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BERKELEY NATIONAL LABORATORY**

White Paper on Energy Efficiency Status of Energy-Using Products in China (2011)

中国用能产品能效状况白皮书（2011）

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Preface

The year 2010 was the closing year of 11th Five-Year Plan. Various departments of the State Council, multiple levels of local government, numerous industries and sectors are taking energy conservation very seriously. A series of policies and measures have been issued to promote energy conservation, energy efficiency standards and labeling have been continuously improved, the research and development of energy efficient technology have been actively encouraged, energy efficient products have been actively promoted, energy management has been a focus for improvement, and industrial structure optimization has been further developed. At the same time, in order to effectively guarantee to the completion of the energy conservation goal of the 11th Five-Year Plan, integrated measures such as strengthened service and enhanced supervision and inspection have also been emphasized.

2010 is also a year to carry forward these tasks. As the world's second largest economy, China is facing the challenges of improving economic structure, mitigating energy supply and demand pressures, and improving energy conservation and emissions reduction, key elements of the recently ended 11th Five-Year Plan and upcoming 12th Five-Year Plan. 2010 provided a perfect viewpoint for reviewing energy efficiency improvement of energy-using products in the 11th Five-Year Plan, while objectively analyzing the development status of energy efficiency as a whole and energy efficient technology in both China and foreign countries, and forecasting the energy efficiency improvements of energy-using products in the 12th Five-Year Plan.

Based on the foundations of last year's White Paper, this year's paper summarizes developments of national energy conservation management in 2010, such as energy efficiency policies, standards, and labeling. Based on related data from household appliances, commercial equipment, office equipment, industrial equipment, and lighting products, it analyzes and updates the energy efficiency profile of key energy-using products, showing the reader the latest energy efficiency level and market development of major energy-using products for end users. Also, it summarizes policy and technology measures for further increasing the energy efficiency of energy-using products and provides a scientific prediction of the energy efficiency potential of these products.

This year's White Paper centers around two themes: "review" and "outlook". The "review" is based on the objective, complete, and accurate data of product energy efficiency. It seeks to reflect the complete energy efficiency status profile of energy-using products in China, and present the significant achievements of energy conservation and emission reduction in China during the 11th Five-Year Plan period to the nation and the world, with a focus on improvements of the energy efficiency of energy-using products. The "outlook" is a summarized analysis of policies, technologies, and specific measures for improving energy efficiency of energy-using products. It encourages industrial upgrade and promotes high efficiency energy-

using products, with a goal that these experiences and inspirations can be a useful reference for planning and implementing energy conservation tasks associated with the 12th Five-Year Plan, as well as improving the energy efficiency of related domestic and international products.

During the compilation of this White Paper and the implementation of related projects, experts and scholars from Beijing University of Technology, Hefei General Machinery Research Institute, The National Quality Supervision and Inspection Center for Compressor and Refrigeration Equipment Products, International Copper Association Ltd., China Quality Certification Center, China Household Electrical Appliances Association, China Refrigeration and Air-Conditioning Industry Association, Tsinghua University, Energy Research Institute of National Development And Reform Commission (NDRC), Development Research Center of the State Council (DRC) provided strong support and enthusiastic assistance. We wish to express our sincere appreciation to all of them.

We wish to acknowledge relevant leaders and experts from the Department of Resource Conservation and Environment Protection of National Development and Reform Commission (NDRC) and Industrial Standards Department of the Standardization Administration of China (SAC) for providing support and guidance.

Finally, we sincerely acknowledge the Energy Foundation and the International Copper Association Ltd. for helping to compile this White Paper, and the experts from Lawrence Berkeley National Laboratory for providing technical support.

Due to some limitations in the authors' knowledge, there may be some unavoidable imperfectness in this White Paper, and so we kindly request our readers provide feedback.

The Authors

July 2011

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1. Overview

During the closing year of 11th Five-Year Plan, the enforcement of major energy efficiency policies, implementation of energy efficiency tasks in each region and sector, and unprecedented target and responsibility assessments were all emphasized, so as to guarantee the achievement of the energy conservation and emission reduction goals of the 11th Five-Year Plan. Among them, the following actions targeted major energy-using products: active promotion of energy efficient products and technologies; the publishing of a promotion catalogue of key national energy saving technologies (3rd edition); continuous implementation of the “energy-saving products discount program” project, specifically for the promotion of highly energy efficient air conditioners, energy efficient automobiles and energy efficient motors, new energy automobiles, high efficiency lighting equipment (to replace all low-efficiency lighting equipment for city street lighting, public areas, and public institutions in eastern and central regions as well as western regions where possible); expansion of the coverage of energy efficiency labeling, along with the publishing of the 6th edition of energy efficient label products catalogue; implementation of mandatory and prioritized energy efficient products in government procurement program, thus perfecting the dynamic management system of the government energy-saving product procurement list; implementation of a faster schedule of improvement for legislation and standards; development of energy efficiency management regulations, energy measurement supervision regulations, and energy-saving product certification administration regulations for key energy-users; and lastly development and improvement of energy efficiency standards for energy-using products as well as energy consumption standards for buildings.

This White Paper focuses on the areas and products involved in the above tasks, based on the *White Paper - Energy Efficiency Status of Energy-Using Products in China (2010)*, here referred to as “White Paper 2010”, which analyzed the energy efficiency status of 21 typical energy-using products¹ in five sectors: household appliances, office equipment, commercial equipment, industrial equipment, and lighting equipment. Table 1 illustrates the detailed product coverage for this year’s paper, noting the addition of three household appliance items (automatic electric rice cooker, AC electric fan, and household induction cooktop) and one industrial sector item (three-phase distribution transformer).

¹ In *White Paper – Energy Efficiency Status of Energy-Using Products in China (2011)*, the lighting equipment sector includes 5 key energy efficient products.

Table 1. Energy-using products covered by White Paper 2011

Category	Number of product	Product covered
Household Appliances	9	room air conditioners, refrigerators, electric storage tank water heaters (electric water heaters for short), variable speed room air conditioners (variable speed air conditioners for short), household gas tankless water heaters (gas water heaters for short), washing machines, automatic electric rice cookers, AC electric fans and household induction cooktops
Office Equipment	2	copy machines, computer monitors
Commercial Equipment	3	unitary air conditioners, multi-split air conditioning (heat pump) system, water chillers
Industrial Equipment	2	small and medium three-phase asynchronous motors (motors for short), three-phase distribution transformers
Lighting equipment	5	compact fluorescent lamps (including single-capped fluorescent lamps and self-ballasted fluorescent lamps for general lighting), double-capped fluorescent lamps for general lighting, high-intensity discharge (HID) lamps (including high pressure sodium lamps and metal halide lamps)

As indicated by survey, the total national electricity consumption in China reached 4.1923 trillion kWh in 2010 with an increase of 14.6% year on year and a growth rate 8.6% higher than 2009.

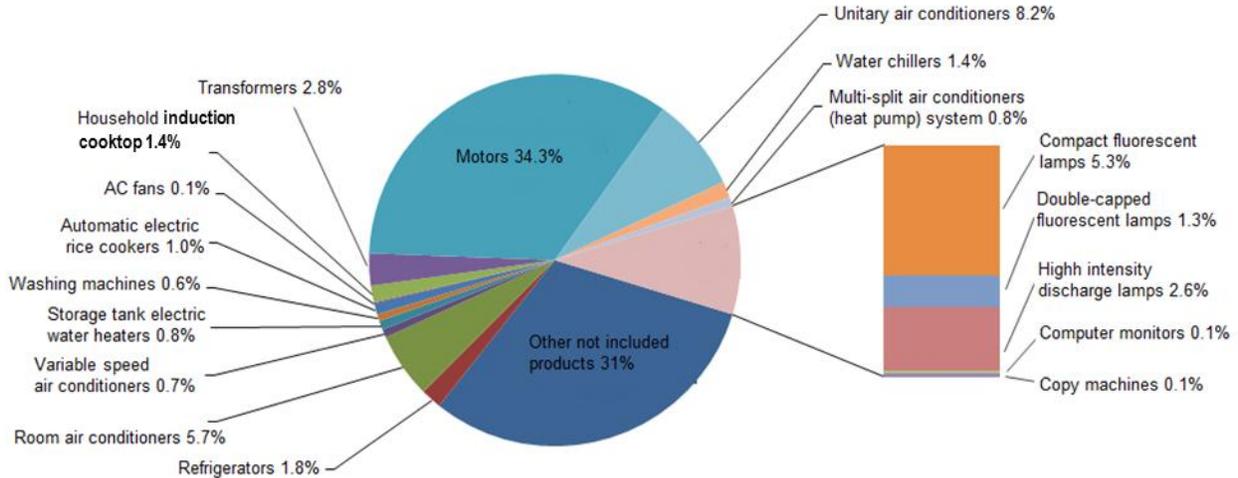


Figure 1. The share of electricity consumption for China energy-using products in 2010²

The electricity consumption of 21 energy-using products covered in this White Paper totaled 2.8802 trillion kWh³ in 2010. Figure 0-1 illustrates the percentage of electricity consumption of these 21 products in total national electricity consumption. As in 2009, the electricity

² Not including the gas saving of gas tankless water heater.

