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White Paper on Energy Efficiency Status of Energy-Using Products in China (2012)

中国用能产品能效状况白皮书（2012）

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1. Overview

2011 is the first year of the 12th Five-Year Plan and, as such, it is a crucial year to push forward the work of energy conservation and emissions reduction. Important large-scale energy conservation policies issued in 2011 include *Outline of the 12th Five-year Plan for National Economic and Social Development of The People's Republic of China* (the "Plan") and *Notice of the State Council on Issuing the Comprehensive Work Proposal for Energy Conservation and Emission Reduction during the 12th Five-Year Plan Period* (GF (2011) No. 26) (the "Proposal"). These two policies have established strategic objectives for energy conservation during the 12th Five-Year Plan in China, and they have also identified the key tasks and direction of energy efficiency programs for energy-using products.

The Plan and Proposal set the following objectives:

1. Optimize energy conservation legislation and standards; develop, improve, and strictly enforce energy efficiency standards for major energy-using products; strengthen the implementation of energy efficiency labeling as well as energy conservation and environment protection product certification; perfect energy labeling, energy efficient product certification, and government mandatory procurement system for energy efficient products; and promote advanced energy efficiency technologies and products.
2. Optimize financial incentive policies; implement the concepts of "replacing subsidies with incentives" and "providing incentives to encourage improvements"; use financial subsidies as a support mechanism for high efficiency household appliances, lighting products, automobiles, and motors; implement government green procurement and perfect the mandatory and preferential procurement system; and gradually increase the share of energy efficient and environment friendly products.
3. Carry out key energy efficiency programs for major energy-using products, such as energy efficiency retrofit programs, energy efficient product discount programs, and demonstration programs for the industrialization of energy efficient technologies; establish a three-dimensional strategy for energy efficiency improvement (retrofitting and increasing the energy efficiency of existing energy-using equipment, fully promoting high efficiency energy-using products, and demonstrating energy conservation technologies) on three levels (existing energy-using product market, new products, and future development).

China has established a sound energy efficiency standard system which is mostly targeted on energy-using products and equipment. During the 11th Five-Year Plan period, energy efficiency standards were mainly used to raise the "entry threshold" for product energy efficiency. As such, they played a significant role in eliminating products with high energy consumption and increasing the overall product energy efficiency in the market. During the 12th Five-Year Plan period, a "pyramid" of measures will continue raising the top level of energy efficiency for major energy-using products, including combining the concepts of "promoting energy efficient technology applications" and "promoting high efficiency and super-efficient products"; pushing enterprise technology advancement; and speeding up the upgrade and replacement of

standards while promoting rapid increases in the level of energy efficiency. In order to achieve the objectives above, the Proposal clearly prioritizes carrying out the development of "top runner" standards for energy-using products and related research.

1.1 Overview of current energy efficiency levels for major energy-using products

Under the combined influence of energy conservation legislation, standards, and incentive policies, the energy efficiency performance of major energy-using products are increasing. In the household appliances sector, a market-based climate for promoting and using high efficiency products has been created. The overall energy efficiency level of key products such as refrigerators and room air conditioners has increased, while older energy efficiency incentive policies such as "rural area household appliance subsidy program" and "household appliance old for new exchange program" are being phased out. In the lighting equipment sector, the overall product energy efficiency level is continuously improving. *The Road Map for Gradually Phasing Out Incandescent Lamps in China* has been officially announced and implemented, and the results of promoting high efficiency lighting products are significant. In the industrial equipment sector, the energy efficiency levels for one key product, motors, are maintaining a steady increase aided by the "energy efficient product discount program".

Affected by various factors such as policies, technologies, market influences, legislation, and standards, the energy efficiency distribution of energy efficient products in key energy-using product sectors such as household appliances, office equipment, commercial equipment, industrial equipment, and lighting equipment in 2011 is illustrated in Figure 1. The percentage of energy efficient products (by total number of models) in household appliance sector was over 60%, including refrigerators, household gas tankless water heaters, electric storage tank water heaters, washing machines, automatic electric rice cookers, and AC fans. Among those, the percentage of refrigerators with grade 1 energy efficiency had reached 69%, while the percentage of grade 1 and grade 2 room air conditioners and variable speed room air conditioners was no more than 35%. In the office equipment sector, the percentage of energy efficient products such as computer monitors and copy machines was close to or exactly 100%. The percentage of energy efficient products in multi-split air conditioning (heat pump) systems in commercial equipment sector was 100%, and nearly all of them were grade 1 energy efficient products. The percentage of energy efficient products was close to 60% for water chillers and close to 20% for unitary air conditioners. In the industrial equipment sector, the percentage of energy efficient products in small and medium three-phase asynchronous motors was 59.2%, and the majority of those were of grade 2 energy efficiency. Lastly, in the lighting product sector, the percentage of energy efficient products in both compact fluorescent lamps and high-intensity discharge lamps[①] of lighting product sector were over 80%.

[①] The analysis of compact fluorescent lamps and high-intensity discharge lamps were done on self-ballasted fluorescent lamps and high pressure sodium lamps respectively, both of which have implemented energy efficiency labeling.

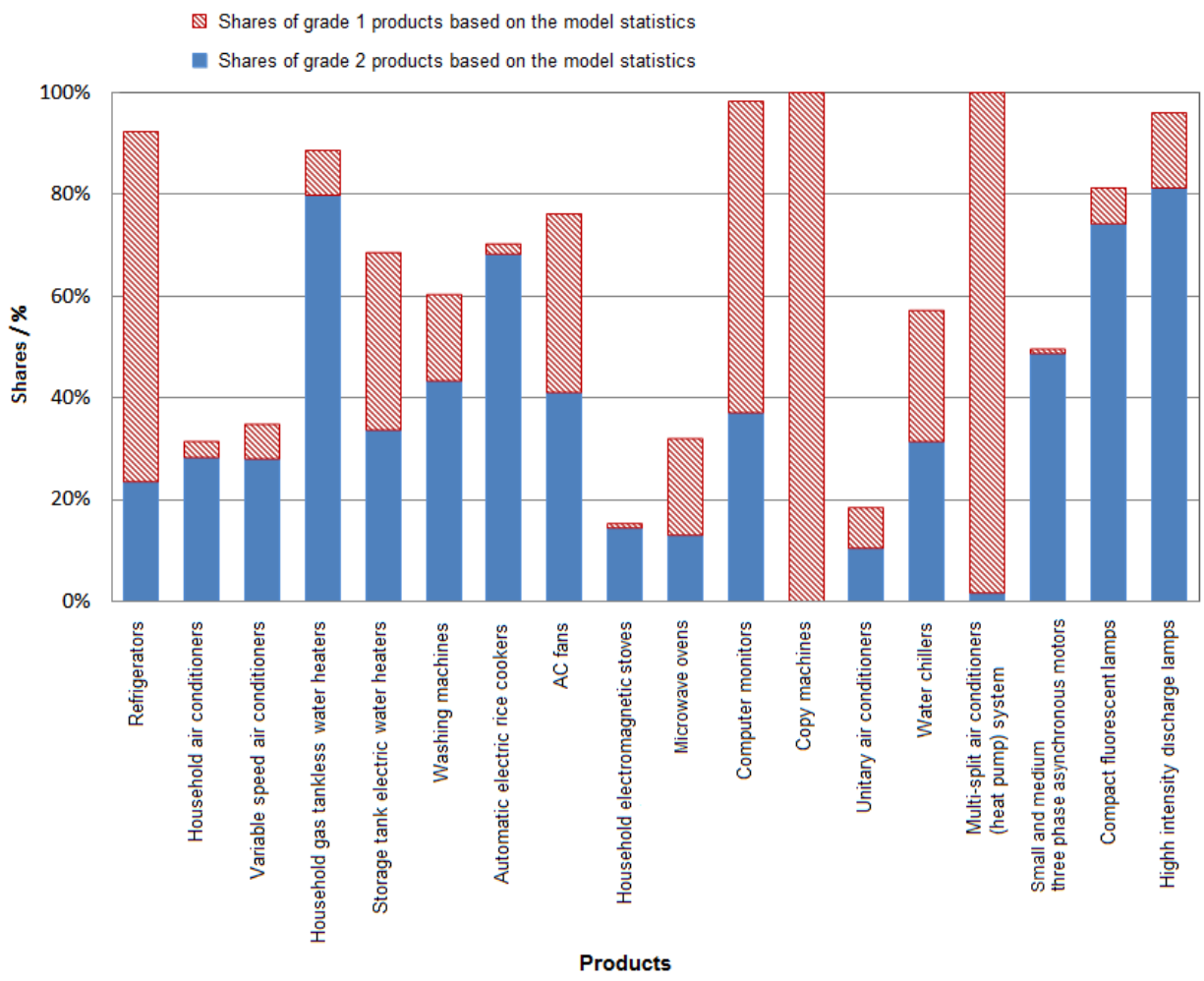

Figure 1. Distribution of energy efficiency levels for key energy-using products (2011)

1.2 Specific energy efficiency level status of major energy-using products

The detailed energy efficiency levels and development status for major energy-using products in our country are presented below.

1.2.1 Household appliance sector – high-level adjustments

As the major focus of energy efficiency efforts for energy-using products during the 11th Five-Year Plan, the household appliance product sector benefited from new policies and legislation, a wide coverage of standards and labeling, and mature development in technology and industry. In the past few years, the energy efficiency level of household appliance products, mainly represented by room air conditioners and refrigerators, has continued to improve steadily, and some products such as refrigerators have achieved world-class energy efficiency levels. The energy efficiency of other products have fallen behind, due to the gradual withdrawal of related national energy efficiency incentive policies for some energy-using products such as room air

conditioners. Additionally, the inventory for some energy-using products which are newer to the marketplace, such as variable speed room air conditioners, is largely comprised of lower efficiency products.

