Proceedings of ISEC2006
ASME International Solar Energy Conference
July 8-13, 2006, Denver, CO

ISEC2006-99011

CHINA ENERGY LABEL: A strategy to encourage energy conservation and the challenge ahead in power markets

Zhun Yu **Yingbai Xie** **Youyin Jing** **Guohua Shi**

Institute of Energy and Power Engineering, North China Electric Power University, Baoding China

ABSTRACT

This paper aims to elucidate China energy label and《The minimum allowable values of the energy efficiency and energy efficiency grades for room air conditioners》implemented recently (2005). Energy efficiency ratio (EER) considered in this standard was compared with coefficient of performance (COP), based on it, two air-conditioners with different EER were calculated to be contrasted by their total cost during the operational life. At the same period, the content, significance and result of the energy standard was analyzed. The results show that air-conditioners with higher EER can be more economical, and they can obtain better qualities as well as utilization effects. Also, this standard determines the energy efficiency grade index of room air-conditioners below 14 kW and the market entrance admission index of energy efficiency. Starting this standard requires that each air-conditioner should have an energy label, thus market transformation goals can be achieved, consequently, it will accelerate the advancement of enterprises and reinforce the energy-saving management of the government. However, designers, manufacturers and high efficiency product sellers in the power market will be challenged.

1. INTRODUCTION

In recent years, there was a rapid development of national economy in China. Its steady and sound development provided a favorable external macroscopic environment for air-conditioning industry, meanwhile, not only a significant investment circumstance but also a stable base were supplied for the development of consumer market. As a power consuming industry, air-conditioning takes a remarkable position on power supply. In 2004, the power consumption of air-conditioning in China was more than 400 hundred million kilowatt-hours, which made up 2% of total social power consumption. An essential reason of the above facts is that many existing air conditioners have low energy efficiency; it is obvious that some measures, especially implementing relative polices, should be performed. However, the first energy efficiency standard issued in 1990 didn't obtain its primary objective due to two facts: firstly, it had some irrational specifies since its cost-effectiveness analysis was not sufficient, secondly, the government and society didn't realize the importance of carrying out this standard. Recently, with the appealing of regulation and control on air conditioning industry policies, in addition, the development and production levels for air conditioning were greatly improved, it is necessary to revise and define energy efficiency standard completely. On March 1 of 2005, combined with *National Development and Innovation Committee* and *Quality Supervision , Inspection and Quarantine of the People's Republic of China*, *National*

Standardization Committee issued 《The minimum allowable values of the energy efficiency and energy efficiency grades for room air conditioners》. In this standard, EER is mainly taken into account, moreover, following aspects are regulated: allowable values of the energy efficiency, evaluation of estimate for energy saving, criterion for energy efficiency grades, experimental methods and test regulations.

Table 1 Energy efficiency grade index (R/A:<14KW)

Type	Normal refrigeration output (CC) W	Energy efficiency grade (EER)W/W				
		1	2	3	4	5
Integral type	/	3.10	2.90	2.70	2.50	2.30
Divided type	CC≤4500	3.40	3.20	3.00	2.80	2.60
	4500<CC≤7100	3.30	3.10	2.90	2.70	2.50
	7100<CC≤14000	3.20	3.00	2.80	2.60	2.40

Table 2 The minimum allowable values of the energy efficiency of air conditioner (Implemented on Jan 1, 2009)

Type	Normal refrigeration output (CC) W	Energy efficiency grade (EER)W/W
Integral type		2.90 (original value is 2.70)
Divided type	CC≤4500	3.20 (original value is 3.00)
	4500<CC≤7100	3.10 (original value is 2.90)
	7100<CC≤14000	3.00 (original value is 2.80)

There are series of parameters for air conditioner while its performance is concerned. Among these parameters, EER (energy efficiency ratio) is the most important as well as COP (coefficient of performance). A schematic of the refrigeration unit in air conditioner is shown in Fig.1.