³ This value is the simple summation of the electricity consumption of the products covered in this report. In practice, the electricity consumption of small and medium three phase asynchronous motors may overlap with that of other products.

consumption of small and medium three phase asynchronous motors in the industrial sector, commercial unitary air conditioners in the commercial equipment sector, and room air conditioners in the household appliance sector are still at the top of the list, responsible for 34.3%, 8.2% and 5.7% of the total national electricity consumption in 2010, respectively. Obviously, these products remain a focus of energy efficiency now and in the future.

Table 2 provides the energy savings of typical energy-using products in 2010. The total energy savings of 21 typical energy-using products are 7.68 billion kWh, or 950,000 tons of standard coal equivalent (tce)⁴. Figure 0-2 illustrates the year-on-year energy savings of newly added products in 2010.

(1) The electricity savings of room air conditioners, small and medium three phase asynchronous motors, and three phase distribution transformers are significant. In total, they are 2.27 billion kWh, 1.69 billion kWh, and 1.62 billion kWh respectively, and they account for 71.9% of the total electricity savings of 21 typical energy-using products.

(2) The electricity consumption of unitary air conditioners, high-intensity discharge lamps, and washing machines show negative savings. As a heavy electricity user among commercial energy-using products, the large negative savings of unitary air conditioners should be brought to attention.

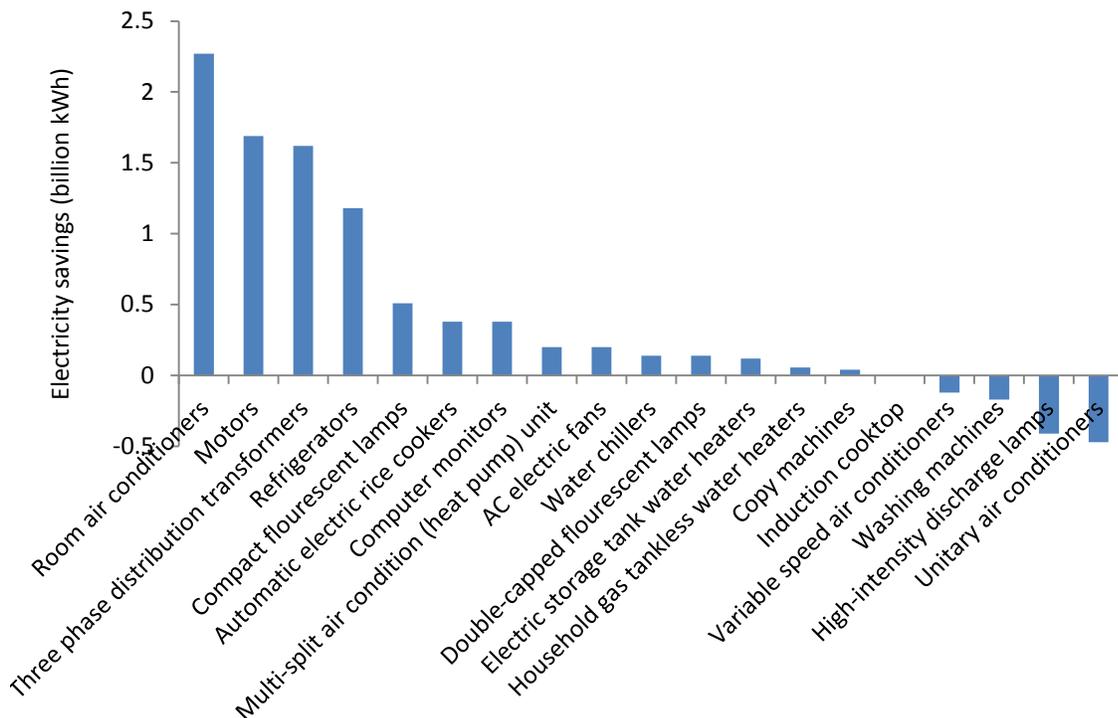


Figure 2. Year on year electricity savings of newly added typical energy-using products in 2010

⁴ Calculated using the heat-equivalent value of electricity of 0.1229 kilograms coal equivalent (kgce)/kWh

Table 2. Energy savings of typical energy-using products in 2010

		2010 total electricity consumption of products	2010 newly added product single unit (set) year on year annual electricity savings ⁵		2010 newly added products year on year total annual energy savings	
			Billion kWh	Absolute value (kWh)	Change (%)	Billion kWh
Products						
Household appliances	Refrigerators	76.41	19.1	8.1	1.18	145
	Room air conditioners ⁶	241.01	44.8	5.7	2.27	279
	Variable speed air conditioners	30.18	-10.9	-3.3	-1.2	-15
	Household gas tankless water heaters ⁷	—	—	—	—	7
	Electric storage tank water heaters	33.12	9.3	2.7	0.12	14
	Washing machines (impeller)	11.91	0	0	-0.17	-21
	Washing machines (drum)		-21.8	-8.2		
	Automatic electric rice cookers	40.09	10.4	5.8	0.38	46
	AC electric fans	3.86	18.7	47.3	0.20	24
	Household induction cooktops	59.68	9.8	3	0	0
Office	Computer monitors	5.52	9.5	21	0.38	46
	Copy machines	3.51	70.2	19.7	0.04	5
Commercial	Unitary air conditioners	341.76	-500.4	-3.6	-0.47	-58
	Water chillers	58.00	868.2	1.3	0.14	18
	Multi-split air condition (heat pump) system	34.42	342.8	4.4	0.20	24
Industrial	Motors	1,439.17	61.0	0.5	1.69	207
	Three phase distribution transformers	118.32	1,740.0	3.4	1.62	199
Lighting ⁸	Compact fluorescent lamps	220.45	0.6	1	0.51	62

⁵ Energy consumption and energy-savings in this article are based on the average value of product model data survey.

⁶ Based on a research report on the status of household appliance utilization, room air conditioner annual usage averages 1,136 hours, from which annual electricity consumption is calculated

⁷ The tce of gas water heaters is the conversion from gas savings.

⁸ Based on the latest survey, lighting product electricity consumption in 2009 has been updated.

	Double-capped fluorescent lamps	53.51	3.1	1.9	0.14	17
	High-intensity discharge lamps	109.30	-14.8	-0.7	-0.41	-51
Total⁹		2,880.22	—	—	7.68	950

As for trends among energy-using product sectors, the overall energy efficiency of household appliances, industrial equipment, office equipment, lighting equipment and commercial equipment were affected by different policies, technologies, market, legislation, standards, and other factors, such that each sector showed a different trend of change.

1.1 Household appliances sector – continued leadership

As a key area covered by energy saving policies and a sector which has widely implemented energy efficient standards and labeling systems, household appliances have made significant progress in energy efficiency in 2010 as it had in previous years. The electricity savings of nine household appliances covered in this White Paper reached 3.9 billion kWh, but trends in energy efficiency diverged. The average energy efficiency of new room air conditioners and refrigerators increased about 7% (based on models). As the focal point of the “energy efficient products discount program,” “rural area household appliance subsidy program,” “household appliance old-for-new exchange program,” “government procurement program for energy efficient products”, and other programs, the energy efficient product market for room air conditioners was established, and enterprises became a driving force for implementing energy efficiency, technology development, and product upgrades. Thus, the energy savings of the products continued to grow rapidly from 2009 and reached 2.27 billion kWh in 2010, becoming an example of rapidly increased energy efficiency in energy-using products. The energy efficiency achievement of gas water heaters, electrical water heaters, washing machines, and electromagnetic stoves either stalled or declined as energy efficient policies either did not cover or were less effective in these areas.

1.2 Industrial equipment sector – groundbreaking advances

Due to the energy-use characteristics and system complexity of the industrial sector, energy efficiency of typical industrial equipment has been a key and difficult area for long period of time. In June 2010, the most important energy-using equipment in industrial sector – small and medium asynchronous electrical motors were entered into the “energy efficient product discount program”. The policy, only in effect for half of the year, showed good results by the end of the year, having spurred improvement in existing technology and production capacity that had stalled for many years. The small and medium asynchronous electrical motors and three-phase distribution transformers saved electricity amounting to 1.69 billion kWh and 1.62

⁹ Total excludes gas water heater saving converted to electricity-equivalent.

billion kWh respectively in 2010. The average energy efficiency of these products increased 4% and 0.2%, a significant increase from 2009.

1.3 Office equipment sector – outstanding results

The energy efficiency of computer monitors and copy machines continued to increase and overall achieved saving electricity 420 million kWh in 2010. Energy efficiency increased about 10% on average. The major reasons are that is a highly concentrated sector with highly internationalized technology, a shorter technology innovation cycle, and faster cycle of product upgrade and replacement. Also, related product energy efficiency standards and labeling which took effect in 2009 have made an outstanding impact on the industry and market. In addition, consumer awareness for energy efficient products is increasing with the further implementation of government energy efficient product procurement policies in our country, with policies expanding from public finance procurement into group procurement, company procurement, consumer group procurement, and other areas.

1.4 Lighting equipment sector – further advancements

With credit to the full scale promotion of high efficiency lighting products during the 11th Five-Year Plan period, the public's willingness to use high efficiency lighting products is getting stronger. Related enterprises are actively participating in product promotion and manufacturing, and market mechanisms for energy efficient products have gradually become more mature. Self-ballasted fluorescent lamps under 14W are one of the most popular products in the high efficiency lighting product sector and have been entered into the "national high efficiency lighting product promotion program".

1.5 Commercial equipment sector – awaiting improvements

The energy efficiency advancement of some commercial air conditioning products came to a standstill in 2010, while the energy savings of newer model unitary air conditioners declined compared with 2009. Attention is needed in this sector.