After many years of rapidly leaping forward, energy efficiency levels for household appliance products have stabilized. Keywords such as “consolidation, adjustment, and development” accurately describe the development stage in 2011. As the focus of major energy conservation promotion policies and standards in China, the energy efficiency potential of various products in the household appliance sector has been almost fully discovered under the existing energy efficiency assessment systems. The sector is under great pressure to be both vigilant to costs while also continuously increasing energy efficiency to higher and higher levels. Yet, existing energy efficient technologies have been almost fully utilized, and further increases in energy efficiency will require substantial upgrade in technology innovation. Therefore, the current development priority must be given to tracking the most advanced technology trends internationally, improving and perfecting the energy efficiency assessment system for household appliance products, and creating more room to increase the energy efficiency ceiling.

Room air conditioners and variable speed room air conditioners are also facing additional pressure due to the adoption of environmentally friendly coolants during the 12th Five-Year Plan period which will impact product design, safety, and energy efficiency. In addition, collection, recycling, and disposal of CFC and HCFC coolants brings additional uncertainty to the development of household air conditioning products.

1.2.2 Industrial equipment sector - steady increase

Due to the introduction of the energy efficient product discount program in 2010, the energy efficiency of related products in the industrial equipment sector has “broken the ice” and been increasing significantly, displaying the “multiplier effect” that national energy conservation incentive policies can create. The energy efficient product discount program for high efficiency motors in 2011 expanded on the initial strength and intensity of efforts in 2010, and now the overall energy efficiency level of small and medium three-phase asynchronous motors is showing a steady upward trend. In addition, the work for revising energy efficiency standards of small and medium three-phase asynchronous motors as well as three phase distribution transformers has been underway since 2011. In fact, the new energy efficiency standard for small and medium three-phase asynchronous motors has been completed and submitted for approval, and industry is anticipating its release and implementation.

Products in the industrial equipment sector have large volumes and coverage as well as many complicated applications. As such, there are unique challenges yet huge potential for energy conservation in this sector, and substantial advancement in energy efficiency is anticipated for many products. Therefore, the key for increasing the energy efficiency of major energy-using products in the industrial sector during the 12th Five-Year Plan period is to continuously apply effective energy conservation policies to expand product and sub-sector coverage.

1.2.3 Office equipment sector- high-level development

In the office equipment sector, the energy efficiency of computer monitors and copy machines has continued to increase beyond existing high levels of efficiency, due to sector specific characteristics including high industry concentration, highly internationalized technologies, short technology update cycles, quick turnover, and generational change. Additionally, related product energy efficiency standards and labeling that have been implemented since 2009 have also had a very significant impact on the sector. With the further implementation of government energy efficient product procurement programs in China and the increasing consumer awareness, public fund procurement methods have expanded to now also include group procurement, company procurement, and consumer group procurement.

1.2.4 Lighting equipment sector - promoting the good and eliminating the bad

Energy efficiency levels for lighting equipment followed the trend of "promoting the good and eliminating the bad" in 2011. On the one hand, high efficiency product promotions, such as the "green lighting program" and financial subsidies for promoting high efficient lighting products, helped to "promote the good" and maintain the steady growth of energy efficiency level of lighting products while rapidly increasing the national inventory of efficient products such as self-ballasted fluorescent lamps and high pressure sodium lamps. On the other hand, a phase-out of incandescent lamps has begun to "eliminate the bad". National Development and Reform Commission (NDRC) and related departments issued the *Roadmap for Gradually Phasing Out Incandescent Lamps in China* in 2011. This roadmap policy determined that, starting from October 1, 2012, the import and sale of regular incandescent lamps for illumination will be gradually banned. There are different phases of the policy based on the power usage of the lamp. The policy will thus lead to an increase overall energy efficiency level of lighting products by gradually phase out low efficiency lighting products. Industry should pay attention, however, to problems associated with the manufacturing of energy efficient lighting products, such as manufacturing energy consumption, environment pollution, product lifetime, and disposal.

1.2.5 Commercial equipment sector – change amidst stability

The overall energy efficiency of commercial equipment showed a small increase in 2011 based on sales volume. But in terms of product models, the energy efficiency for most unitary air conditioner and water chiller showed a significant decline, while the energy efficiency of multi-split air conditioning (heat pump) systems had showed a significant increase. One reason for the decline in energy efficiency of certain products may be the downsizing of the real estate market which caused an increased demand for low cost products.

With the development and application of new and higher-tier technologies in recent years, the energy efficiency assessment system for commercial equipment has developed and advanced significantly. One major development was a change from assessing the energy efficiency ratio of the equipment to assessing the coefficient of performance for an entire year. Therefore, one

focus for future efforts is to make sure energy efficiency assessment standards keep up to date with the development of new product standards. Commercial equipment usually belongs to an energy system and does not operate independently. Therefore, the energy efficiency of future products will have two directions for development: 1) to improve the development of the product itself based on the energy efficiency assessment system, and 2) to target the energy system in which the product is located for holistic energy efficient design and standard development.

Commercial equipment also faces the problem of HCFC coolant substitution. According to the requirements of Montreal Protocol, countries in Article 5 (which includes China) should freeze the consumption of HCFCs at 2009-2010 average levels by 2013, and then reduce consumption by 10% off that baseline by 2015. This requirement will give industry pressures and challenges from both the energy conservation and environmental protection sectors.

1.3 Energy usage and energy savings

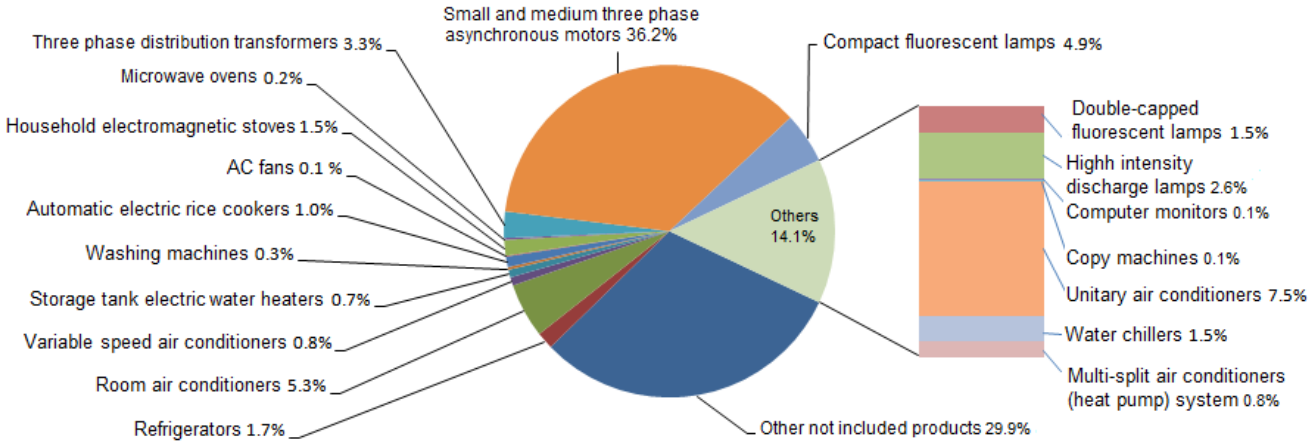

Figure 2. 2011 breakdown of electricity consumption for typical energy-using products in China (not including energy consumption of gas-fired tankless water heaters)

Under the combined influence of policies, technologies, market influences, legislation, and standards, the development of energy efficiency level of energy-using products will be directly reflected in the energy consumption and energy savings variation between products. According to the China Statistical Yearbook, the total national electricity consumption in China was 4.6928 trillion kWh in 2011, increasing by 11.7% year-on-year. The electricity consumption of the 22 energy-using products covered by this book totaled 3.23824 trillion kWh[②] in 2011, with the breakdown by product illustrated in Figure 2 and Table 1. Electricity 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 were at the top of the list, accounting for 36.2%, 7.5%, and 5.3% respectively, of the total national electricity consumption in 2011.

[②] This value is the simple sum of electricity consumption of the products covered in this report. The electricity consumption of small and medium three phase asynchronous motors may overlap with other products.

In 2011, the total electricity savings of 22 typical energy-using products reached 18.86 billion kWh (using 2009 as baseline), while gas savings reached 33 million cubic meters or 2.312 million tons of standard coal equivalent (tce)[③]. The year-on-year electricity savings of newly added products in 2011 is illustrated in Figure 3. It shows:

(1) On one hand, the electricity savings of small and medium three phase asynchronous motors, three phase distribution transformers, and room air conditioners were all significant at 6.57 billion kWh, 3.62 billion kWh, and 2.46 billion kWh respectively. Together, they accounted for 67.1% of the total electricity savings in 22 typical energy-using products.

(2) On the other hand, the electricity savings of high-intensity discharge lamps, unitary air conditioners, variable speed room air conditioners, washing machines, and copy machines showed negative growth year-on-year, particularly high-intensity discharge lamps and unitary air conditioners which had a large decline two years in a row.

Table 1. Energy savings of typical energy-using products in 2011

Products		2011 Total Electricity Consumption of products	2011 newly added products YoY annual electricity savings (per unit)		2011 Total Annual Energy Savings
		billion kWh	Absolute value (kWh)	Relative value (%)	billion kWh
Household appliances	Household Refrigerators	78.13	1.19	0.55	2.29
	Room air conditioners	249.12	-37.7	-4.86	2.46
	Variable speed air conditioners	37.99	-12.44	-3.56	-0.73
	Household gas tankless water heaters	75.06	0.28	0.14	0.11
	Electric storage tank water heaters	34.89	13.95	4.29	0.42
	Washing machines (top-loading)	7.18	1.56	5.26	-0.24
	Washing machines (front-loading)	5.8	6.24	2.22	
	Automatic electric rice cookers	47.65	-1.23	-0.72	0.82
	AC electric fans	4.27	1.21	6.15	0.58

[③] Calculated as electricity (equivalent value) to standard coal factor 0.1229 kgce/kWh.