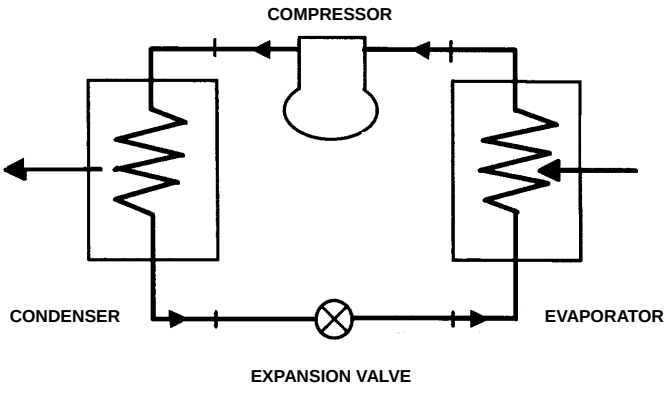

Fig.1. Schematic of the refrigeration unit

EER is the ratio between cooling output and electrical input, while COP is the ratio between heat rate of evaporator and compression work. EER and COP can be calculated from

$$EER=Q$$

And

$$COP=QE/WC$$

Where:

QE – heat rate at evaporator, kW

QP – rate of primary energy, kW

WC – compression work, kW

2. DESCRIPTION OF THE STANDARD

2-1. Instruction Principles

Instructed with the following five principles, this standard was set up: ① international relative standards should be fully considered as well as the state of label grades. ② it should be in accordance with national energy-saving policies and environmental protection policies. ③ To be in connection with developing levels of air-conditioning industry in China. ④ Chinese traditional customs should be reflected within the standard. ⑤ the standard should adapt to industrial testing levels and accuracy.

2-2. Main Indexes In The Standard

The standard ensures the energy efficiency grade index of room air-conditioner below 14 KW and the minimum allowable values of the energy efficiency after 4 years, the specific data are shown in Table 1 and Table 2.

In these tables, grade 2 represents the value of energy conservation, which means the optimal equilibrium value between capital construction expense and operating cost, it is calculated by production cost, power rate (0.60 yuan per KWh) and working time (500 hours annually) for each machine, in

case that power rate and run time are increased, the equilibrium point will move towards grade 1; at the same time, grade 5 is a critical value and manufacturers can proceed with production and selling unless the measured value of their products is higher than it.

Implementation of this standard requires that each air-condition should have an energy label (see Fig.2) on it as well as its leave factory documents and corresponding records ought to be put on in relative departments, meanwhile, if the value of optional examination is lower than standard values, the manufacturer will be punished.

3. ACTUAL SIGNIFICANCES

Besides ameliorating the status of electric force in short supply, the implementation of energy label has several actual significances.

3-1. Results On Market

The market can be purified as the quantity of inferior air-conditions is decreased, thus the variety of market will influence enterprises less.

3-2. Cost Saving

Although products of high EER is correspondingly expensive, it is economical for consumers after a period of time while operating cost is considered. Table 3 is the compared results of two products in the same brand. The difference of prices is 480 yuan, and saved power rate can be calculated from:

$$(890-760)\times 12\times 100\times 0.55\times(6\sim 8)/1000$$
$$= \quad 514.8\sim 686.4 \text{ yuan}$$

Table 3 Compared results of two products in the same brand

Product name	EER	Price (yuan)	Working time annually (day)	Working time daily (hour)	Power rate (yuan/KWh)	Life of air-condition (year)
Air-condition 1	3.42	1970	100	12	0.55	6-8
Air-condition 2	2.92	1490	100	12	0.55	6-8

3-3. Product Quality

The quality of air-conditioning can be improved. Air conditioners of high EER will adopt compressors of high quality and performance, the manufacturing technique and area of evaporators and condensers will be also required strictly, in addition, the grade of other devices, such as electric engine, will be advanced.

3-4. Application Effect

Satisfying applied effects can be achieved. As the high integral performance and optimization of system design, air conditioners of same capacity with high EER will get better utilization effects.