The key problem in this sector is that the operating efficiency of commercial equipment often depends on the entire system design, so even if the equipment is efficient, it may not necessarily be operated in an efficient mode. This results in "high efficiency with no energy savings", and there is further a lack of effective assessment and monitoring techniques and measures.

2. The effect of major energy efficiency policies and measures

2.1 Energy efficient products discount program

In addition to room air conditioners and high efficiency lighting products, the energy efficient products discount program also expanded in 2010 to include high efficiency motors in the industrial sector and energy efficient automobiles in the transportation sector. Also, some adjustments were made to the detailed regulations in promotion and implementation of high efficiency room air conditioners. Currently, the “energy efficient products discount program” covers four categories of products: high efficiency lighting products, household appliances (room air conditioners), industrial equipment (motors) and transportation (automobiles). A national subsidy of a few hundred Yuan was given to each high energy efficient air conditioner with energy efficient level in grade 1 and 2. For large volume users as well as city and rural residents who purchased high efficiency lighting products, a 30% and 50% financial subsidy was provided respectively, and applied to the winning bid supply agreement price. For high efficiency motors which qualified for promotion requirements, a financial subsidy of 12 – 60 Yuan/kW was provided. For energy efficient automobiles which qualify for overall fuel consumption requirements, a one-time fixed subsidy of 3000 Yuan per automobile was provided.

By using financial subsidies, the energy efficient products discount program greatly sped up the promotion and application of high efficiency room air conditioners, motors, automobiles, and lighting equipment, establishing an effective incentive mechanism and boosting industry upgrade and technology advancement, while ensuring steady and fast economic development. Additional benefits included “reducing prices, saving electricity and money, while improving living quality” for the people, a developed and established consumption market for high energy efficiency products, an increased market share of high energy efficiency products, and an increase in domestic consumption.

By December 2010, the energy efficient products discount program, which started in June 2009, had sold more than 34 million high energy efficient air conditioners, more than 1 million energy efficient automobiles, and more than 360 million energy efficient lamps¹⁰. Based on the preliminary calculation, it directly drove 120 billion Yuan of consumption demand, while realizing 19.5 billion kWh in electricity savings, 300,000 tons of saved oil, and 14 million tons of CO₂ emissions reduction.

2.2 Rural area household appliance subsidy program

In March 2010, the Ministry of Finance, Ministry of Commerce, and Ministry of Industry and Information Technology jointly announced *Newly Added Items for Rural Area Household Appliance Subsidy Proposal*. The proposal declared that each province and municipality could add a new item in the rural area household appliance subsidy program in addition to the nine

¹⁰ Total number of energy efficient lamps sold during “11th Five-year plan”.

existing subsidized items: color televisions, refrigerators (with freezer), cellular phones, washing machines, computers, air conditioners, water heaters (including tank storage electric water heaters, gas water heaters, solar water heaters), microwave ovens, and induction cooktops.

According to the national statistics, 77.18 million subsidized electrical appliances were sold in the rural areas with sales reaching 173.23 billion Yuan in 2010, with year on year increases of 30% and 70% respectively. Among them, color televisions and refrigerators took first and second position. Since the implementation of rural area household appliance subsidy program in December 2007, accumulated over 110 million products have been sold, with sales of over 240 billion Yuan in three years. Meanwhile, the policy mechanism is improving and implementation is strengthening. In fact, the policy encouraged the household appliance enterprises to promote the rapid popularization of high efficiency household appliance products in rural areas through product, service, sales channel, and price advantages, while developing a sound marketing and sales network and more mature energy efficient household appliance consumer groups. Overall, the rural area household appliance subsidy program strengthened and benefited the rural countryside, boosted consumption, and drove up production.

2.3 Old for new exchange program

In June 2009, China launched an automobile and household appliance program called “old for new exchange program”. This program was continued in 2010, expanding pilot coverage and getting significant results, including sales of 170 billion Yuan and a quickened upgrade and replacement of old energy-using products.

In July 2009, the Ministry of Finance, Ministry of Commerce and other 10 ministries and committees jointly announced *Automobile Old for New Exchange Implementation Measures*. It stipulated that the four categories of automobiles which qualified for exchange requirements may receive a financial allowance between 3,000 – 6,000 Yuan per vehicle from June 1, 2009 to May 31, 2010.

In June 2010, the Ministry of Commerce, Ministry of Finance and Ministry of Environmental Protection jointly announced *Promoting Household Appliance Exchange Working Proposal*. The implementation period was tentatively set for June 1, 2010 to December 31, 2011, and the pilot provinces and provincial-level municipalities increased to 19 from the original 9.

The “old for new exchange” subsidies for household appliances included a household appliance allowance, a freight allowance, and a disposal allowance. The five subsidized product categories were televisions, refrigerators, washing machines, air conditioners, and computers. The amount of the household appliance allowance was 10% of the new household appliance sale price, but

with a maximum subsidy limit. The freight allowance subsidy amount was based on the category, specification, and shipping distance of recycled household appliance. The national finance department and the province in question shared 80% and 20% of the subsidy cost respectively.

According to statistics, since the implementation of “old for new exchange program”, 459,000 high pollution “yellow sticker” and old automobiles were eliminated, 6.41 billion Yuan was provided in subsidy allowances, and 49.6 billion Yuan of new automobiles were purchased. An accumulated 32.224 million new household appliances were sold and sales reached 121.11 billion Yuan, while 33.446 million old household appliances were recovered and reused, saving nearly 500,000 tons of steel, plastic, nonferrous metal, and other resources.

2.4 Promoting high efficiency lighting products

Based on experience from other countries, the promotion of high efficiency lighting products has the advantages of relatively low upfront investment, large product volume and coverage, and good results for the overall promotion of energy efficiency, so it is always a leading example for increasing product energy efficiency.

Electricity used in lighting is about 12% of total national consumption. Our government has done a lot of work to eliminate incandescent lamps and promote high efficiency lighting such as “energy efficient lamps” (CFLs). Since 1996, our government has promulgated a series of promotional policies, implemented green lighting projects, developed product standards for high efficiency lighting products, further encouraged technology advancement and upgrade of lighting products, and made significant achievements in increasing product quality, developing new lighting technology, and increasing consumer awareness on saving electricity for lighting.

The “Green Lights Project” was one of the ten key energy-saving projects during the 11th Five-Year Plan and developed specific energy savings, environmental protection, and economic efficiency goals. As one of the key products in the “energy efficient product discount program”, financial subsidies and other approaches have been used to promote high efficiency lighting products since 2009. In 2010, the focus was on utilizing high quality and environmentally friendly high efficiency lighting products, which are manufactured with low mercury and clean production process. According to national statistics, a total of 360 million energy efficient lamps were sold for a total of 4.1 billion Yuan resulting in electricity savings of 12.5 billion kWh annually and 62.7 billion kWh during the life cycle of these products. Driven by the policies, the market price of high efficiency lighting products dropped 40% compared to the period before the promotion, and the promotion was successfully completed. Also, the promotion of high efficiency lighting products greatly advanced the development of our national lighting product energy efficiency standards and labeling. Our country has established a national mandatory

lighting product energy efficiency standard system, including eight standards: double-capped fluorescent lamps/self-ballasted fluorescent lamps for general lighting, single-capped fluorescent lamps, high pressure sodium lamps, ballasts for high pressure sodium lamps, metal halide lamps, and ballasts for metal halide lamps. High efficiency lighting performance standards and lighting equipment energy efficiency standards have been developed, providing clear requirements for various technical specifications. Currently, the energy efficiency labeling system mainly covers self-ballasted fluorescent lamps and high pressure sodium lamps, with significant results thus far.

2.5 Government procurement program for energy efficient products

The National Development and Reform Commission (NDRC) and Ministry of Finance successively published the 7th and 8th edition of the government procurement catalogue in 2010. As of December 2010, among all eight editions of government procurement list published, 28 categories, 46 products in thousands of models, and hundreds of enterprises have been covered.

Starting in 2007, the mandatory government procurement of energy efficient products program became an important policy measure for strengthening energy efficiency in government organizations and using government procurement policy as guidance. It was developed and implemented by Ministry of Finance and NDRC. The listed products were determined by Ministry of Finance and NDRC, picking the best products which were certified by national recognized energy efficient product certification organizations, based on energy efficiency performance, technology level, market maturity, and other factors. The list is also regularly published on the Chinese Government Procurement website, NDRC portal website, China Energy and Water Conservation Certification website, and other websites for public information.

When various levels of government organizations use public finance funds to carry out procurement activities, under the precondition of meeting technical, service, and other procurement requirements, purchasing priority should be given to energy efficient products. In order to promote energy conservation, environment protection, and energy cost reduction in government organizations, mandatory purchasing is required for some of the products which meet the energy efficiency performance requirements.

Energy efficient products which are eligible for priority procurement should meet following conditions: certified by national recognized energy efficient product certification organizations, have significant energy saving results, manufactured in large volume, mature technology, and reliable quality. There should be a sound supply system and good after-sale service for those products, and product suppliers should meet the requirements of government procurement regulation for government suppliers.

Within the energy efficient products for priority procurement, products which require mandatory procurement are determined by following principles: products are for general use, suitable for centralized procurement, and are more cost effective when procured in volume; the product should have outstanding energy saving results and significant cost effectiveness; and there are sufficient suppliers (usually no less than five) to ensure enough competitiveness of the product, so the purchaser has room for selection.