	Household induction cooktops	71.09	0.37	0.12	0.01
	Microwave ovens	9.39	11.37	9.34	0.18
Office	Computer monitors	5.2	2.17	6.44	0.79
	Copy machines	3.71	0	0	-0.15
Commercial	Unitary air conditioners	353.86	170.75	1.2	-0.84
	Water chillers	67.86	2345.81	3.55	0.72
	Multi-split air condition (heat pump) unit	38.73	751.99	11.33	0.97
Industrial	Small and medium three phase asynchronous motors	1,695.49	102.88	0.89	6.57
	Three phase distribution transformers	119.57	244.90	0.5	3.62
Lighting	Compact fluorescent lamps	230.98	0.88	1.43	2.09
	Double-capped fluorescent lamps	56.97	3.18	2	0.53
	High-intensity discharge lamps	120.37	3.52	0.15	-1.23
Total		3,238.24	—	—	18.86

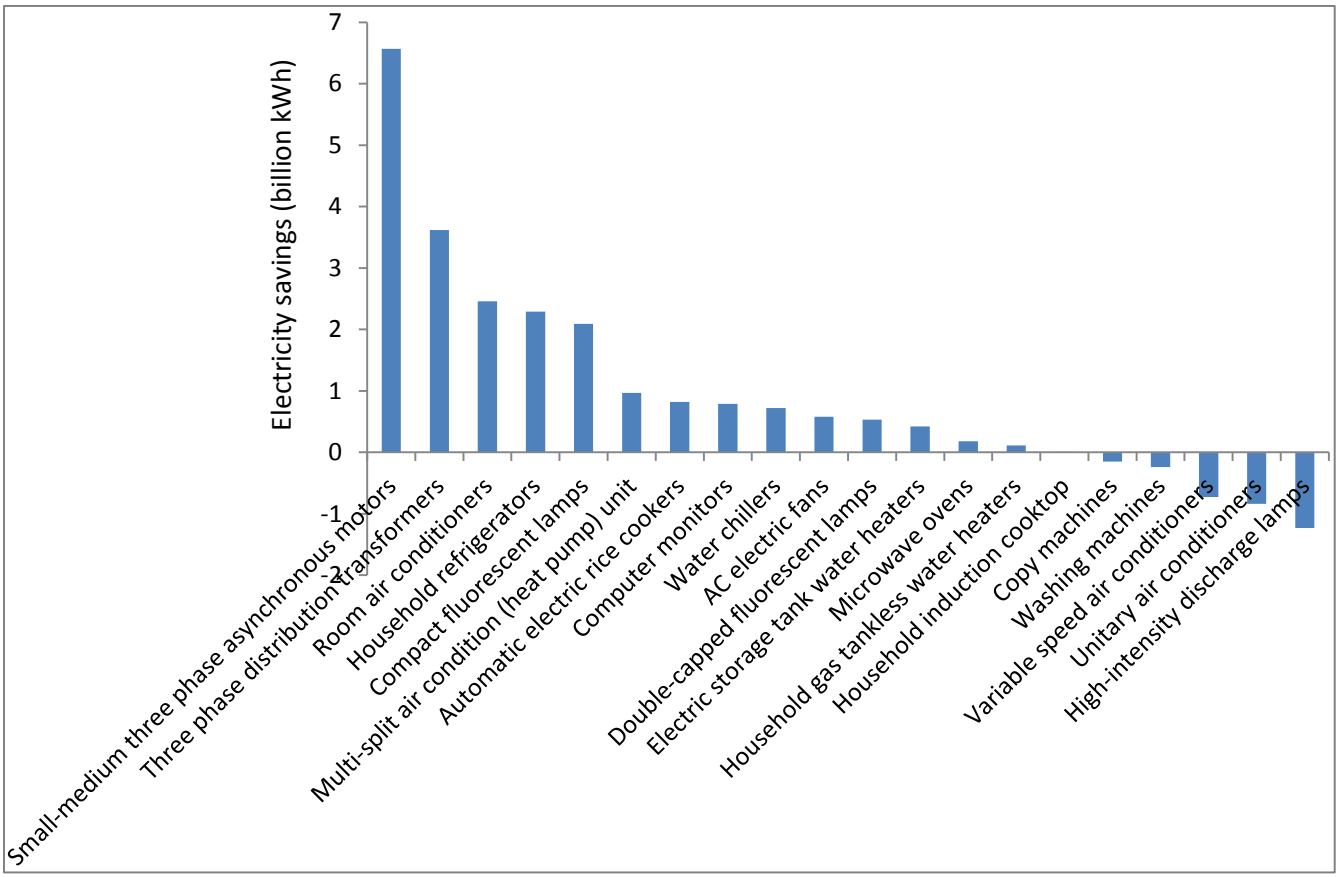

Figure 3. Year-on-year electricity savings of newly installed typical energy-using products in 2011 (including the equivalent electricity savings of gas-fired tankless water heaters)

2. The effects of major energy efficiency policies and measures

2.1 Energy efficient products discount program

Originally implemented in 2010, the energy efficient product discount program continued in 2011. Three editions (5th, 6th, and 7th) of the energy efficient automobile promotion catalogs and two editions (2nd and 3rd) of high efficient motor promotion catalogs were published. In the meantime, taking note of implementation results over the past two years, a series of important policy adjustments were made on the energy efficient product discount program in 2011, including:

(1) For products that have reached promotion objective, implement a mechanism to withdraw the policy at the appropriate time. High efficiency room air conditioners were the first group of products in the energy efficient products discount program in June 2009. Driven by this program, new energy efficiency standards (GB12021.3-2010) were implemented smoothly, leading to a complete end to the manufacture and sale of low energy efficient air conditioners with original grades 3, 4, and 5. The overall energy

efficiency level increased 24%, on par with advanced world levels. In addition, the market price of high efficiency fixed-speed room air conditioners dropped dramatically, saving consumers a total of 30 billion Yuan in purchasing costs. The above results indicate that the energy efficient products discount program reached its objective, which is to increase domestic demand, make structural adjustments, and benefit the consumer. The policy has achieved the overall effect of opening up the energy efficient product market with room air conditioners becoming the first successful example of industrial and market upgrade achieved through financial incentives.

(2) Adjust and improve policy mechanisms based on the specific implementation situation. The Ministry of Finance, NDRC, and Ministry of Industry and Information Technology jointly issued *Notice of the Adjustment on Promotion Subsidies of Energy Efficient Automobiles* (CJ 2011 No.754) in September 2011 to adjust the comprehensive product fuel consumption standard limit which must reached by the automobiles in order to qualify for promotion. The classifications used in the original policy for products with complete vehicle curb mass (CM) over 1,320kg have been removed, and all products have been grouped into one category. But for products with CM under 1,320kg, the classification has remained unchanged. The requirements of fuel consumption per 100km (L/100km) for products in all categories have been reduced by an average of over 7%, thus significantly increasing the energy efficiency level of promoted vehicles.

2.2 Rural area household appliance subsidy program

As the financial incentive for energy efficiency with the earliest implementation and largest coverage area in China's recent years, the rural area household appliance subsidy program has played an important role in driving rural area spending, popularizing energy efficient household appliances, and improving the living quality of farmers since 2008. According to official data, the rural area household appliance subsidy program has associated nationwide appliance sales of 103 million units with sales value totaling 264.1 billion Yuan in 2011, representing year-on-year increases of 34.5% and 53.1% respectively. As of late 2011, cumulative sales for the whole program totaled 218 million units and 505.9 billion Yuan, with 59.22 billion Yuan issued in subsidies.

Once the rural area household appliance subsidy program had reached its expected results, the policy began to be phased out. On September 8, 2011, Ministry of Finance, Ministry of Commerce and Ministry of Industry and Information Technology jointly issued *Notice of Ending the Rural Area Household Appliance Subsidy Program in Shandong, Sichuan, Henan, and Qingdao* (CJ [2011] No.748). This notice requires that Shandong, Sichuan, Henan, and Qingdao (which were the first regions to implement the policy) to terminate the rural area household appliance subsidy program as scheduled as of November 30, 2011. In addition, according to the *Rural Area Household Appliance Subsidy Program Operation Detail* (CJ [2009] No.155), all other provinces, cities, and autonomous regions in the nation will end the program by the end of January 2013.

Looking back on its three years of implementation, the rural area household appliance subsidy program focused on the huge market opportunity in China's rural area. Meanwhile, China's household appliance industry, which was suffering serious impacts from the world economic crisis, could divert sales of large volumes of production into the domestic market, giving the industry time and space to adjust its structure and push for further development while improving the rural residents' quality of life. In addition, during the implementation process of this program, energy efficiency standards played a key supporting function, and the product energy efficiency index became an important measuring scale for products to qualify for the subsidy. This in turn pushed the development of energy conservation and emissions reduction technology within the household appliance industry. At the same time, government subsidies allowed many rural residents to enjoy real economic benefits in the purchase of their appliances.

2.3 Old for new exchange program

As laid out by related plans, the "old for new" exchange programs for automobiles and household appliances were terminated on January 31, 2011 and December 31, 2011 respectively. The old for new exchange program for household appliances had been implemented for over two years. It played an important role in countering the international financial crisis, increasing spending, and promoting energy conservation and environment protection, and it achieved significant economic and social benefits.

The national old for new exchange program for household appliances sold a total 92.48 million new appliances across five categories. The program pulled in over 342 billion Yuan in direct spending and, at the same time, strongly promoted the healthy and orderly process development for collecting, disassembling, and reusing old products, leading to increased resource recycling and reduced environmental pollution.

