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# **Status of China's Energy Efficiency Standards and Labels for Appliances and International Collaboration**

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## 1. Introduction

China first adopted minimum energy performance standards (MEPS) in 1989. Today, there are standards for a wide range of domestic, commercial and selected industrial equipment. In 1999, China launched a voluntary endorsement label, which has grown to cover over 40 products including water-saving products (See Figure 1). Further, in 2005, China started a mandatory energy information label (also referred to as the “Energy Label”). Today, the Energy Label is applied to four products including: air conditioners; household refrigerators; clothes washers; and unitary air conditioners (See Figure 2).

MEPS and the voluntary endorsement labeling specifications have been updated and revised in order to reflect technology improvements to those products in the market. These programs have had an important impact in reducing energy consumption of appliances in China. Indeed, China has built up a strong infrastructure to develop and implement product standards. Historically, however, the government’s primary focus has been on the technical requirements for efficiency performance. Less attention has been paid to monitoring and enforcement with a minimal commitment of resources and little expansion of administrative capacity in this area. Thus, market compliance with both mandatory standards and labeling programs has been questionable and actual energy savings may have been undermined as a result. The establishment of a regularized monitoring system for tracking compliance with the mandatory standard and energy information label in China is a major area for program improvement.

Over the years, the Collaborative Labeling and Appliance Standards Program (CLASP) has partnered with several Chinese institutions to promote energy-efficient products in China. CLASP, together with its implementing partner Lawrence Berkeley National Laboratory (LBNL), has assisted China in developing and updating the above-mentioned standards and labeling programs. Because of the increasing need for the development of a monitoring system to track compliance with standards and labeling, CLASP, with support from Japan’s Ministry of Economy, Trade and Industry (METI), has expanded its ongoing collaboration with the China National Institute of Standards (CNIS) to include enforcement and monitoring. CNIS has already begun working on the issue of compliance. CNIS has conducted modest sample testing in 2006 for refrigerators, freezers and room air-conditioners, and repeated the same task in 2007 with a similar sample size for three products (refrigerators, freezers, air-conditioners and clothes washers). And, CNIS, with technical support from LBNL, has analyzed the data collected through testing.

At the same time, parallel effort has also been paid to look at the potential impact of the label to 2020. In conjunction with CNIS, CLASP technical experts reviewed the standards development timeline of the four products currently subject to the mandatory energy information label. CLASP, with the support of METI/IEEJ, collaborated with CNIS to develop the efficiency grades, providing: technical input to the process; comment and advice on particular technical issues; as well as evaluation of the results. In addition, in order to effectively evaluate the impact of the label on China’s market, CLASP further

provided assistance to CNIS to collect data on both the efficiency distribution and product volume distribution of refrigerators on the market.

This short report summarizes the status of Standards and Labeling program, current enforcement and monitoring mechanism in China, and states the importance of international collaborations.

## **2. China's energy efficiency standards and labels for appliances**

China is now one of the world's largest producers and consumers of household appliances, lighting, and other residential and commercial equipment. In 1981, shortly after China's economic reforms began, ownership of appliances was extremely limited and even televisions were an uncommon commodity. In contrast, by 2005, each of China's nearly 190 million urban households had on average 1.3 color televisions, and nearly all owned a clothes washer, refrigerator, and air conditioner. In just 7 years, personal computer ownership rates jumped from zero to over 40%. The rapid uptake of appliances and electronics into Chinese households has driven a sustained increase in residential electricity use with an average of 14% per year between 1980 and 2004. The impact of this growth spurred the government to initiate China's first program on equipment standards which was established in 1990. By the mid-1990s, increasing emphasis on energy conservation and on the harmonization of Chinese domestic standards with international norms led to the initiation of a program to "modernize" China's standard system. Further impetus was provided by the Energy Conservation Law of 1998, which placed specific emphasis on both minimum efficiency standards and energy efficiency labeling. By 1999, the foundations of the new system for standards and labeling were in place when revised standards and new voluntary labeling criteria were released for refrigerators and air conditioners.