2.6 Key energy efficient technology promotion catalogue

The key energy efficient technology promotion catalogue is a list of energy efficient technologies which are prioritized for development within a certain period of time, based on the national medium and long-term energy efficiency special program planning and energy efficient technology policy outline.

NDRC issued *National Key Energy Efficient Technology Promotion Catalogue* (3rd edition) on November 29, 2010. It covers 11 industries such as coal, electricity, iron and steel, nonferrous metal, petroleum chemicals, building material, machinery, textile, buildings, and transportation with a total 30 high efficiency energy saving technologies.

2.7 Energy efficiency standards

Our country issued four new mandatory energy efficiency national standards in 2010, three of which covered the household appliance sector and one of which covered the industrial equipment sector. *The Minimum Allowable Value of Energy Efficiency and Energy Efficiency Grades for Room Air Conditioners* (GB12021.3-2010) is a revised standard, and the other three are developed and implemented first time. By December 2010, our nation has issued and implemented 44 mandatory energy efficiency national standards. As a successful example for tightly combining standardization with policy and market demands, *The Minimum Allowable Value of Energy Efficiency and Energy Efficiency Grades for Room Air Conditioners* has played an important role in promoting high energy efficient products.

Table 3. Energy efficiency standards issued in 2010

Serial No.	Standard No.	Standard name	Date of issue	Date of implementation	Sector
1	GB 12021.3-2010	Minimum Allowable Value of Energy Efficiency and Energy Efficiency Grades for Room Air Conditioners	2010-2-26	2010-6-1	Household appliance
2	GB 24849-2010	Minimum Allowable Value of Energy Efficiency and Energy Efficiency Grades for Household and Similar Purpose Microwave Ovens	2010-6-30	2010-12-1	Household appliance
3	GB 24850-2010	Minimum Allowable Value of Energy Efficiency and Energy Efficiency Grades for Flat Panel Televisions	2010-6-30	2010-12-1	Household appliance
4	GB 24848-2010	Minimum Allowable Value of Energy Efficiency and Energy Efficiency Grades for Heaters Used by Petroleum Industry	2010-6-30	2010-12-1	Industry

2.8 Energy efficiency labels

NDRC, the General Administration of Quality Supervision Inspection and Quarantine (AQSIQ), and the Certification and Accreditation Administration of China (CNCA) successively issued the 6th and 7th edition of *Product Catalogue for Implementing Energy Efficiency Labeling in The People's Republic of China* in April 2010 and October 2010. As listed in Table 4, it covered four new additional products: power transformers, ventilation fans, flat panel televisions, household and similar purpose microwave ovens, as well as revised edition for room air conditioners.

Table 4. Sixth and seventh edition of products to be implemented for energy efficiency labeling

Edition No.	Issue date	Implementation date	Products covered
6 th	April, 2010	November, 2010	Power transformers, ventilation fans and room air conditioners
7 th	October, 2010	March, 2011	Flat panel televisions, household and similar purpose microwave ovens

By the end of 2010, our country issued seven editions of product catalogues for implementing energy efficiency labeling, covering 23 energy-using products in household, office, commercial, industrial, and lighting sectors.

- a. Household appliances: household refrigerators, room air conditioners, washing machines, household gas tankless water heaters, variable speed room air conditioners, electric storage tank water heaters, household induction cooktops, automatic electric rice cookers, AC electric fans, flat panel televisions, and household and similar purpose microwave ovens.
- b. Office equipment: computer monitors, copy machines, and unitary air conditioners.
- c. Commercial equipment: water chillers, multi-split air conditioning (heat pump) systems, and displacement compressors.
- d. Industrial equipment: small and medium three phase asynchronous motors, power transformers, ventilation fans, and AC contactors.
- e. Lighting equipment: self-ballasted fluorescent lamps and high pressure sodium lamps.

2.9 Energy efficient product certification

On December 15, 2010, the State Council Legislative Affairs Office and AQSIQ carried out a public inquiry regarding the *Energy Efficient Products Certification Administration Measures*. In its public opinion draft, it clearly indicated that government would prioritize the procurement of certified energy efficient products. It will also provide detailed regulations in application and processing, product testing, and inspection, to verify already certified products, withdraw certifications for disqualified products, and announce the results to the public. By 2010, there were 57 categories of energy efficient products that had been certified. Also, the energy efficiency certification system included certification of some water conservation products. There were 64 categories of water conservation products that had been certified by the end of 2010.

2.10 Elimination of outdated manufacturing process equipment and products

In order to stop repetition of sub-standard construction and to promote the upgrade and replacement of manufacturing processes, equipment, and products, since 1999, the former State Economic and Trade Commission successively issued three editions of *Catalogue of Outdated Manufacturing Capacities, Process and Products for Elimination* in response to domestic and international market changes and industry developments. The catalogue covered a total of 353 items in 15 sectors such as iron and steel, nonferrous metal, light industry, textile, petrochemical, and building material.

In December 2009 upon consideration of the actual situation of energy conservation and emissions reduction in the industry and communication sectors, the Ministry of Industry and Information Technology issued the *Catalogue of High Energy Consumption and Outdated Electrical and Mechanical Equipment (Products) for Elimination* (First edition), covering 272 types of equipment (products) in nine categories, including 27 items for motors, 13 items for electric welding machines and electric resistance furnaces, 4 items for transformers and voltage regulators, 50 items for boilers, 15 items for fans, 123 items for pumps, 33 items for compressors, 5 items for diesel engines and 2 items for other equipment. It clearly mandated that industry should speed up the elimination of high energy-consuming and outdated electrical and mechanical equipment.

In October 2010, the Ministry of Industry and Information Technology, in accordance with the requirement of *State Council in Regarding to Further Strengthen the Elimination of Outdated Manufacturing Capacity Notice* (GF [2010] No.7), developed and issued the *Guideline Catalogue of Outdated Manufacturing Process Equipment and Products in Some Industrial Sectors for Elimination* (2010 edition). The outdated manufacturing process equipment and products listed in the catalogue seriously waste energy, pollute the environment, and creating unsafe working conditions, and therefore must be eliminated within the required period. They cannot be transferred, manufactured, sold, utilized, or adapted. This catalogue covered 502 items in 8 sectors such as iron and steel, nonferrous metal, chemical, building material, machinery, light industry, textile, and medical equipment.

3. Energy efficiency status of energy-using products in major sectors

3.1 Energy efficiency status of typical household appliances

Household appliances are traditional key products for energy efficiency. They are a central focus of various energy policy measures and have broken down barriers that have restricted the sales and promotion of energy efficient products due to high prices. The energy efficiency of typical products (such as room air conditioners) is constantly improving, and its performance is influencing other household appliance products, rapidly creating a model effect and foundation for promoting energy efficient products in the entire household appliance sector.

An energy efficiency assessment was conducted in 2010, targeting nine widely used product categories such as refrigerators, room air conditioners, variable speed air conditioners, gas water heaters, electric water heaters, washing machines, household induction cooktops, AC fans, and automatic electric rice cookers. The results are shown in Table 5. It was the first time for the household electromagnetic stove, AC fan, and automatic electric rice cooker to be included in the assessment list.

As currently covered by various major energy efficiency policies, the energy efficiency level of household appliance has increased significantly, especially in major energy-using products such as room air conditioners, variable speed air conditioners, and refrigerators. Energy efficiency has become the main topic throughout the process of optimizing product market structure, adjusting the direction of sector development, and upgrading technology. In the meantime, the consumer's energy efficiency awareness is constantly improving. While considering the energy efficiency performance of the products, they also carefully study the price, payback period, and ease of use of the products.

There are some problems with energy efficiency of household appliances that need to be solved quickly, including:

(1) Sustainability of energy conservation policy promotion. Currently, the surge in energy efficient household appliance production and sales have been caused by energy conservation policy promotions, such as "rural area household appliances subsidy program" and "energy efficient products discount program". Enterprises have not developed the awareness for the continued development and sale of energy efficient products without this programmatic support. Once policies are withdrawn, how to handle the resurgence of low efficient products is an unavoidable question.

(2) Supervision and assessment is one of the key problems that need to be addressed. There is an immediate need to improve effective supervision and penalties.

(3) There is a gap between the energy efficiency assessments and the actual usage for some household appliances. A discussion is required to determine whether high efficiency products can achieve real energy savings, and improving related standards in this area is inevitable.