In September 2011, the Beijing Municipal Commission of Commerce, Beijing Finance Department, Beijing Municipal Commission of Development & Reform, and Beijing Energy Efficiency and Environmental Protection Center jointly organized "Beijing High Energy Efficient Household Appliance Promotion Sale Pilot Project" (the "Promotion Sale Pilot Project") to increase consumer spending on energy efficient household appliances and provide financial subsidies to individuals and organizations who purchased energy efficient household appliance that were covered by the old for new exchange program and had a grade 1 or grade 2 energy efficiency label. Anyone who purchased qualifying products would receive extra subsidies in addition to the old for new exchange subsidies. For example, customers who purchased a television, refrigerator, washing machine, or air conditioner with grade 1 energy efficiency would receive another 300 Yuan/unit subsidy, while customers who purchased a television or air conditioner with grade 2 energy efficiency would receive another 100 Yuan/unit subsidy, and customers who purchased an energy efficient computer (equipped with a monitor of grade 1 and grade 2 energy efficiency) would receive another 200 Yuan/unit subsidy.

2.4 Promoting high efficiency lighting products

Promotion of high efficiency lighting has the earliest implementation and largest geographic coverage of any of China's energy efficient product promotion programs. From January 2006 to December 2011, under the strong support and drive from government authorities and with the active participation of related enterprises in the lighting industry, a total over 500 million units of high efficiency lighting products were promoted, saving 20 billion kWh of electricity annually and reducing carbon dioxide emissions by 20 million tons.

In order to accelerate the elimination of regular incandescent lighting products, increase energy efficiency, protect the environment, and actively fight global climate change, the NDRC, Ministry of Commerce, General Administration of Custom, State Administration for Industry and Commerce, and State General Administration of Quality Supervision, Inspection and Quarantine jointly issued the *Road Map for Gradually Phasing Out Incandescent Lamps in China* (Notice [2011 No. 28]) on November 1, 2011, with the following main contents:

The products to be phased out are incandescent lamps designed for general illumination in households and similar locations with electricity voltage between 200–250 V. The elimination process will take place in five phases:

Phase one: November 1, 2011 to September 30, 2012 is a buffer period. Related importers and merchants should follow the requirements in this notice in preparation for the phase out.

Phase two: Starting from October 1, 2012, imports and sales of regular illumination incandescent lamps 100W and above are banned.

Phase three: Starting from October 1, 2014, imports and sales of regular illumination incandescent lamps 60W and above are banned.

Phase four: October 1, 2015 to September 30, 2016 is a midterm evaluation period to assess the previously implemented policy and make adjustments to subsequent policy.

Phase five: starting from October 1, 2016, imports and sales of regular illumination incandescent lamps 15W and above are banned (taking into account any adjustments based on the midterm evaluation results).

2.5 Government procurement program for energy efficient products

Since the first edition of government procurement list for energy efficient products (the "government procurement list") was published in 2004 up to the end of 2011, government authorities such as NDRC and Ministry of Finance have successively published 10 editions of the government procurement list. The 9th and 10th editions of the government procurement list were successively published in 2011.

As one of the major measures for achieving public organizations energy efficiency during the 12th Five-Year Plan, further and sustained implementation of government procurement for energy efficient products must be continued, as it is an important way for government organizations to lead and demonstrate in pushing energy conservation and emissions reduction, while encouraging the promotion of energy efficient technologies and products.

2.6 Key energy efficient technology promotion catalogue

Issued on December 30, 2011, the *National Key Energy Efficient Technology Promotion Catalogue* (4th edition) covered 13 industries including coal, electricity, iron and steel, nonferrous metal, petroleum chemicals, chemicals, building material, machinery, textile, light industry, building, transportation, and communication, with a total of 22 high efficiency energy saving technologies. Light industry and communication are two newly added industries that were not included in the 3rd edition.

2.7 Energy efficiency standards

In 2011, two new mandatory energy efficiency national standards were issued for commercial cooling equipment and household solar water heating systems. The *Minimum Allowable Values of Energy Performance and Energy Efficiency Grades of Commercial Refrigerating Appliances - Part 1: Refrigerated Display Cabinets with Remote Condensing Unit* (GB 26920.1-2011), and *Minimum Allowable Values of Energy Efficiency and Energy Efficiency Grades for Household Solar Water Heating Systems* (GB 26969-2011). As of the end of 2011, China has 46 mandatory energy efficiency standards, covering the following products:

(1) Household appliances: household refrigerators, room air conditioners, washing machines, color televisions, AC electric fans, automatic electric rice cookers, household gas-fired tankless water heaters, combined gas-fired air and water furnace, electric storage tank water heaters, variable speed room air conditioners, household induction cooktops, flat panel televisions, household and similar purpose microwave ovens, solar water heating systems;

(2) Lighting equipment: fluorescent lamp ballasts, double-capped fluorescent lamps, single-capped fluorescent lamps, self-ballasted fluorescent lamps, high pressure sodium lamps, high pressure sodium lamp ballasts, metal halide lamps, metal halide lamp ballasts;

(3) Office equipment: computer monitors, copy machines, printers, fax machines;

(4) Commercial equipment: unitary air conditioners, water chillers, multi-split air conditioning (heat pump) systems, external power supplies, refrigerated display cabinets;

(5) Transportation equipment: passenger vehicles, light duty commercial vehicles, three-wheel cars, low speed trucks, cargo trucks, buses;

(6) Industrial equipment: small and medium three phase asynchronous motors, ventilation fans, centrifugal water pumps, distribution transformers, power transformers, AC contactors, petroleum heaters, industrial boilers, low power motors, displacement compressors.

China is the largest solar water heater producer and user in the world, the annual production of solar water heaters in China reached 49 million square meters and inventory on hand reached 160 million square meters in 2010. As the first mandatory energy efficiency standard for solar water heaters in the world, the publishing and implementation of *Minimum Allowable Values of Energy Efficiency and Energy Efficiency Grades for Household Solar Water Heating Systems* (GB 26969-2011) will have significant effects in helping related industries in China promote high energy efficiency products and technologies.

Table 1. Mandatory energy efficiency national standards issued in 2011

Serial No.	Standard No.	Standard name	Date of issue	Date of implementation	Sector
1	GB 26920.1-2011	Minimum Allowable Values of Energy Performance and Energy Efficiency Grades of Commercial Refrigerating Appliances - Part 1: Refrigerated Display Cabinets with Remote Condensing Unit	2011-7-19	2012-5-1	Commercial
2	GB 26969-2011	Minimum Allowable Values of Energy Efficiency and Energy Efficiency Grades for Household Solar Water Heating Systems	2011-7-19	2012-8-1	Household

Based on estimates at the end of 2011, the accumulated energy savings of 19 product categories[④] which energy efficiency standards have been implemented for some time totaled 687.8 billion kWh of electricity or 248 million tons of standard coal equivalent (tce), resulting in 640 million tons of carbon dioxide emissions reduction and 2.82 million tons of sulfur dioxide emissions reduction.

2.8 Energy efficiency labels

[④] The 19 product categories are: room air conditioners, household refrigerators, washing machines, gas water heaters, variable speed room air conditioners, electric water heaters, induction cooktops, automatic electric rice cookers, AC electric fans, unitary air conditioners, small and medium three phase asynchronous motors, water chillers, multi-split air conditioning systems, compressors, ventilation fans, computer monitors, copy machines, self-ballasted fluorescent lamps, and high pressure sodium lamps.

NDRC, General Administration of Quality Supervision Inspection and Quarantine (AQSIQ), and Certification and Accreditation Administration of China (CNCA) issued the *Product Catalogue for Implementing Energy Efficiency Labeling in the People's Republic of China* (8th edition) in August 2011. It covers three new product categories including printers, fax machines, and digital television receivers. Up to now, China has successively issued eight editions of the product catalogue for energy efficiency labeling, covering 25 energy-using products in household appliances, commercial equipment, office equipment, and industrial equipment.

(1) Household appliances: household refrigerators, room air conditioners, washing machines, household gas-fired tankless water heaters, combined gas-fired air and water furnace, variable speed room air conditioners, electric storage tank water heaters, household induction cooktops, automatic electric rice cookers, AC electric fans, flat panel televisions, household and similar purpose microwave ovens, digital television receivers;

(2) Lighting equipment: self-ballasted fluorescent lamps, high pressure sodium lamps;

(3) Office equipment: computer monitors, copy machines, printers, fax machines;

(4) Commercial equipment: unitary air conditioners, water chillers, multi-split air conditioning (heat pump) systems, displacement compressors;

(5) Industrial equipment: small and medium three phase asynchronous motors, power transformers, ventilation fans, AC contactors.

2.9 Energy efficient product certification

CNCA actively carried out further measures on energy conservation and emission reduction in 2011 related to the certification of renewable energy and energy-saving products. As of the end of 2011, a total 78 energy-saving products and 20 renewable energy products had received certification.

CNCA issued and implemented the *12th Five-Year Plan for National Certification and Accreditation Development* in December 2011. According to the layout of the Plan, the tasks during the 12th Five-Year Plan will be focused on key sectors such as strategic and emerging industries, agriculture, information technology, and modern service industries, all of which relate to the national economy, the people's livelihood, and national security. Further research will be conducted on key technologies for certification and accreditation, particularly in the areas of carbon emissions reduction, new energy and renewable energy, and energy management system. There are also key problems to be tackled in building up and perfecting the current certification and accreditation systems.

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

3.1 Energy efficiency status of typical household appliances

Household appliances are closely tied to people's quality of life and have large sales volume and coverage. The sector has been an important focus for energy conservation and emissions reduction policies as well as macroeconomic policies that drive domestic demand. During the 11th Five-Year Plan, the quantity and energy efficiency level of household appliances has shown a sustained and rapid increase under the influence of incentive policies such as the energy efficient products discount program, rural area household appliance subsidy program, and old for new household appliance exchange program; the government procurement program for energy efficient products; as well as the positive effects of energy efficiency standards and labeling. Due to the beginning of the phase-out of incentive policies in 2011, the overall energy efficiency level of some product categories decreased. Table 4 provides the energy efficiency level survey results of 10 major household appliances, including refrigerators, room air conditioners, variable speed room air conditioners, gas-fired water heaters, electric water heaters, washing machines, household induction cooktops, AC electric fans, automatic electric rice cookers, and microwave ovens. It shows that the annual average energy efficiency level of major appliances in 2011 did not change much compared to 2010, instead maintaining an overall steady trend. The product with the largest increase in overall energy efficiency level was household refrigerators. The energy efficiency levels for room air conditioners, variable speed room air conditioners, and AC electric fans all decreased, with AC electric fans decreasing significantly.