4. EXISTING PROBLEMS AND SOLUTIONS

4-1. Existing Problems

So far the standard has been implemented for a year, however, several problems still remain to be solved: ① few products are covered by energy efficiency standard. Up till now, only 19 standards were issued and their ranges were limited to only household appliances so that a rounded system has not been established. ② it takes too long time to revise the standard. ③ there was no effective way to put the standard into effect. ④ corresponding laws which can support the execution of these standards are not perfect. ⑤ the expenditure spent on standardizing energy efficiency is not sufficient. ⑥ the study on energy efficiency standard and label is not adequate relatively. ⑦ the management system for energy efficiency standard and label should be further amended. ⑧ social recognition to energy efficiency standard is not satisfying.

4-2. Solutions of Developing Energy Efficiency Standard in China

Following solutions should be adopted to improve the situation:

① standard revision and label design must be publicized, namely work scheme ought to be indicated to society so that reviewing information can be obtained in time. ② the efficiency of standards should be increased which implies a reduction of learning and developing time. ③ the fund on projects for standards and labels should be increased by the government since these projects are complicated system engineering and a great deal of work such as data collection and model establishment need to be accomplished. ④ propaganda, training and execution on these standards should be emphasized. ⑤ in the course of establishing energy efficiency standard system, following factors should be considered synthetically: energy-saving amount, cost benefits, environmental benefits, implementary capability, existing

standards and international coherence. ⑥ the contained objects of these standards should be increased stage by stage. ⑦ supporting policies based on the market should be executed effectively.

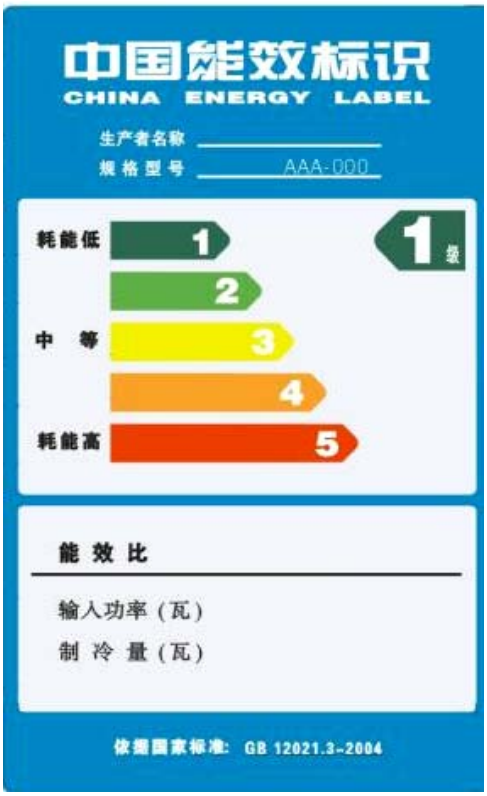

Fig.2. China energy label

5. CONCLUSIONS

In this paper, the standard for energy efficiency and label is presented. This standard establishes the permissible entering index of energy efficiency for room air conditioner in China, meanwhile, it supplies important technical documents for developing the authentication of energy-saving products and the implementation of energy label. Thus it will function on eliminating high power-consuming products, accelerating the development of enterprises as well as reinforcing energy conservation management of government.

REFERENRES

[1] Jiangsu economic. Power consumption of air conditioning is surprising, enterprises of household appliances will unite. [EB/OL]. http://www.zikoo.com/msgdata/article/3155.html. 2005-04-15/2005-07-12

[2] ASHRAE Handbook, Fundamental 1997

[3] Cheng Jianhong, 2005, “Draft and role of energy efficiency standard and label for air-conditioning”, Power Dsm, 7, 4, pp: 12-15

[4] Lv Wenbin, Li Aixian, 2001, “Comprehensive riview on international energy efficiency standard and labeling, certification program (first part)”, Power Dsm, 3, 2, pp: 57-60

[5] Lv Wenbin, Li Aixian, 2001, “Comprehensive review on international energy efficiency standard and labeling, certification program (second part)”, Power Dsm, 3, 2, pp: 57-60

[6] Lin Ling, “Problems and solutions for energy efficiency standard in China”, World Standardization & Quality Management, 6, pp: 42-45