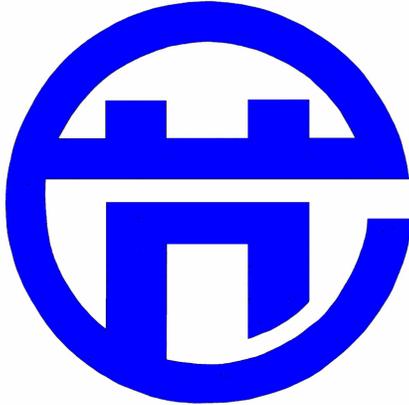
### **2.1 Status of S&L**

Currently, China has three major programs related to standards and labeling:

*1. Mandatory minimum efficiency standards.* Developed by CNIS, mandatory energy efficiency standards now cover most residential and commercial appliances, lighting and heating and cooling equipment, and total 22 or more. Beginning in 1999, CNIS developed a series of new single-period standards based upon international practice, and in 2003 began development of "reach" standards, or two-period, two-tiered standards. The proposed 2007 reach standard, (which formally was a part of the 2003 standard) will be superseded by the 2008 standard (which has its own, more stringent 2011 reach standard).

*2. Voluntary energy efficiency labeling.* The voluntary energy efficiency endorsement labeling program (Figure ), analogous to the US Energy Star program with which it cooperates closely, has been administered by CSC since 1998. Currently, the program labels 50 products from over 300 participating manufacturers including: home appliances; consumer electronics; office equipment; lighting; and selected industrial

equipment. The program requires manufacturers to: submit to an on-site audit of production facilities; undertake third-party testing in certified laboratories; and to accord with ISO 9000 standards. Audits are repeated annually.



**Figure 1: China's Voluntary Energy Efficiency Label**

3. *Mandatory energy information labeling.* In 2005, China launched a categorical mandatory energy information label, adapted from the EU categorical energy label (Figure 2). Including five categories of efficiency, from 100% (meeting the minimum standard) to 55% of the minimum standard. The label initially covered two products and in 2007 was extended to cover four products including: air conditioners; household refrigerators; clothes washers; and unitary air conditioners. CNIS is responsible for managing this program. Unlike both the mandatory standard and the voluntary energy efficiency label, manufacturers are able to self-report the energy consumption of each model.



**Figure 2: China's Mandatory Energy Information Label**

Significant overlap exists between the list of products subject to minimum energy efficiency standards and those certified for voluntary labeling (Figure 3). For products subject to the minimum efficiency standard, such as refrigerators and air conditioners, voluntary labeling criteria are developed simultaneously with the same timeframe of implementation and revision. Other products, such as printers, computers, DVD players, and other consumer electronics, are generally not subject to minimum efficiency standards and are covered only by the voluntary labeling program. In these cases, the timeline for revisions is subject to market and technical developments.

### Minimum Efficiency Standards

	1990	1999	2000	2001	2002	2003	2004	2005	2006
Domestic refrigerators/freezers*	◆	◆				◆			
Room air conditioners*	◆		◆					◆	
Clothes washers	◆					◆			
Electric irons	◆								
Automatic rice cookers	◆								
Televisions	◆								◆
Radio receivers and recorders	◆								
Electric fans	◆								
Fluorescent lamp ballasts			◆						
Small electric motors						◆			○
Compact fluorescent lamps						◆			
Linear fluorescent lamps						◆			
HPS lamps							◆		
HPS lamp ballasts							◆		
Instantaneous gas water Heaters									○
External power supplies									○
Commercial packaged AC								◆	