Table 4. Average energy efficiency levels of major household appliances in 2011

Products		Assessment Indicators	2010 Average Energy Efficiency Level		2011 Average Energy Efficiency Level		Increased Level Compared to 2010	
			By Model	By Sales Volume	By Model	By Sales Volume	By Model	By Sales Volume
Household refrigerators	Refrigerator	Energy efficiency index（η）	51.30%	52.86%	46.20%	52.38%	9.94%	0.91%
	Refrigerator-freezer		36.40%	40.74%	36.20%	40.85%	0.55%	-0.27%
	Freezer		61.20%	56.59%	58.60%	55.14%	4.25%	2.55%
Room air conditioners	CC≤4500	Energy efficiency ratio（EER）	3.46	3.32	3.33	3.29	-3.76%	-0.66%
	4500 < CC≤7100		3.36	3.22	3.23	3.19	-3.87%	-0.95%
	7100 < CC≤14000		3.27	3.06	3.13	3.08	-4.28%	0.68%
Variable speed air conditioner	CC≤4500	Seasonal energy efficiency ratio（SEER）	4.49	3.95	4.33	3.84	-3.56%	-2.69%
	4500 < CC≤7100		4.28	3.62	4.13	3.56	-3.50%	-1.66%
	7100 < CC≤14000		3.93	3.27	3.82	3.25	-2.80%	-0.69%
Gas water heaters	Water heater overall	Heat efficiency	87.68%	87.87%	87.80%	88.20%	0.14%	0.37%
	Heating furnace, heating only		90.73%	87.75%	90.80%	88.04%	0.08%	-

	Heating furnace, dual use (heating)		88.99%	88.01%	89.50%	88.01%	0.57%	0.00%
	Heating stove, dual use (hot water)		89.06%	87.87%	89.50%	88.20%	0.49%	0.37%
Electric water heaters		24 hr fixed energy consumption index	0.73	0.68	0.7	0.68	4.11%	0.99%
		Hot water output ratio	0.62	0.62	0.64	0.63	3.23%	-2.50%
Washing machines	Washing machine (front-loading)	Electricity consumption (kWh/cycle/kg)	0.02	0.018	0.019	0.018	2.89%	0.63%
		Water consumption (L/cycle/k)g	25.026	24.996	24.6	24.956	1.70%	0.16%
		Cleaning ratio	0.795	0.808	0.8	0.813	0.62%	0.63%
	Washing machine (top-loading)	Electricity consumption (kWh/cycle/kg)	0.184	0.19	0.18	0.19	2.30%	0.00%
		Water consumption (L/cycle/k)g	10.339	12.004	10.3	12.004	0.38%	0.00%
		Cleaning ratio	1.071	1.03	1.06	1.03	-0.99%	0.00%
Household induction cooktops		Heat efficiency %	85.9	85.88	86	86	0.12%	0.14%
		Standby mode energy consumption W	2.2	–	2.4	–	-9.09%	–
AC electric fans	200mm capacitor desk fan	Energy efficiency value m^3/(min.W)	0.64	0.62	0.51	0.62	–	0.37%
	200mm shaded-pole desk fans		0.66	0.53		0.53	–	0.45%
	230mm capacitor desk fan		0.65	0.73	0.65	0.73	–	0.36%
	230mm shaded-pole desk fan		0.75	0.58		0.58	–	0.38%
	250mm capacitor desk fan		0.84	0.81	0.79	0.81	–	0.27%
	250mm shaded-pole desk fans		0.78	0.63		0.63	–	0.40%
	300mm capacitor desk fan		0.98	0.88	0.92	0.88	-6.12%	0.27%
	350mm capacitor desk fan		1.17	0.98	1.28	0.98	9.40%	0.24%
	400mm capacitor desk fan		1.18	1.09	1.15	1.1	-2.54%	0.74%
	450mm capacitor desk fan		1.21	1.28	1.18	1.1	-2.48%	-14.07%
	500mm capacitor desk fan		1.22	1.47	1.19	1.29	-2.46%	-12.22%
	600mm capacitor desk fan		1.43	2.87	1.56	1.47	9.09%	-48.81%

	900mm capacitor ceiling fan		2.95	2.95	2.75	2.88	-6.78%	-2.59%
	1050mm capacitor ceiling fan		2.95	3.09	2.89	2.96	-2.03%	-4.41%
	1200mm capacitor ceiling fans		3.07	3.33	3.07	3.1	0.00%	-6.92%
	1400mm capacitor ceiling fan		3.29	3.53	3.28	3.33	-0.30%	-5.66%
	1500mm capacitor ceiling fan		3.72	3.68	3.44	3.54	-7.53%	-3.76%
	1800mm capacitor ceiling fan		—	—	—	3.68	—	—
Automatic electric rice cookers	P≤400W	Heat efficiency %	78.4	77.6	77.3	77.8	-1.40%	0.28%
		Keep-warm mode energy consumption Wh	36.9	40	33.6	40	8.94%	0.00%
		Standby mode energy consumption Wh	1.4	1.61	1.2	1.61	14.29%	0.12%
	400W < P≤600W	Heat efficiency %	80.9	78.6	80.6	78.8	-0.37%	0.28%
		Keep-warm energy consumption Wh	41.7	50	44.1	50	-5.76%	0.00%
		Standby mode energy consumption Wh	1.5	1.6	1.4	1.6	6.67%	0.12%
	600W < P≤800W	Heat efficiency %	82.8	79.6	82	79.8	-0.97%	0.28%
		Keep-warm mode energy consumption Wh	37.6	60	50.9	60	-35.37%	0.00%
		Standby mode energy consumption Wh	1.5	1.6	1.5	1.6	0.00%	0.12%
	800W < P≤1000W	Heat efficiency %	82.8	80.6	82.3	80.8	-0.60%	0.27%
		Keep-warm mode energy consumption Wh	58.7	70	56.8	70	3.24%	0.00%
		Standby mode energy consumption Wh	1.5	1.61	1.4	1.61	6.67%	0.12%
	1000W < P≤2000W	Heat efficiency %	84.3	81.6	83.1	81.8	-1.42%	0.27%
		Keep-warm mode energy consumption Wh	68.8	80	72.1	80	-4.80%	0.00%
		Standby mode energy consumption Wh	1.7	1.6	1.8	1.6	-5.88%	0.12%
Microwave oven		Efficiency %	—	—	59.1	59.1	—	—
		Standby mode energy consumption W	—	—	1.1	1	—	—

	Off-state energy consumption	–	–	0.1	1	–	–
	Barbecue mode energy consumption W	–	–	1.1	–	–	–

3.1.1 Household refrigerators

In 2011, the household refrigerator market in China showed the following characteristics:

(1) Overall product energy efficiency level showed stable growth. In 2011, annual household refrigerator production in China reached 96.66 million units, and annual sales reached 69.55 million units. The share of energy efficient household refrigerators was 92.1% in 2011, of which the share of grade 1 products reached 69.0%, becoming the market's mainstream product grade. Based on product sales-weighted calculations, the average energy efficiency index of refrigerators had the largest increase at 9.9%. The average energy efficiency level of freezers also saw a significant increase, while the energy efficiency of freezer-refrigerators basically maintained the same level as last year.

(2) The market entered an adjustment period, and competition increased. Before 2011, associated energy conservation incentive policies were continuously implemented, and market brands and energy efficiency levels were growing steadily. But due to the withdrawal of associated incentive policies and the prolonged global economic crisis, the household refrigerator industry faced tough challenges, and the growth rate for production and sales reduced.

(3) Difficulties in product upgrades and technology advancement became more and more obvious. As the household appliance with the earliest development and relatively good marketing in China, the room for various conventional energy efficient technology improvements in household refrigerators was getting smaller, and therefore industry urgently needed substantial innovation to improve upon existing technology. Therefore, from now on, technology innovation is the fundamental driving force for the development of the household refrigerator industry, regardless of whether it is for the healthy development of the industry or for energy conservation and environmental protection.

(4) The reform of existing energy efficiency assessment system is inevitable. The current energy efficiency assessment system for household refrigerators reflected the practical requirements of refrigerators at the time it was issued and had positive effects in promoting energy efficiency for the industry, but now it is necessary to further improve the assessment methods based on the difference between practical application and rated testing operation. Therefore, the development of future refrigerator product standards should center on the improvement of its energy efficiency assessment system, guiding the development direction for industry technology and breaking through the bottleneck of the current leading energy efficient technology.

3.1.2 Room air conditioners

In 2011, the room air conditioner products (not including variable speed room air conditioners) market in China showed the following characteristics:

(1) Overall product energy efficiency declined slightly in 2011. The share of energy efficient room air conditioners was 31%, of which the share of grade 1 products was 2.9%. Grade 3 products were the market mainstream. Air conditioners with rated cooling capacity between 7,100W – 14,000W had the largest decrease in energy efficiency ratio at 4.28%.

(2) The pace of development slowed as the industry began to restructure. The room air conditioner market appeared to be "fast at the beginning but slow later on" in 2011. Industry production reached 77.95 million units in total, with a year-on-year decrease of 30.5%, while domestic sales reached 34.89 million units, with a year-on-year decrease of 32.4%.