Table 5. Average energy efficiency levels of typical household appliances in 2010

Products		Evaluation indicators	Unit of indicators	2010 average energy efficiency level		Increase compared to 2009 (%)	
				By Model	By Sales Volume	By Model	By Sales Volume
Refrigerators	Refrigerators	Energy efficiency index (η)	%	51.30	52.90	6.6	5.8
	Freezer-refrigerators			36.40	40.70	8.1	3.0
	Freezers			61.20	56.60	12.6	10.5
Room AC (Before new standard implemented)	CC \leq 4500	Energy efficiency ratio (EER)		3.55	3.31	7.6	13.7
	4500 < CC \leq 7100			3.4	3.18	7.3	12.4
	7100 < CC \leq 14000			3.3	3	7.8	12.3
Room AC (After new standard implemented)	CC \leq 4500	Energy efficiency ratio (EER)		3.46	3.32	4.9	13.9
	4500 < CC \leq 7100			3.36	3.22	6.0	13.8
	7100 < CC \leq 14000			3.27	3.06	6.9	14.6
Variable speed AC	CC \leq 4500	Seasonal energy efficiency ratio (SEER)	—	4.49	3.95	-3.2	8.7
	4500 < CC \leq 7100			4.28	3.62	1.7	7.6
	7100 < CC \leq 14000			3.93	3.27	1.8	5.8
Gas water heaters	Water heater overall	Heat efficiency	%	87.7	87.9	0.8	0.7
	Heating furnace, heating only			90.7	87.8	0.3	—
	Heating furnace, dual use (heating)			89.0	88.0	-0.1	0.0
	Heating furnace, dual use (hot water)			89.1	87.9	-0.5	-0.2

Electric water heaters		24 hr fixed energy consumption index	—	0.73	0.68	-2.7	—
		Hot water output ratio	—	0.62	0.62	0.0	—
Washing machines	Impeller washing machine	Electricity consumption (kWh/cycle/kg)	Electricity consumption (kWh/cycle/kg)	0.02	0.02	-2.2	—
		Water consumption (L/cycle/kg)	Water consumption (L/cycle/kg)	25.03	25	5.6	—
		Cleaning ratio	Cleaning ratio	0.8	0.81	1.9	—
	Drum washing machines	Electricity consumption	kWh/cycle/kg	0.18	0.19	-8.4	—
		Water consumption	L/cycle/kg	10.34	12	-4.4	—
		Cleaning ratio	—	1.07	1.03	-0.1	—
	Household induction cooktops		Heat efficiency	%	85.9	85.88	0.1
Stand by power consumption			W	2.2	—	-4.8	—
AC electric fans	200mm capacitor desk fans	Energy efficiency value	$m^3/(min.W)$	0.64	0.62	—	—
	200mm shaded-pole desk fans			0.66	0.53	—	—
	230mm capacitor desk fans			0.65	0.73	—	—
	230mm shaded-pole desk fans			0.75	0.58	—	—
	250mm capacitor desk fans			0.84	0.81	—	—
	250mm shaded-pole desk fans			0.78	0.63	—	—
	300mm capacitor desk fans			0.98	0.88	—	—
	350mm capacitor desk fans			1.17	0.98	—	—

	400mm capacitor desk fans			1.18	1.09	—	—
	500mm capacitor desk fans			1.21	1.28	—	—
	600mm capacitor desk fans			1.22	1.47	—	—
	900mm capacitor ceiling fans			1.43	2.87	—	—
	1050mm capacitor ceiling fans			2.95	2.95	—	—
	1200mm capacitor ceiling fans			2.95	3.09	—	—
	1400mm capacitor ceiling fans			3.07	3.33	—	—
	1500mm capacitor ceiling fans			3.29	3.53	—	—
	1800mm capacitor ceiling fans			3.72	3.68	—	—
Automatic electric rice cookers	P _≤ 400W	Heat efficiency	%	78.4	77.6	—	—
		Keep warm energy consumption	Wh	36.9	40	—	—
		Stand by energy consumption	Wh	1.4	1.6	—	—
	400W < P _≤ 600W	Heat efficiency	%	80.9	78.6	—	—
		Keep warm energy consumption	Wh	41.7	50	—	—
		Stand by energy consumption	Wh	1.5	1.6	—	—
	600W < P _≤ 800W	Heat efficiency	%	82.8	79.6	—	—
		Keep warm energy consumption	Wh	37.6	60	—	—
		Stand by energy consumption	Wh	1.5	1.6	—	—
	800W < P _≤ 1000W	Heat efficiency	%	82.8	80.6	—	—
		Keep warm energy consumption	Wh	58.7	70	—	—
		Stand by energy consumption	Wh	1.5	1.6	—	—
1000W <	Heat efficiency	%	84.3	81.6	—	—	

	P≤2000W	Keep warm energy consumption	Wh	68.8	80	—	—
		Stand by energy consumption	Wh	1.7	1.6	—	—

3.1.1 Refrigerators

In 2010, the refrigerator market in our country had shown following characters:

- (1) Growth was higher than expected. Production reached 75.46 million units, and sales reached 61.8 million units annually. Production and sales of large volume and multifunctional freezer-refrigerators experienced relatively high growth.
- (2) Consumer acceptance of energy efficient products continued to increase.
- (3) The energy efficiency of various product models had different levels of increase. Freezer efficiency increased 12.6%, significantly higher than other types of refrigerators.
- (4) The average energy efficiency of freezer-refrigerator products (based on sales volume) is nearing the grade 1 energy efficiency level; the average energy efficiency increase of freezer products (based on sales volume) was more than 10%.
- (5) Recently, Japan and the EU are accelerating the revision of energy efficiency testing and assessment techniques, and the variance with present standards is quite large. It will have a major impact on the future market as well as the direction of technology research and development.

3.1.2 Room air conditioners

In 2010, the room air conditioner products market in our country showed the following characteristics:

- (1) Sales of room air conditioners remained very strong. In 2010, room air conditioner production in our country was over 110 million units and sales were 51.58 million units. The current market is expanding rapidly from mature markets in tier one and tier two cities to medium and small cities and towns as well as rural areas. Room air conditioners are key products covered by national energy efficiency subsidy programs such as “energy efficient products discount program”, “rural area household appliances subsidy program”, and “old for new exchange program”. The adoption of financial subsidies promoted energy conservation and emission reduction, boosted domestic consumption, and expanded the market share of energy efficient products.

(2) Based on the product sales volume, the average energy efficiency level had increased over 12% compared to 2009. The current market share of high efficiency energy-saving air conditioners is over 60%.

(3) The main reason for the increase in average energy efficiency of the air conditioner market in 2010 is that the air conditioner market development, energy conservation policies, and energy efficiency standards were all actively promoting and supporting each other. Based on surveys, within one year of implementing the energy efficient products discount program, a total of 19.56 million units of high efficiency air conditioner had been sold. The focused efforts of energy conservation policies and significantly changed product market structure enabled revision of related energy efficiency standards without any difficulty. Meanwhile, the market price of high efficiency air conditioners has dropped dramatically due to the effect of policies, from 3,000 – 4,000 Yuan per unit before promotion, down to about 2,000 Yuan at present. The sales price of some grade 1 high efficiency air conditioner models has dropped to as low as 1,000 Yuan, clearly benefiting the public.

(4) In 2010, the revised and published *Minimum Allowable Value of Energy Efficiency and Energy Efficiency Grades for Room Air Conditioners* (GB12021.3-2010) standard was released. The new standard changed the room air conditioner grading from 5 grades to 3 grades, based on energy efficiency ratio. Grade 1 represents the highest energy efficiency, grade 2 represents the evaluation value of energy efficiency, and grade 3 represents the minimum allowable value. The new standard has increased the threshold to qualify as an energy efficient room air conditioner. The minimum allowable energy efficiency value has increased about 23% compared to GB 12021.3-2004. Production has been stopped for formerly grade 3, 4, or 5 low energy efficient air conditioners. The energy efficiency level of sector overall has increased dramatically.

As one of the important consumer energy-using products, energy efficiency is the key development focus of room air conditioners at present and will be for a long time to come. It should be emphasized that for many years the production and sales volume of air conditioner products in our country have grown at a high rate year after year, with the development direction of the air conditioner sector mostly concentrated on expanding production capacity and market share. To increase the energy efficiency of the products usually relies on increasing raw material inputs, so the development, implementation, and adoption of related energy efficiency technologies needs to be further strengthened. From the technology aspect, establishing and developing a technology support system is one of the key items needed to push further energy efficiency increases for room air conditioner products. Some enterprises have overly focused on market share and development of ancillary functions beyond the core

function of the air conditioner (adjusting room temperature and humidity), thus leading to insufficient development in the core technology of air conditioner products.

3.1.3 Variable speed air conditioners

In 2010, the variable speed air conditioner market in our country had the following characteristics:

(1) Market share grew rapidly. In 2010, the variable speed air conditioner production in our country had reached 18.34 million units and sales reached 11.43 million units. Growth reached 200%. Consumers had gradually recognized its characteristics such as energy-saving and environmentally friendly, quiet and comfortable, and fast cooling and heating.

(2) The average energy efficiency level (based on sales volume) increased about 7% compared to 2009, and the energy efficiency level rose from grade 4 to grade 3. These improvements were supported by energy efficiency policies, product technology upgrade in the sector led by the development and implementation of associated energy efficiency standards and labeling, as well as the technology features and advantages of variable speed air conditioners.

(3) Performance was boosted by the rural area household appliances subsidy program. According to *Tender Notices for National Rural Area Household Appliance Subsidy Program* announced on December 31, 2009, this was the first time variable speed air conditioners entered the list of products for tendering in national rural area household appliances subsidy program. As the tender notice indicated, the winning bidder of variable speed air conditioners may benefit from a direct subsidy of 13% of sales price, paid for from national finances. Since the implementation of this policy, the high energy efficiency and comfort advantages of variable speed air conditioners have been further recognized by consumers. Price has also declined significantly, accelerating the promotion and popularization of these products.

3.1.4 Washing machines

In 2010, the washing machine product market in our country had the following characteristics:

(1) The market for front-loading (drum) washing machines grew faster than for top-loading (impeller) washing machines. In 2010, 62.1 million washing machines were produced with 38.39 million units sold. From the technology point of view, front-loading machines have gradually become conventional, and the appearance of new technologies such as variable speed and large front-loading washing machines gradually pushed the washing machine market towards sales of high-end technologies.

