered refrigeration equipments, air conditioners heat pumps, components and materials and the highlight was air conditioners and heat pumps. There were 51 companies mainly in east costal area, Jiangsu, Zhejiang and Shanghai, the others were in North China and Shandong. Up till now, 20% of the best companies in the industry were foreign investment enterprises which produced advanced or nearly advanced products and were the most

profitable in the industry.

Today, after last statistics two years ago, China has get the great improvement not only in opening degree but also the investment environment mainly in following three points:

First, China will provide more convenient market environment for foreign investment after joining into WTO. According to the promises, China will cut down the tariff step by step, amend the three protocols on the foreign investment enterprises, cancel the restriction on stock holding proportion and the requirement on foreign exchange balance, protect effectively the property right.

Second, develop new investment channels, encourage the foreign companies' participating in state companies reconstruction, enhance the technology level of foreign investment, promote trade and technology cooperation with the foreign companies of small and medium enterprises.

Third, actively carry out the west development strategy; strengthen the reconstruction of the productivity when improving the infrastructure of the west provinces; encourage the foreign investment enterprises introduce, develop and innovate new technologies by issuing series of favorable policies.

The above-mentioned three points are the epitome of the encouraging situation in refrigeration and air conditioning industry. Now, the number of foreign investment enterprises is increasing 20% than that of 1999. Besides the new projects, the former ones invest more and more wholly foreign owned enterprises has been established. At present, the world economic has been entered into new adjustment rotation. During the world industry construction adjustment, the transferring of the manufacture industry in developed countries to China has been accelerated. The MNCs of refrigeration and air conditioning heat pump are beginning to establish production base in China using low cost labor and excellent technology and equipment, supplying the high quality products to the world market. In the intensive competition of the world market, the manufacture of air conditioning heat pumps using in household and commercial systems is the industry with comparatively competition edge. Besides the domestic market, the overseas expansion strategy has been carried out. The export of some enterprises reached 30% of total production volume and more of them has established their own famous brand. The foreign enterprises with technologies and capitals establish wholly owned enterprises or joint ventures in China. Combining the advantages of Chinese labor intensive with technology intensive, they are very probably in the position of developing the global brand with international competition edge.