(3) The effects of policy phase-out were seen, while overall product energy efficiency was already high and fluctuated within that range. China's domestic sales of energy efficient room air conditioners reached 13.7 million units in 2011, accounting for 39.3% of all room air conditioner sales. As the energy efficient products discount program began to be phased out, overall product energy efficiency decreased. Yet, the implementation of the energy efficient products discount program overall brought about a large increase in this product's energy efficiency standard. The magnitude of the increase and effectiveness of the policy have been rarely seen in the world to date, and the energy efficiency end results are sustainable.

(4) Improvements to the energy efficiency assessment system are urgently needed. To date, the energy efficiency assessment for room air conditioners is still using a single point energy efficiency ratio assessment approach. With the change of consumer use behavior, however, existing techniques have not been able to completely reflect the product's energy efficiency level. Additionally, there is no requirement for heat generation efficiency, and comparison assessments cannot be conducted with variable speed room air conditioner using the same platform.

3.1.3 Variable speed room air conditioners

In 2011, the variable speed room air conditioner market in China showed the following characteristics:

(1) The pace of industry development quickened, and product sales increased rapidly. The domestic sales of variable speed room air conditioner was 25.63 million units in 2011, with a year-on-year increase of 124.3% and accounting for 42.3% of total air conditioner

sales (including both fixed speed and variable speed room air conditioners), up by 24.1% year-on-year.

(2) The overall energy efficiency of the products saw a modest decline. The share of energy efficient variable speed room air conditioners was 34.6% in 2011, of which the share of grade 1 products was 7.0%, dropping 14.3% as compared to 2010. Grade 3 products were the market mainstream accounting for 62.2% of sales, increasing 25.2% as compared to 2010. The share of grade 4 and 5 products was 3.1%, falling 11% as compared to 2010. The overall market development was heading in the direction of energy savings. For overall product energy efficiency level, there was a downward trend, in particular for products with cooling capacity under 7,100W, for which energy efficiency levels declined 2-3%. The main reason for the downward trend is that energy efficiency grade 3 and 4 products became the mainstream of the variable speed room air conditioners' new market share in 2011. The energy efficiency ratio for products with a rated cooling capacity less than 4,500W decreased the most at 3.56%. According to sales statistics, the share of energy efficient variable speed room air conditioners was only 9.3%. Although there is a large difference between product model statistics and sales statistics, they are reflected equally in the market development trends for energy efficient variable speed room air conditioners.

(3) The revision of variable speed room air conditioner energy efficiency standard was in sight in 2011. Based on comprehensive tests of the utilization status of room air conditioners in China, a technical proposal was made and recognized by industry to use APF as an energy efficiency assessment index for variable speed room air conditioners. APF combined annual operating efficiency under both heating and cooling conditions, representing a large advancement in energy efficiency standards and a globally leading methodology.

3.1.4 Other household appliances

(1) Household gas-fired tankless water heaters

There was no significant change in the energy efficiency level of household gas-fired tankless water heaters. The production of household gas tankless water heaters was 16.5 million units in 2011, with a year-on-year decrease of 2.4%, while domestic sales were 9.91 million units, with a year-on-year decrease of 1.9%. The share of energy efficient household gas tankless water heaters was 88.4%, with a year-on-year increase of 7.4%. In terms of energy efficiency grade distribution, the share of grade 1 products was 8.8%. Although the share of grade 1 products had some increase compared to 2010, the grade 2 and 3 products were still the mainstream, and their energy efficiency grade distribution status was similar to that of 2010. The product's average heat efficiency at its rated heating load did not change from 2010 levels.

(2) Electric storage tank water heaters

The energy efficiency level of electric storage tank water heaters decreased slightly in 2011. The production of electric storage tank water heaters was 20.8 million units in 2011, with a year-on-year growth of over 10%, while domestic sales totaled 13.1 million units, with a year-on-year growth of 7.4%. The market structure was relatively stable with some movement towards higher end products. The share of energy efficient electric storage tank water heaters was 68.4% in 2011, with a year-on-year increase of 10.8%. The share of grade 1 products was 35.0%, with a year-on-year increase of 17.1%, while the share of grade 3 products was 26.7%, with a year-on-year decrease of 5.1%. The electric storage tank water heater market gradually developed in the direction of energy efficiency. As for overall energy efficiency levels, the 24-hour fixed energy consumption index of electric storage tank water heaters deceased 4.1% year-on-year in 2011, while the hot water output ratio increased 3.2%.

(3) Washing machines

The overall energy efficiency level of washing machines was stable. Production of washing machines totaled 35.72 million units, with a year-on-year decrease of 42.5%, while domestic sales totaled 35.8 million units, with a year-on-year decrease of 6.7%. Front-loading machines gradually replaced traditional top-loading washing machines and became the market mainstream. The share of energy efficient washing machines was 60% in 2011, of which grade 1 products accounted for 16.9%. The share of energy efficient grade top-loading washing machines was 53.8%, with a year-on-year increase of 13.8%, while the share of energy efficient front-loading washing machines was 99.5%, with a year-on-year decrease of 0.5%. Of that 99.5%, the share of grade 1 products was 98.0%. Top-loading washing machines moved in the direction of energy efficiency in 2011, while all front-loading washing machines basically achieved an energy efficient grade. As far as their overall energy efficiency level is concerned, effective electricity consumption, effective water consumption, and cleaning ratio basically maintained the same level as in 2010.

(4) Automatic electric rice cookers

There is a large variance in the energy efficiency levels for different types of automatic electric rice cookers. In 2011, the production of automatic electric rice cookers in China was 186 million units, with a year-on-year increase of 8.9%, while domestic sales reached 51 million units, with a year-on-year increase of 37.8%. The share of energy efficient automatic electric rice cookers was 70%, of which the share of grade 1 products was 2% while the majority of rice cookers were grade 2 products. This distribution of energy efficiency grades was basically consistent with that of 2010. For energy efficiency levels, the heat efficiency of products with different power series all had different levels of decrease, depending on the model. There were large differences between different models for the energy consumption in keep-warm and standby modes. Based on sales statistics, the share of energy efficient automatic electric rice cookers was 35%, while grade 3 products were the mainstream. There was a large difference between product model statistics and sales statistics. There is still room to expand the energy efficient automatic electric rice cooker market.

(5) AC electric fans

There was a large variance in energy efficiency levels for different models of AC electric fans, but the overall energy efficiency level dropped modestly. The production of AC electric fans was 174 million units in 2011, with a year-on-year increase of 7.9%, while domestic sales reached 39 million units, with a year-on-year increase of 75%. The majority of AC electric fans sold were energy efficient models, accounting for 76.1% of sales in 2011. The share of grade 1 products was 35.3%. Product energy efficiency distribution varied widely among different types of AC electric fans, with grade 1 product proportion ranging anywhere from 4.8% to 80%. There is still room to advance to higher energy efficiency levels. At the same time, there was a wide variation in year-to-year change of energy efficiency levels between different products with some decreasing by as much as -7.53% and some increasing by as much as 9.40%.

(6) Household induction cooktops

The overall energy efficiency level of household induction cooktops declined slightly in 2011. The annual production of household induction cooktops in China was 141 million units in 2011, with a year-on-year decrease of 30%, while domestic sales totaled 43.2 million units, also with a year-on-year decrease of 30%. The share of energy efficient household induction cooktops was 15%, increasing by 7% from 2010. The share of grade 2 products was 14%, increasing by 8% as compared to 2010, while grade 3 products were the market mainstream. As for energy efficiency levels, the heat efficiency of household induction cooktops in 2011 was consistent with 2010 levels, but the standby mode power consumption increased modestly.

(7) Microwave ovens[⑤]

Production of microwave ovens was 67.01 million units in 2011, with a year-on-year decrease of 1.2%, while domestic sales reached 15.77 million units, with a year-on-year increase of 4.8%. The share of energy efficient microwave ovens was 31.6% in 2011, and grade 3 products were the market mainstream. As for energy efficiency levels, the average value of efficiency was 59.1%, the average power consumption in standby mode was 1.1W, the average off-state power consumption was 0.1W, while the average barbecue mode energy consumption was 1.1Wh.

3.2 Energy efficiency status of typical office equipment

3.2.1 Computer monitors

The energy efficiency level of computer monitors saw a large increase. The production of computer monitors in China reached 120 million units in 2011, with domestic sales close to 36 million units. The share of energy efficient computer monitors was 98.1% in 2011, an increase of 5% as compared to 2010. Grade 1 products were the market mainstream accounting for 61.5%

[⑤] There is no energy efficiency variation data for microwave ovens as this was the first assessment for this product category.

of models. As for energy efficiency levels, computer monitors energy efficiency levels experienced a large increase of 5.3% in 2011 with off-state energy efficiency increasing by 13%. The majority of computer monitors are energy efficient models.

In Table 5, the 2011 average energy efficiency level (energy efficiency, off-state energy efficiency) of computer LCD monitors increased significantly compared to last year, with energy efficiency increasing by 6.6% and off-state energy efficiency increasing by 20.5%, approaching the grade 1 energy efficiency level specified by energy efficiency standard (GB21520-2008) *The Minimum Allowable Value of Energy Efficiency and Energy Efficiency Grades for Computer Monitors*. Since the implementation of this energy efficiency standard (GB21520-2008) in 2008, the average energy efficiency level of computer LCD monitors has increased from just having met grade 2 energy efficiency in 2009, to nearly meeting grade 1 energy efficiency in 2011. The main causes for this rapid increase are the energy efficiency standards and general characteristics of the office equipment sector, such as quick upgrade and generational change as well as technology advancement.

3.2.2 Copy machines

The energy efficiency level of copy machines decreased in 2011. The production of photocopy machines reached 6.54 million units, with domestic sales totaling 580,000 units. Although the share of energy efficient copy machines was 100% and entirely of grade 1 efficiency, the energy consumption of some product models saw a large increase as compared to 2010, with overall energy efficiency levels decreasing as seen in Table 5.