(2) Energy efficiency level appeared standstill. According to current energy efficiency standard *The Minimum Allowable Value of Energy Efficiency and Energy Efficiency Grades for Electric*

Washing Machines (GB 12021.4-2004), the average energy efficiency level of top-loading washing machines on the market reached grade 3, while all front-loading washing machines are grade 1 energy efficient products. Efficiency levels are basically the same as in 2009.

(3) Discount programs further popularized the products. Washing machines were covered by government procurement, rural area appliance subsidy, and old for new exchange programs. Meanwhile, the washing machine is one of the most welcomed new products in the rural area market. The washing machine market growth slowed down in tier one and tier two cities, but grew significantly in tier three and tier four cities. In 2010, data showed the washing machine market year on year sales growth in tier one and tier two cities were 10.8% and 18.4% respectively, but 36.7% and 118% in tier three and tier four cities.

3.2 Energy efficiency status of typical office equipment

In 2010, the production of computer monitors in our country had reached 240 million units, with nearly 40 million units sold. The production of copy machines had reached 5.6 million units, with 550,000 units sold. As the first group of typical energy-using products to have energy efficiency standards and labeling in the office equipment sector, the average energy efficiency level of computer monitors and copy machines has increased significantly in recent years, with details shown in Table 6. Two main reason are the relatively high energy efficiency of liquid crystal display equipment (LCD) and sales of LCD monitors taking 90% of the monitor market while cathode ray tube monitors (CRT) sales have basically been eliminated. Copy machines include monochrome copy machines, monochrome multifunction machines, and color multifunction machines.

The average energy efficiency level of LCD monitors met grade 2 requirements of *The Minimum Allowable Value of Energy Efficiency and Energy Efficiency Grades for computer monitors* (GB21520-2008), and copy machines met Grade 1 requirements of *The Minimum Allowable Value of Energy Efficiency and Energy Efficiency Grades for copy machines* (GB21521-2008). In 2010, both products had reached the level of energy efficient products found in current standards. Among them, the energy efficiency in “Off” state of LCD monitors increased significantly compared to 2009. The power consumption ratio of cold cathode fluorescent lamp (CCFL) back light systems, which are currently widely used in LCD monitors, is 80% of the entire unit, including CCFL lighting and voltage step-up circuit for powering the back light. The power consumption ratio for other components are only 20%. Thus reducing the energy consumption of the back light system is one of the key issues for further increasing the energy efficiency level of LCD monitors.

Table 6. Average energy efficiency level of typical office equipment in 2010

Products		Evaluation indicators	Unit of indicators	2010 average energy efficiency level		Increase compared to 2009 (%)	
				By Model	By Sales Volume	By Model	By Sales Volume
Computer monitors	LCD monitors	Energy efficiency	cd/W	0.95	0.94	7.80	9.4
		"Off" state energy consumption	W	0.69	0.78	21.10	22.0
Copy machines	monochrome copy machine	Typical energy consumption	kWh	1.88	—	76.40	—
		"Off" state energy consumption	W	0.23	—	8.50	—
		Copying speed	Pages/min	19.75	—	50.00	—
	monochrome multifunction copy machine	Typical energy consumption	kWh	4.80	—	20.90	—
		"Off" state energy consumption	W	0.15	—	31.60	—
		Copying speed	Pages/min	30.83	—	13.60	—
	Color multifunction copy machine	Typical energy consumption	kWh	10.19	—	-11.90	—
		"Off" state energy consumption	W	0.21	—	-7.04	—
		Copying speed	Pages/min	39.94	—	-10.28	—

Office and commercial equipment are the energy-using products most significantly affected by social economic development and technology advancement. The energy efficiency standard systems for these products are improving continuously and have outstanding energy consumption profiles. It should be pointed out that the current energy efficiency standards for office equipment (GB21520-2008 and GB21521-2008) have taken into account considerations of how and when the product is used. During standards development, the energy consumption level of the product is assessed by combining the operating energy efficiency, total energy consumption, and energy consumption during "Off" state to reflect the overall energy efficiency of the product more accurately. This energy consumption assessment standard system is rational and will lead enterprises to fully consider the energy efficiency performance during product design and manufacturing, in turn increasing the energy efficiency level of related products.

In addition, due to the fact that average energy efficiency levels for computer monitors and copy machines have reached grade 2 or above in current standards, they have built a strong

foundation for realizing the reach-standard level of energy efficiency limit laid out in the standards GB21520-2008 and GB21521-2008.

Table 7. Average energy efficiency level of major commercial energy-using products in 2010

Products		Evaluation Indicators	Unit of Indicators	2010 average energy efficiency level		Increase compared to 2009 (%)	
				By Model	By Sales Volume	By Model	By Sales Volume
Unitary	Air cooling (non-ducted)	Energy efficiency ratio (EER)	—	2.74	2.74	-1.79	2.62
	Air cooling (ducted)			2.5	2.44	-3.47	2.56
	Water cooling (non-ducted)			3.56	3.14	2.59	2.28
	Water cooling (ducted)			3.2	2.84	5.26	2.53
Multiple-split	CC≤28000W	IPLV	—	3.87	3.51	2.38	—
	28000W < CC ≤84000W			4.06	3.46	4.64	—
	CC>84000W			3.51	3.41	-3.57	—
Water chillers	CC≤50W air cooling series	coefficient of performance (COP)	—	2.87	2.78	2.87	—
		Total power consumption	KW	9.70	—	7.42	—
	CC>50W air cooling series	coefficient of performance (COP)	—	3.07	2.98	0.99	—
		Total power consumption	KW	110.30	—	-18.30	—
	CC≤528W water cooling series	coefficient of performance (COP)	—	4.79	4.37	1.27	—
		Total power consumption	KW	62.50	—	-1.11	—
	528W < CC≤1163W water cooling series	coefficient of performance (COP)	—	5.22	4.67	3.57	—
		Total power consumption	KW	157.80	—	-1.62	—
	CC>1163W water cooling series	coefficient of performance (COP)	—	5.89	5.06	7.09	—
		Total power consumption	KW	467.10	—	13.93	—

3.3 Energy efficiency status of typical commercial equipment

As a major energy-using product in commercial equipment sector, the central air conditioning market has always been dominated by unitary, multiple-split, and water chiller systems. In 2010, commercial air conditioning equipment had the following characteristics, with a summary of performance shown in Table 7.

(1) The size of market expanded gradually, and the share of multiple-split units grew steadily.

(2) The overall energy efficiency level of commercial air conditioning equipment rose slightly compare to 2009. The energy efficiency level of water chiller systems and multiple-split systems had a relatively outstanding increase, but the level was standstill for unitary units. More rapid revision of the energy efficiency standards is one of the conditions to ensure a continued healthy development of the market.

(3) Energy efficiency policies associated with building energy efficiency and energy efficient government (group) procurement were the only factors pushing increasing levels of energy efficiency. Price was still a major factor in product selection by users. In addition, applications for *Catalogue of Income Tax Credit for Energy Conservation and Water Saving Special Equipment Enterprises* incentive program continue to be low. As such, the administration procedure should be adjusted.

3.4 Energy efficiency status of typical lighting equipment

Lighting products are one of the most widely used products in society, by application and volume. The promotion of high efficiency lighting products has a long history, the publicity and implementation are strong, the social acceptance and utilization is high, and high efficiency products have taken a large share in manufacturing and utilization.

As one of the earliest promoted energy efficient products in our country, the promotion of energy efficient lighting products had taken place throughout the entire period of the 11th Five-Year Plan. Sales volume and average energy efficiency of products sold increased rapidly within this five years. Based on surveys, a total of 360 million energy efficient lamps were sold during the 11th Five-Year Plan. The promotion of energy efficient lighting has become a leading example in promoting energy efficient products by combining policies and regulations, market mechanisms, media propaganda, government guidance, response from enterprises, and public participation.

The self-ballasted fluorescent lamps and high pressure sodium lamps which have implemented energy efficiency labeling were both used for an energy efficiency status survey in 2010. Related data are shown in Table 8. In 2010, nearly 4 billion compact fluorescent lamps

(including self-ballasted fluorescent lamps and single-capped fluorescent lamps) were produced, with nearly 1 billion sold; 110 million high intensity discharge lamps (including high pressure sodium lamps and metal halide lamps) were produced, with 16 million sold; 2.5 billion double-capped fluorescent lamps were produced, with 48.8 million sold. Currently, the average energy efficiency levels of both self-ballasted fluorescent lamps and high pressure sodium lamps have reached grade 2 of the related energy efficiency standards. All related products on the market have reached the basic energy efficiency level.

In 2010, lighting products had the following characters:

(1) High efficiency lighting products had higher market shares. Based on an incomplete survey, high efficiency lighting products overall had around 60% of market share during the 11th Five-Year Plan period. Utilization increased significantly, but there was still large potential in small and medium cities as well as rural areas for promoting these products.