### Endorsement Labeling

	1990	1993	1999	2000	2001	2002	2003	2004	2005	2006
Domestic refrigerators/freezers*			◆				◆			
Room air conditioners*				◆					◆	
Fluorescent lamp ballasts				◆						
Automatic rice cookers					◆					
Hot water bottle					◆					
Small electric motors					◆					
Microwave ovens					◆					
Electric water heaters					◆					
Televisions						◆				◆
Compact Fluorescent lamps							◆			
Linear Fluorescent lamps							◆			
Clothes washers							◆			
Printers							◆			
Computers								◆		
Monitors								◆		
Fax machines								◆		
DVD players								◆		
Copiers								◆		
External power supplies									◆	
Set-Top-Box										◆

◆ Implementation of standard/label or of standard/label revision  
 ○ Currently under revision, development, or awaiting implementation

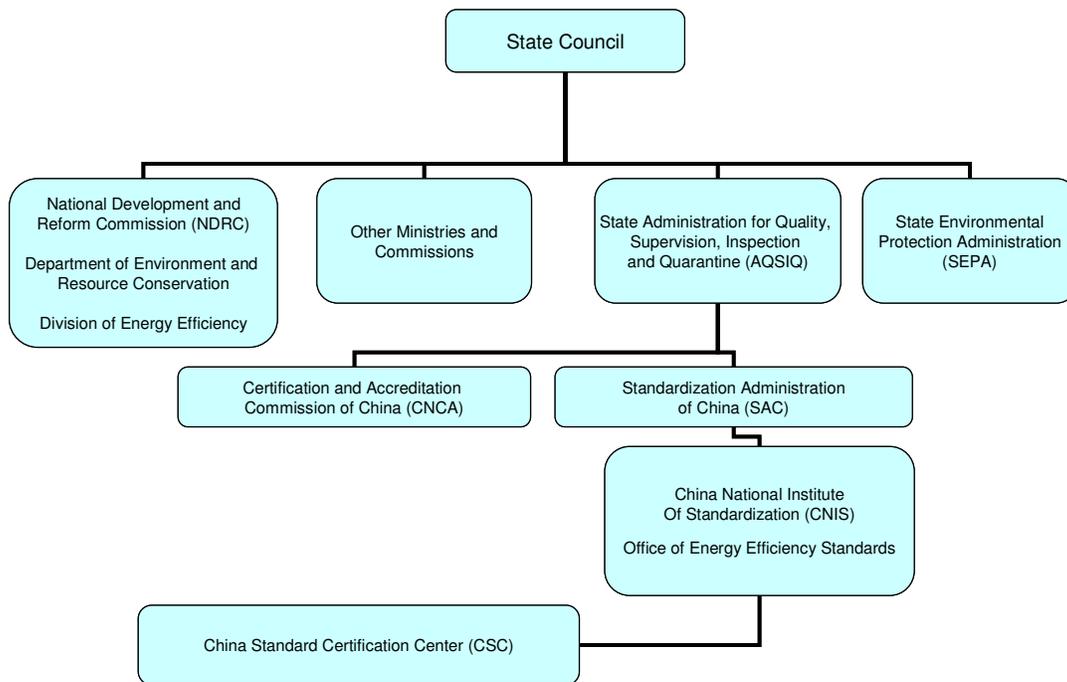
\*Products subject to mandatory energy information labeling.

**Figure 3: Timeline of Standards and Labeling in China (Selected Products)**

**2.2 The Framework of the M&E of the Standard and Label**

China’s standards system—including energy efficiency, safety, classification, and other areas—is currently under the authority of AQSIQ (State Administration of Quality, Supervision, Inspection, and Quarantine), formerly known as the State Bureau of Technical Supervision (SBTS). Although directly under the State Council, AQSIQ holds a vice-ministerial rank. This is lower than other ministries such as the Ministry of Construction (Figure ). The administrative functions of AQSIQ relative to standardization are exercised by the Standardization Administration of China (SAC), which is responsible for review and approval of new energy standards. Technical development work on energy standards has been delegated to the China National Institute of Standardization (CNIS), Office of Energy Efficiency Standards. In 1998, China established the China Certification Center for Energy Conservation Products (CECP, now the China Standards Certification Center or CSC) to implement a voluntary energy efficiency labeling program.