Table 5. Average energy efficiency level of major office equipment in 2011

Products		Assessment Indicators	2010 Average Energy Efficiency Level		2011 Average Energy Efficiency Level		Increased Level Compared to 2010	
			By Model	By Sales Volume	By Model	By Sales Volume	By Model	By Sales Volume
Computer monitors	LCD monitor	Energy efficiency cd/W	0.95	0.94	1	1	5.37%	6.59%
		Off-state energy efficiency W	0.69	0.78	0.6	0.62	13.54%	20.51%
Copy machines	Monochrome copy machine	Typical energy consumption kWh	1.88	—	2.09	—	-11.39%	—
		Off-state energy consumption W	0.23	—	0.22	—	0	—

		Copying speed Pages/min	19.75	—	22.9	—	15.95%	—
	Color copy machine	Typical energy consumption kWh	—	—	—	—	—	—
		Off-state energy consumption W	—	—	—	—	—	—
		Copying speed Pages/min	—	—	—	—	—	—
	Monochrome multifunction copy machine	Typical energy consumption kWh	4.8	—	5	—	-4.08%	—
		Off-state energy consumption W	0.15	—	0.19	—	-27.37%	—
		Copying speed Pages/min	30.83	—	37	—	-20.03%	—
	Color multifunction copy machine	Typical energy consumption kWh	10.19	—	10.19	—	-0.05%	—
		Off-state energy consumption W	0.21	—	0.21	—	-0.53%	—
		Copying speed Pages/min	39.94	—	39.94	—	-0.01%	—

3.3 Energy efficiency status of typical commercial equipment

The commercial equipment energy efficiency assessment system had significant developments and progress in 2011, with the adoption of APF to measure comprehensive annual product energy efficiency for both heating and cooling. The correspondent development of energy efficiency standard, however, lagged behind comparatively. Based on EER assessment system specified by the energy efficiency standard, the energy efficiency status of three major energy-using products in the commercial equipment sector – unitary air conditioners, multi-split air conditioning (heat pump) systems, and water chillers – is shown in Table 6, with detail presented in the following sections.

3.3.1 Unitary air conditioners

The overall energy efficiency level of unitary air conditioners increased slightly. The production of unitary air conditioners (excluding special models such as ducted air conditioners and rooftop air conditioning systems) totaled 1.05 million units (sets) in 2011, with a year-on-year decrease of 40.5%. The sales of regular unitary air conditioners, however, increased by 13.3% to 1.03 million units. Overall, the majority of unitary air conditioners are air-cooled. The share of energy efficient unitary air conditioners was 18% in 2011, with a year-on-year decrease of 12%. The share of grade 1 products was 8%. As such, non-energy efficient products were the market mainstream. As for energy efficiency levels, the average energy efficiency ratio of ducted unitary air conditioners saw a moderate increase from 2010, while the ratio for non-ducted models saw a moderate decrease. Based on sales statistics, the overall energy efficiency of unitary air conditioners increased continuously in 2010 and 2011 and has now basically reached the grade 3 requirements of the energy efficiency standard (GB19576-2004).

3.3.2 Multi-split air conditioning (heat pump) systems

Total production of multi-split units was 720,000 units (sets) in 2011, with a year-on-year increase of 21.1%, while domestic sales reached 714,000 units (sets), with a year-on-year increase of 21.4%. The share of energy efficient multi-split air conditioning (heat pump) systems was 100% in 2011, with a year-on-year increase of 23.2%.The share of grade 1 products was 98.8% year-on-year, with an increase of 28.8%. As for energy efficiency levels, the comprehensive cooling performance coefficient of various multi-split air conditioning (heat pump) system product series increase significantly by as much as 29.34% for some product series. Based on sales statistics, the overall energy efficiency level of multi-split air conditioning (heat pump) systems remained roughly constant at last year's level, while the majority products on the market are energy efficient products.

3.3.3 Water chillers

The overall energy efficiency level of water chillers increased slightly. The production of water chillers was 200,000 units in 2011, with a year-on-year increase of 5.2%, while domestic sales reached 188,000 units, with a year-on-year increase of 3.8%. The share of energy efficient water chillers was 57% in 2011, of which the share of grade 1 products was 26%. The share of grade 4 and 5 products was 16%, similar to 2010 levels. Based on sales statistics, the share of grade 1 products was only 7.5%, but various assessments indicated that grade 2 and 3 products were the market mainstream. As for energy efficiency level, the performance coefficient of various water chillers remained constant or increased slightly compared to 2010 levels.

Table 6. Average energy efficiency level of major commercial energy-using products in 2011

Products	Assessment Indicators	2010 Average Energy Efficiency Level		2011 Average Energy Efficiency Level		Increased Level Compared to 2010	
		By Model	By Sales Volume	By Model	By Sales Volume	By Model	By Sales Volume

Unitary air conditioners	Air cooled (non-ducted)	Energy efficiency ratio (EER)	2.74	2.74	2.64	2.78	-3.65%	1.61%
	Air cooled (ducted)		2.5	2.44	2.53	2.48	1.20%	1.80%
	Water cooled (non-ducted)		3.56	3.14	3.46	3.18	-2.81%	1.40%
	Water cooled (ducted)		3.2	2.84	3.34	2.88	4.37%	1.55%
Multi-split air conditioning (heat pump) unit	CC<=28000	integrated part load value （IPLV）	3.87	3.51	4.5	3.54	16.28%	0.93%
	28000<CC<=84000		4.06	3.46	4.52	3.49	11.33%	0.94%
	CC>84000		3.51	3.41	4.54	3.44	29.34%	0.96%
Water chillers	CC≤50W air cooled series	Coefficient of Performance (COP)	2.87	2.78	2.88	2.81	0.35%	1.09%
		Total power consumption kW	9.7	—	8.66	—	-10.72%	—
	CC>50W air cooled series	Coefficient of Performance (COP)	3.07	2.98	3.09	3.01	0.65%	1.02%
		Total power consumption kW	110.3	—	182.34	—	65.31%	—
	CC≤528W water cooled series	Coefficient of Performance (COP)	4.79	4.37	4.96	4.42	3.55%	1.04%
		Total power consumption kW	62.5	—	66.65	—	6.64%	—
	528W < CC≤1163W water cooled series	Coefficient of Performance (COP)	5.22	4.67	5.36	4.73	2.68%	1.20%
		Total power consumption kW	157.8	—	153.34	—	-2.83%	—
	CC>1163W water cooled series	Coefficient of Performance (COP)	5.89	5.06	5.91	5.13	0.34%	1.41%

		Total power consumption kW	467.1	—	487.35	—	4.34%	—

3.4 Energy efficiency status of typical lighting equipment[6]

3.4.1 Compact fluorescent lamps

The production of compact fluorescent lamps reached 2.66 billion units in 2011, with domestic sales totaling 1.066 billion units. As a type of compact fluorescent lighting for which energy efficiency labels had also been implemented, the share of energy efficient self-ballasted fluorescent lamps was 81%, of which the share of grade 1 products was 7%. As for energy efficiency levels, the minimum initial lumen efficiency of self-ballasted fluorescent lamps increased modestly compared to 2010. Based on sales statistics, all self-ballasted fluorescent lamps were energy efficient products, and the market share of grade 1 products was 29%. The overall average energy efficiency level of the product maintained an upward trend.

3.4.2 High intensity discharge lamps

The production of high intensity discharge lamps was 113 million units in 2011, with domestic sales reaching 26.64 million units. As a type of high intensity discharge lighting for which the energy efficiency label had also been implemented, the share of energy efficient high pressure sodium lamps was 96%, of which the share of grade 1 products was 15%. As for energy efficiency levels, the minimum initial lumen efficiency of high pressure sodium lamps remained at the same level as 2010. Based on sales statistics, all high pressure sodium lamps were energy efficient products, and the market share of grade 1 products was 40%. The overall average energy efficiency level of the product maintained an upward trend.

Table 7. Average energy efficiency level of major lighting equipment in 2011

Products		Assessment Indicators	2010 Average Energy Efficiency Level		2011 Average Energy Efficiency Level		Increased Level Compared to 2010	
			By Model	By Sales Volume	By Model	By Sales Volume	By Model	By Sales Volume
Self-ballasted fluorescent lamps	5-8W - RR series	Minimum initial lumen efficiency (lm/W)	46.8	47.08	47.4	48.22	1.28%	2.42%
	5-8W - RB series		50.4	51.08	50.8	55.82	0.79%	9.28%
	9-14W - RR series		53.8	55.08	54.4	56.22	1.12%	2.07%
	9-14W - RB series		57.5	59.08	57.1	60.22	-0.70%	1.93%
	15-24W - RR series		58.7	62.08	60.2	63.22	2.56%	1.84%

[6] The analysis of high-intensity discharge lamps and compact fluorescent lamps was performed on high pressure sodium lamps and self-ballasted fluorescent lamps respectively, both of which had also implemented energy efficient labeling.

	15-24W - RB series		63	66.08	63.9	67.22	1.43%	1.73%
	25-60W - RR series		60.6	68.08	62.6	69.22	3.30%	1.67%
	25-60W - RB series		63	71.08	63.5	72.22	0.79%	1.60%
High pressure sodium lamps	50W series	Minimum initial lumen efficiency (lm/W)	72	71.67	—	72	—	0.46%
	70W series		79.3	79.94	78.5	80.2	-1.01%	0.33%
	100W series		85.5	86.67	83.7	87	-2.11%	0.38%
	150W series		94.9	96.67	94.6	97	-0.32%	0.34%
	250W series		104.8	103.67	107	104	2.10%	0.32%
	400W series		115.1	113.67	115.6	114	0.43%	0.29%
	1000W series		125	123.67	125	124	0.00%	0.27%

3.5 Energy efficiency status of typical industrial equipment

3.5.1 Small and medium three phase asynchronous motors

In total, there are more than 2,300 motor manufacturing enterprises in China. The production of small and medium three phase asynchronous motors was about 25.63 million units in 2011 with a total wattage of around 174 million kW, representing a 1.7% year-on-year increase. Based on product model statistics, the share of energy efficient motors was 49.2%, with a year-on-year increase of 19.1%. As for energy efficiency levels, the average efficiency of various small and medium three phase asynchronous motor models all had a moderate increase as shown in Table 8. Overall, the market share of high efficiency motors had a moderate increase compared to 2010. The incentive policies provided by central and local governments, especially the energy efficient product discount program for high efficiency motors played an important role in this increase. It should be noted, however, that for products supported by financial policies for energy efficiency, the increase of energy efficiency for motors was relatively small compared to household appliances and lighting products for the following reasons:

(1) The 2006 edition of motor energy efficiency standard (GB18163-2006) has now been implemented for four years, but the new target energy efficiency values, which were supposed to be implemented by 2011 as mentioned in the standard, have not been issued and implemented.