Table 8. Average energy efficiency level of typical lighting equipment in 2010

Products		Evaluation indicators	Unit of indicators	2010 average energy efficiency level		Increase compared to 2009 (%)	
				By Model	By Sales Volume	By Model	By Sales Volume
Self-ballasted fluorescent lamps	5-8W - RR series	Minimum initial lumen efficacy	lm/W	46.80	47.10	1.70	—
	5-8W - RB series			50.40	51.10	1.00	—
	9-14W - RR series			53.8	55.1	1.32	—
	9-14W - RB series			57.5	59.1	2.13	—
	15-24W - RR series			58.7	62.1	2.09	—
	15-24W - RB series			63	66.1	0.96	—
	25-60W - RR series			60.6	68.1	0.17	—
	25-60W - RB series			63	71.1	0.17	—
High pressure sodium lamps	50W series	Minimum initial lumen efficacy	lm/W	72	71.7	-7.7	—
	70W series			79.3	79.9	0.4	—
	100W series			85.5	86.7	-2.3	—
	150W series			94.9	96.7	-2.7	—
	250W series			104.8	103.7	0.8	—
	400W series			115.1	113.7	-3.6	—
	1000W series			125	123.7	2	—

(2) Financial incentive policies from the government is one of the major measures used to promote the development of high efficiency lighting products. Our government initiated a high efficiency lighting product subsidy gradually. Financial subsidies were provided to high efficiency lighting products such as compact fluorescent lamps, slim tube double-capped fluorescent lamps, and high pressure sodium lamps, leading to increased technical and manufacturing capacity, improved energy efficiency market mechanism, and more complete standardization systems as well as labeling and certification regulations for high efficiency lighting equipment and engineering.

(3) The development of the lighting product market had appeared to be dispersed and unbalanced. With respect to the market, the recognition of high efficiency lighting equipment in rural areas was less than 10%, and there was a significant gap between cities and rural areas. For energy efficiency, there was a gap between self-ballasted fluorescent lamps and high pressure sodium lamps in terms of the magnitude of energy efficiency increase. In addition, high efficiency lighting equipment production and sales were increasing annually, but technology research and development were falling relatively behind.

3.5 Energy efficiency status of typical industrial equipment

Both energy consumption and energy saving potential are largest for industrial equipment. Some of the products (such as motors) have a technical and manufacturing foundation, but increasing energy efficiency of these products has always been a focus and challenge. One of the main reasons for the challenge is that industrial enterprises are large and complex energy consumers. There are many energy-using elements, and energy consumption is very intensive. Some related energy-using products are part of larger energy-using processes and some are single units. As they are matched and integrated together, the energy usage and distribution between them is complicated, thus the energy efficiency level of specific energy-using products or equipment is difficult to identify and define, so there is a lack of motivation for technology advancement. In fact, many users have little enthusiasm to use energy efficient products as they do not see significant results when using them, thus affecting the promotion of energy efficient products. Meanwhile, product pricing, user acceptance, and social recognition are still the major factors affecting energy efficiency improvement. Further development and continuous improvement of related energy efficiency policies and promotion measures as well as enterprise participation are the important driving forces to overcome these challenges and pry open the energy efficient product market.

The results shown in Table 9 and Table 10 focus on assessing the 2010 energy efficiency status of small and medium three phase asynchronous motors as well as three phase distribution transformers, which were a newly added product in 2010.

In 2010, motor products had shown following characters:

(1) Policy incentives drove an increase in the energy efficiency of motor products. In June 2010, high efficiency motors were listed as one of the high energy efficient products to be subsidized in “energy efficient products discount program”. Subsidized products included small and medium three phase asynchronous motors, high voltage motors, and rare-earth permanent magnet motors.

As major motor products were subsidized by the “energy efficient products discount program”, small and medium three phase asynchronous motors production was 171 million kW with 137 million kW sold in 2010. The average energy efficiency level of the products on the market had increased 0.4% compared to 2009.

(2) The market share of high efficiency motors was still on the lower side. Currently the production and sale of high efficiency motors in our country are relatively small, with domestic market share at less than 3%. A sampling survey in small and medium enterprises showed that domestically produced energy efficient motors of grade 2 and higher accounted for only 8% of the total. Additionally it was found that a large portion (about 60%) of high efficiency motors manufactured by enterprises were for export.

(3) Promotion of high efficiency motors is still a long term challenge. Compared to other products listed in “energy efficient products discount program”, the results of high efficiency motors promotion has not met the expectation. The application rate and coverage rate for high efficiency motor financial subsidy in 2010 were both lower than expected. Although the technology foundation and manufacturing capacity has been established in our country, the promotion of high efficiency motors is still affected by non-technical factors. First with regards to pricing, the current financial subsidy is still on the low side, so it is difficult to influence the market. For example, the average price of high efficient low voltage motors under 22kW is 220 Yuan per kW, 20 – 40% higher than conventional motors. Second, the user demand is not being effectively stimulated. The majority of motor users are enterprises, with the majority of motor products used as parts in other household appliances, industrial equipment, and commercial equipment. The energy efficiency results are difficult to identify and define and therefore users do not notice the energy efficiency results for using high efficient motors. Third, there is a gap between system design and the results of practical application. Currently, the major problem for increasing the energy efficiency of the motor systems involves many factors, such as the

energy efficiency of the motor as well as matching the motor with the equipment that it is driving.

Table 9. Average energy efficiency level of typical industrial equipment in 2010

Products		Evaluation indicators	Unit of indicators	2010 average energy efficiency level		Increase compared to 2009 (%)	
				By Model	By Sales Volume	By Model	By Sales Volume
Small and medium three phase asynchronous motors	2 poles	Efficiency	%	86.90	—	0.50	—
	4 poles			86.10	—	0.50	—
	6 poles			83.8	—	-0.1	—

Table 10. Average energy efficiency level of three phase distribution transformers in 2010

Products		Evaluation indicators	Unit of indicators	2010 average no load loss		Increase Compared to 2009 (%)	
				By Model	By Sales Volume	By Model	By Sales Volume
Three phase distribution transformers	Oil	Loss level	—	—	S11	—	0.2
	Dry			—	SC11	—	0.1

4. Energy efficiency potential analysis

Based on data analysis on 21 energy-using products such as household appliances, industrial, commercial, lighting, and office products in 2010, their energy efficiency potentials¹¹ are shown in Figure 0-3.

(1) By 2015, annual electricity savings will reach 136.44 billion kWh, annual gas savings will reach 7.237 million Nm³, annual CO₂ emissions reduction will reach 140 million tons, and annual SO₂ emissions reduction will reach 7.615 million tons. Out of the total energy savings, household appliances¹² relative contribution is 25.9%, commercial equipment is 6%, industrial equipment is 35.9%, lighting equipment is 30.2%, and office equipment is 2%.

¹¹ The energy efficiency potential is the energy savings derived from the comparison between energy consumption in the ACT scenario and energy consumption in the FRO scenario. The ACT scenario is models the 2010actual market level, with future year sales at at the 2010 efficiency level;. The FRO scenario maintains energy efficiency standards at the 2009 level.

¹² The energy savings and energy consumption include theelectricity-equivalent savings of gas tankless water heaters.

(2) By 2020, annual electricity savings could reach 279.75 billion kWh, annual gas savings could reach 16.919 million Nm³, annual CO₂ emissions reduction could reach 300 million tons, and annual SO₂ emissions reduction could reach 16.932 million tons; Out of the total energy savings, the contribution of household appliances is 32%, commercial equipment 8.1%, industrial equipment 37.3%, lighting equipment 20.9% and office equipment 1.7%.

(3) Annual energy savings of 21 products will be 3.4% of their total energy consumption by 2015, and annual energy savings will be 6.3% of their total energy consumption by 2020.