(2) The current international price for industrial metal raw material commodities such as copper, aluminum, and steel have remained high, pushing up manufacturing costs of high efficiency motors.

(3) As the majority of motor buyers are not end users but rather manufacturers of various equipment (such as fans, water pumps, and compressors), energy efficiency promotion relies on end user demand for high efficiency products.

(4) There will be great technical difficulties to further increase the energy efficiency of motors.

(5) There has not been strong enough supervision in the policy implementation mechanism for eliminating old motors and speeding up the market transition to high efficiency motors.

Table 8. Average energy efficiency level of small and medium three phase asynchronous motors in 2011

Products		Assessment Indicators	2010 Average Energy Efficiency Level		2011 Average Energy Efficiency Level		Increased Level Compared to 2010	
			By Model	By Sales Volume	By Model	By Sales Volume	By Model	By Sales Volume
Small and medium three phase asynchronous motors	2 poles	Efficiency	86.87%	—	88.20%	—	1.30%	—
	4 poles		86.13%	—	87.90%	—	2.06%	—
	6 poles		83.78%	—	86.10%	—	2.77%	—

3.5.2 Three-phase distribution transformers

There are over 1,700 distribution transformer manufacturing enterprises in China. The national production of distribution transformers was 1.083 million units in 2011 with a total capacity of about 461.63 million kVA, representing a year-on-year increase of 11.2%. In the new market for 10 kV distribution transformers, distribution transformers with a loss level of 11 series or above were the market mainstream. Among them, the majority of dry-type distribution transformers were SC10 series, while the majority of oil-type distribution transformers were S11 series, as shown in Table 9.

Recent development in the transformer market indicates that users increasingly prefer energy efficient amorphous alloy transformers, roll core transformers, and improved dry-type transformers. Another growing preferences will be maintenance free box-type transformers.

Table 9. Average energy efficiency level of three phase distribution transformers in 2011

Products		Assessment indicators	Unit of indicators	2011 average no load loss		Increased level compared to 2010 (%)	
				By Model	By Sales Volume	By Model	By Sales Volume
Three phase distribution transformers	Oil-type	Loss level	—	—	S11	—	0.2
	Dry-type			—	SC10	—	0.1

4. Energy efficiency potential analysis

Based on data analysis of 22 energy-using products across the household appliance, industrial equipment, commercial equipment, lighting equipment, and office equipment sectors in 2011, the potential[⑦] for energy efficiency improvements are illustrated in Figure 4.

(1) By 2015, annual electricity savings could reach 159.24 billion kWh, while annual gas savings could reach 6.85 million Nm^3. Annual carbon dioxide emissions reduction could reach 160 million tons, and annual sulfur dioxide emissions reduction could reach 8.803 million tons. Among the total electricity savings, household appliances will account for 17.5% of the savings, with commercial equipment accounting for 6.8%, industrial equipment accounting for 36.4%, lighting equipment accounting for 37.8%, and office equipment accounting for 1.5%.

(2) By 2020, annual electricity savings could reach 299.92 billion kWh, while annual gas savings could reach 15.99 million Nm^3. Annual carbon dioxide emissions reduction could reach 320 million tons, and annual sulfur dioxide emissions reduction could reach 17.973 million tons. Among the total electricity savings, household appliances will account for 26% of the savings, with commercial equipment accounting for 8.5%, industrial equipment accounting for 35.9%, lighting equipment accounting for 28.0% and office equipment accounting for 1.6%.

(3) Annual energy savings of 22 products will account for 3.8% of total energy consumption by 2015, and annual electricity savings will account for 6.6% of total electricity consumption by 2020.

As illustrated in Figure 4, household refrigerators and air conditioners (including fixed speed air conditioners and variable speed air conditioners), water chillers, small and medium three phase asynchronous motors, as well as compact fluorescent lights remain the focus of energy efficiency in their respective sectors for the next ten years. As related policies, legislation,

[⑦] This energy efficiency potential is calculated as the comparison between energy consumption in the ACT scenario and energy consumption in the FRO scenario. The ACT scenario uses 2011 market levels of efficiency and assumes that newly added products in 2012 and beyond will maintain 2011 efficiency levels. The FRO scenario assumes new energy efficiency standards will not be implemented in the future, and product energy efficiency level will remain at 2009 levels. See Appendix B.1in the full report (Chinese only) for detailed description of these scenarios.

standards and labeling, technologies, and markets have become mature and sound, the household appliance sector has established a good development mechanism. Water chillers and other commercial equipment will be an emerging hotspot for energy efficiency in the coming years. Further development of energy efficiency potential here will rely on the combined effects of related market developments, policies, and legislation. Meanwhile, user side features could potentially result in a new development model, by combining economic mechanisms, commercial operation mechanisms, and energy efficient technologies and products to push further increases in energy efficiency. Common industrial equipment such as motors is the product category with the largest energy saving potential. It is also the most difficult to promote energy efficiency for since most users are industrial enterprises. Here, the promotion of energy efficient products has to rely on the emphasis and support of policies, legislation, and standards, which altogether increase the users' enthusiasm for using high efficiency products.

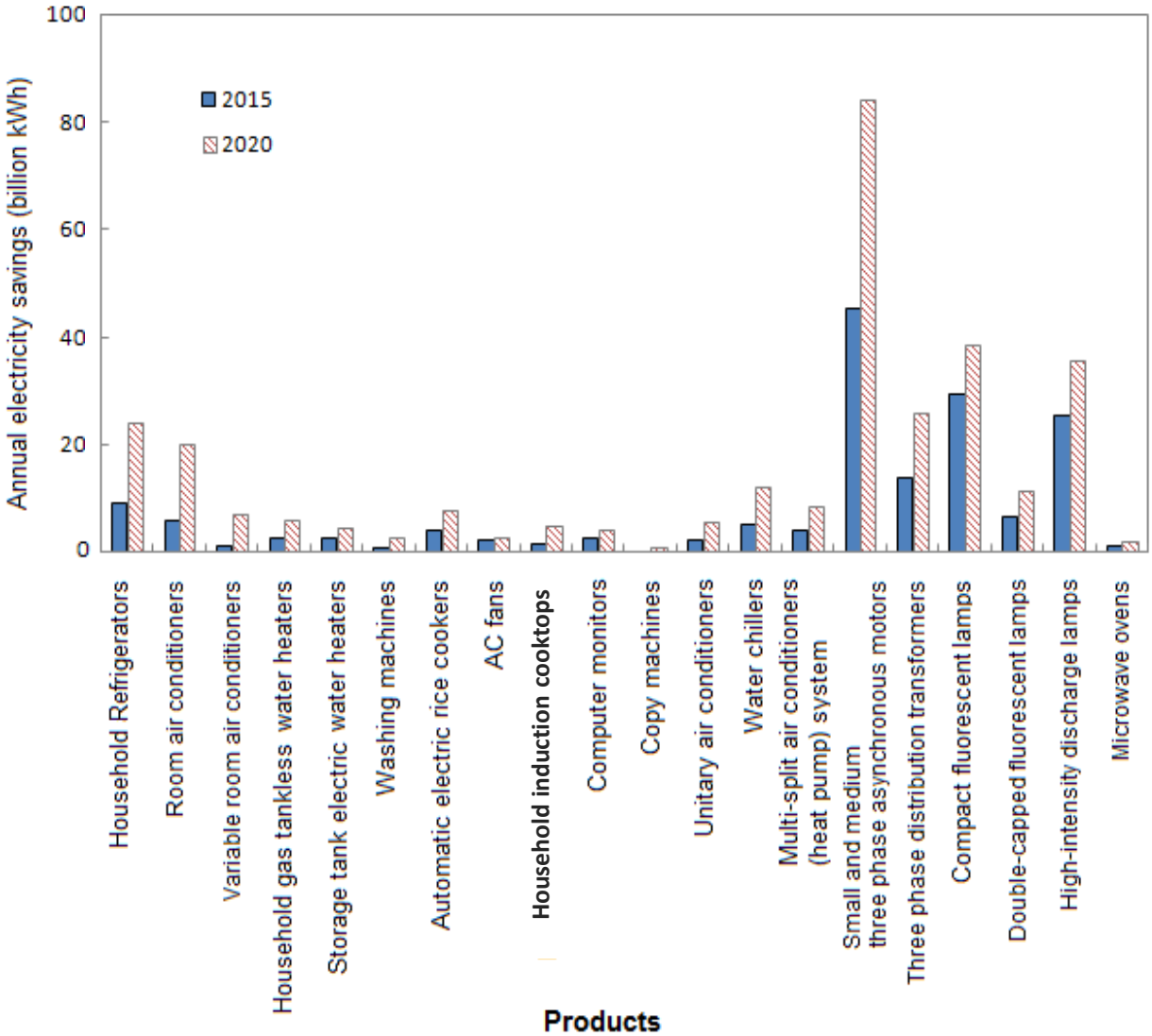

Figure 4. Energy saving potential of typical energy-using products

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