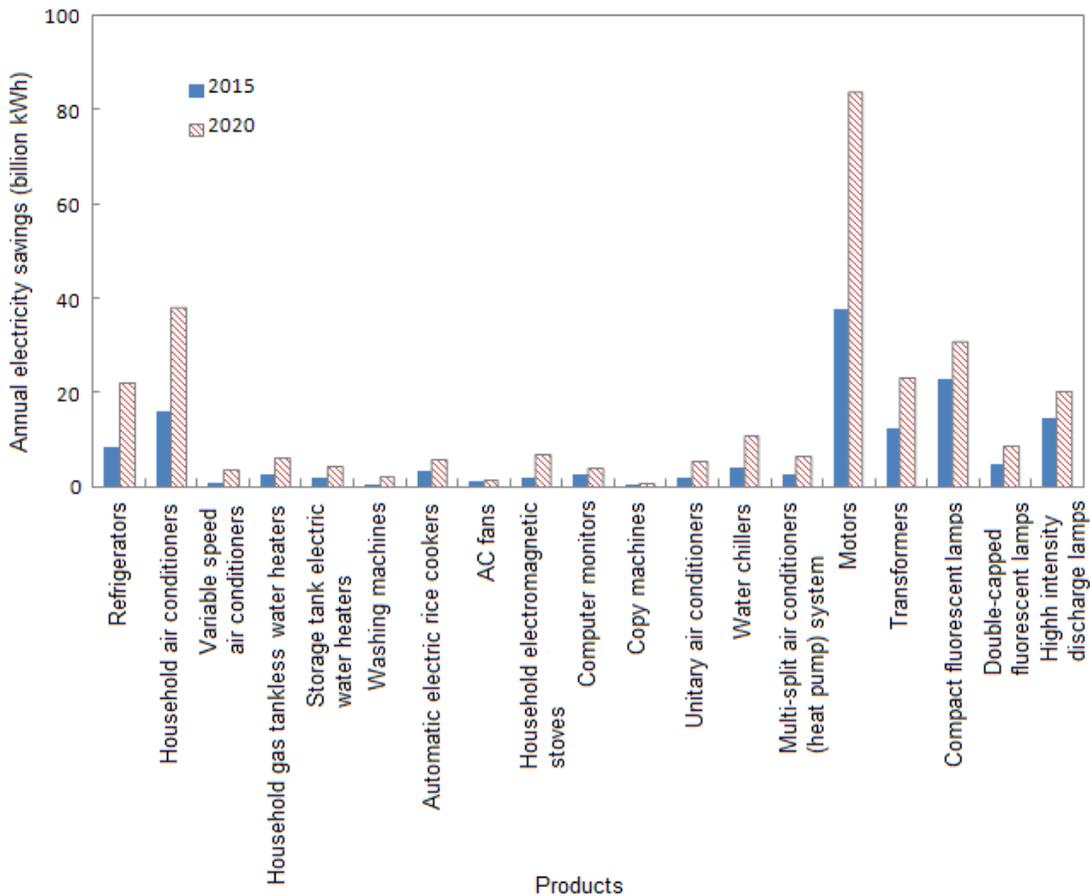


Figure 3. Energy saving potential of 21 typical energy-using products

As illustrated in Figure 0-3, there is huge energy saving potential for room air conditioners in household appliance sector, largely related to the revised energy efficiency standards of room air conditioners which have a large potential to impact future market promotion. The following products will also have significant energy saving potential in next 10 years: refrigerators, water chillers, small and medium three phase asynchronous motors, three phase distribution transformers, and lighting fixtures. In addition to these products being widely used, they will also be impacted by policy incentives and market developments in the coming two years. As

such, the energy efficiency level of the market is rising relatively fast and creating more room for increasing product energy efficiency.

From now on, with the issuance of associated policies and the further development of energy efficiency standards and labeling, the energy saving potential of these 21 typical products and other products not included here will continue to increase and become an important driving force for continuously developing energy conservation and emissions reduction in our country.

5. Retrospective and prospects

As an important year of economic and social development in China, 2010 provided a perfect viewpoint for reviewing the 11th Five-Year Plan and looking forward to the 12th Five-Year Plan.

5.1 Energy savings of major energy-using products in 11th Five-Year Plan

During the 11th Five-Year Plan, with the emphasis and support of by the government as well as the participation of entire society, energy conservation and emission reduction marked significant achievements.. National energy consumption per unit of GDP was reduced by 19.10%, national SO₂ emissions by 14.29%, and national chemical oxygen demand emission by 12.45%, with all three areas close to or outperforming goals set by the *Outline* of the 11th Five-Year Plan.

Based on an incomplete assessment, major energy efficiency efforts for energy-using products conducted during the 11th Five-Year Plan period achieved the following results, shown in Table 11.

Table 11. Energy conservation and emission reduction efforts for major energy-using products during 11th Five-Year Plan

Specific energy conservation efforts	Starting implementation time	Promotion status	Energy conservation and emission reduction results
Energy efficiency products discount program	June 2009 (energy efficient lighting promotion throughout entire 11th Five-Year Plan period)	Sold 360 million energy efficient lamps, more than 34 million high efficient air conditioners, and 1.2 million energy efficient automobiles.	Saved 19.5 billion kWh electricity and 300,000 tons oil annually, and reduced over 14 million tons of CO ₂ emissions.
Rural areas household appliances subsidy program	November 2008	Nationally household appliances sold to rural area reached 150 million units, and sales reached 327.35 billion Yuan.	---
Old for new exchange program	June 2009	Automobile “old for new” exchange program eliminated 459,000 “yellow sticker” and old automobiles, 6.41 billion Yuan in subsidies were provided. National household appliance “old for new” exchange program sold 32.224 million units of new appliance, sales reached 121.11 billion Yuan, recycled 33.446 million units of old appliance.	Recovered and reused nearly 500,000 tons of steel, plastic, nonferrous metal, and other resources

5.2 Key experience from 11th Five-Year Plan

5.2.1 Strong emphasis by the government

In 2007, the State Council set up a Leading Team for Energy Conservation and Emission Reduction Efforts (here referred to as “Leading Team”), and the Premier took on the role of team leader. At the national level, such a highly ranking leading organization for energy conservation and emission reduction is rare in the world. It shows that Chinese government set a strong commitment to improve energy conservation and emission reduction. The Leading Team achieved significant energy savings and emission reduction since it started. It made many decisions to strengthen energy conservation by announcing comprehensive working plans for energy conservation and emission reduction, implementing a series of effective policies and measures, emphasizing goals and responsibilities, restructuring industrial sectors, implementing key projects, promoting technology advancement, strengthening incentive policies, strengthening supervision and administration, and mobilizing the public.

5.2.2 Establishing legal basis

Establishing a comprehensive legal and regulatory system for energy conservation and emission reduction is the legal basis for carrying out related work. Officially put into effect on April 1, 2008, *the Law of the People's Republic of China on Energy Conservation (Revised Edition)* (here referred to as “Energy Conservation Law”) provided the direct and detailed legal basis for energy conservation during and after the 11th Five-Year Plan. It has become the fundamental law for energy conservation. Through the specific chapters and clearly outlined regulations of the Energy Conservation Law, fundamental legal support was provided for implementing policy measures such as developing and implementing energy efficiency policy mechanisms, establishing and improving energy efficiency standards and labeling, implementing energy efficient product certification system, developing and publishing energy efficient technology promotion catalogues during the 11th Five-Year Plan period, and forming a better policy, legislative, and regulatory system to support the production, utilization, and promotion of energy efficient products.

5.2.3 Improving energy efficiency standards and labeling

Energy efficiency standards and labeling are specific measures and tools for identifying energy efficient products and supporting the promotion of energy efficient products. Among the current 44 energy efficiency standards in our country, 31 of them were developed and implemented during the 11th Five-Year Plan period. They cover products in energy-using sectors such as household appliances, transportation equipment, industrial equipment, lighting fixtures, commercial equipment, and electronic products. Meanwhile, our country has successively issued and implemented seven product groups within the energy efficiency label product catalogue since 2005, covering 23 energy-using products in household, commercial, office, and industrial sectors. With the exception of labels for household refrigerators and room air conditioners developed previously, 21 new products were covered by the energy efficiency

labeling system during the 11th Five-Year Plan period. The five years of the 11th Five-Year Plan were a key period for energy efficiency standards and labeling system in our country, advancing from preliminary establishment to full systemic development. Currently, energy efficiency standards and labeling have covered virtually all major energy-using products in the household appliance sector and lighting sectors and provided key technical standards to support the manufacturing, sale, utilization, inspection, and testing of related energy efficient products.

5.2.4 Innovating promotion mechanism for energy efficient products

Pricing has always been a major obstacle in promoting energy efficient products. High purchase costs sometimes cancel out or are higher than the energy saving benefits of energy efficient products, since many energy efficient products were made as high end products. This has seriously affected the general consumer's desire to purchase energy efficient products. Energy efficient products were in the awkward situation of "everybody likes the products, but nobody is buying them" for a long time. Based on the unique situation and market in our country, related government departments have successively provided energy efficiency oriented policy measures such as financial incentive and tax benefits. Under the precondition of respecting the rules of a market economy, effectively utilized economic leverage allowed relatively little public financial subsidy to drive a huge energy efficient product market, causing the price of energy efficient products to be accordingly reduced. The end result was a rapid expansion of the energy efficient product market at a reasonable price level. Meanwhile, to creatively construct an energy efficient product promotion mechanism with Chinese characteristics that covers different areas of both the cities and countryside, as well as different energy-using groups such as industry, consumer application, and public organizations, requires policy guidance and market development to mutually advance with each other, with equal participation from the government, industrial sectors, and consumers. These experiences can provide an important reference for the mechanism and measures that promote energy efficient products and technologies in the 12th Five-Year Plan, and also a valuable reference for energy conservation to many developing countries that are also in period of fast economic growth.

5.3 Prospects for energy conservation in the 12th Five-Year Plan

The 12th Five-Year Plan is a historical period for our nation to continue to accelerate industrialization and urbanization, and is a key period for moving from a middle income country to a middle developed country. With the continuous increase in average income, the consumption structure will continue to improve, and public demand for residential housing, transportation, environment, and household appliances will be even higher. There will be a strong upward trend in energy consumption for building, transportation, and residential sector, so there will be higher requirements for energy conservation.

The difficulties of energy conservation will be further increased during the 12th Five-Year Plan period. Technology innovation must become a major force for pushing forward industrial sectors to upgrade and industrialize new technologies. Meanwhile, the cost of energy efficiency will increase, such that constant financial investment and institutional innovation must become major measures and means to further discover the energy conservation and emissions reduction potential during the 12th Five-Year Plan period.

The ways of thinking about energy efficiency of energy-using products will continue to expand. The research and development of energy efficiency for energy-using products will gradually extend from targeting a new product to targeting the entire product life cycle, from targeting an individual product to targeting the energy system where the product is installed, and from purely pursuing a high efficiency index to pursuing actual energy conservation results.

Therefore, energy conservation, as a core task, will be continuously emphasized and supported during the 12th Five-Year Plan period. High energy consumption sectors such as industry, buildings, and transportation will become key areas of energy conservation. Promoting and utilizing leading-edge energy efficient technologies and products will become important actions for pushing energy conservation forward. Lastly, financial incentive policies will be continuously promoted and implemented as an important driving force for energy conservation.

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