Overall energy efficiency policy, however, is developed and managed by the powerful National Development and Reform Commission (NDRC), based on the framework of energy conservation laid out in the National Energy Conservation Law of 1998. Though administratively separate, CNIS and CSC both provide technical support to NDRC and are responsive to new policy directions developed by NDRC.



**Figure 4: Basic Structure of China’s Standards and Labeling Organizations**

It is clear that the Standardization Law and its Implementation Regulations provide specific guidelines on appropriate penalties for the violation of mandatory standards including MEPS. Recent proposed amendment to the Energy Conservation Law provides further impetus, with specific emphasis on MEPS and voluntary labeling. It stipulates manufacture's responsibility to meet the S&L requirement, and also specify penalties and fines for negligent or false use of the label (30,000 RMB to 100,000 RMB / \$4,196 to \$13,986)

- **Current Enforcement and Monitoring Mechanism for MEPS**

Implementation of China's appliance standards and labels is governed by a variety of laws and regulations and carried out by several related agencies and departments. Agencies involved in implementation and enforcement of appliance standards and labels include: AQSIQ and its provincial branches; CNIS; and CSC.

However, for products covered under the MEPS program, there is no regular monitoring of product performance once the product has been introduced. National product quality supervision testing is at present the main mechanism to verify products' compliance status to standards. National product quality supervision testing is at present the main mechanism to verify products' compliance status to standards. According to the Management Methods of National Supervision and Random Inspection of Products Quality, which was revised in 2005, AQSIQ, as designated supervision agency for product quality, is in charge of organizing national product quality testing and publicizing the testing results and enforcement actions against offenders.

The regular product quality testing happens every quarter and the special product quality testing is set according to the degree of concern over product quality. There are thousands of types of consumer products on the market, and the emphasis is on product safety. Thus, energy efficiency receives little priority in the national product quality testing. For example, in the 2nd quarter of 2005, AQSIQ organized national testing for clothes washers. A total of 30 models from 30 manufacturers were tested. A total of 29 met the standard requirements on safety and performance. However, energy efficiency was not tested during this test and so no data is available on how many of these met national energy efficiency requirements. In the first half of 2006, AQSIQ also organized a special product quality test on room air-conditioners, which covered products from 29 manufacturers. While the manufacturers covered in this special test represent roughly 43% of air-conditioners manufacturers in China, the models tested represent only less than 1% of all models of room air-conditioners in the market. Thus, the report finds that limited sample size is a significant weakness in the existing testing. It was discovered during the course of this research that AQSIQ only has half a million RMB (7.8 million yen) per year allocated for testing for all household appliances, home electronics, and lighting products. There is neither a national registry of product performance, nor a reporting requirement, making it difficult to monitor the compliance status of household appliances.

- **Current Enforcement and Monitoring Mechanism for Labeling Program**

The China Energy Label Center (CELC) was recently established within CNIS to supervise the registration and to monitor the use of energy information labels. Currently, CELC has 6 full time staff members, but no regular budget for monitoring the compliance of the energy information label.

11 product performance information to CNIS but allowed to print the label on their own products and product literatures. There is no fee to the manufacturers for the use of the label. The mandatory labeling program was launched on March 1, 2005. CELC currently has 496 companies registered in the product database. The database records each product's model number by manufacturer and the declared information label category, along with the product's energy consumption as tested by the company and other relevant MEPS requirements, such as water consumption for clothes washers (See Table 1).

**Table 1 Registered Enterprises and Type of Products for Energy Information Label**

Product Types	No. of companies	No. of product models
Refrigerators	139	5630
Room air-conditioners	82	7852
Clothes Washers	257	3291
Unitary air-conditioners	18	934

The key gaps between the current Chinese and international best practices are in the following areas:

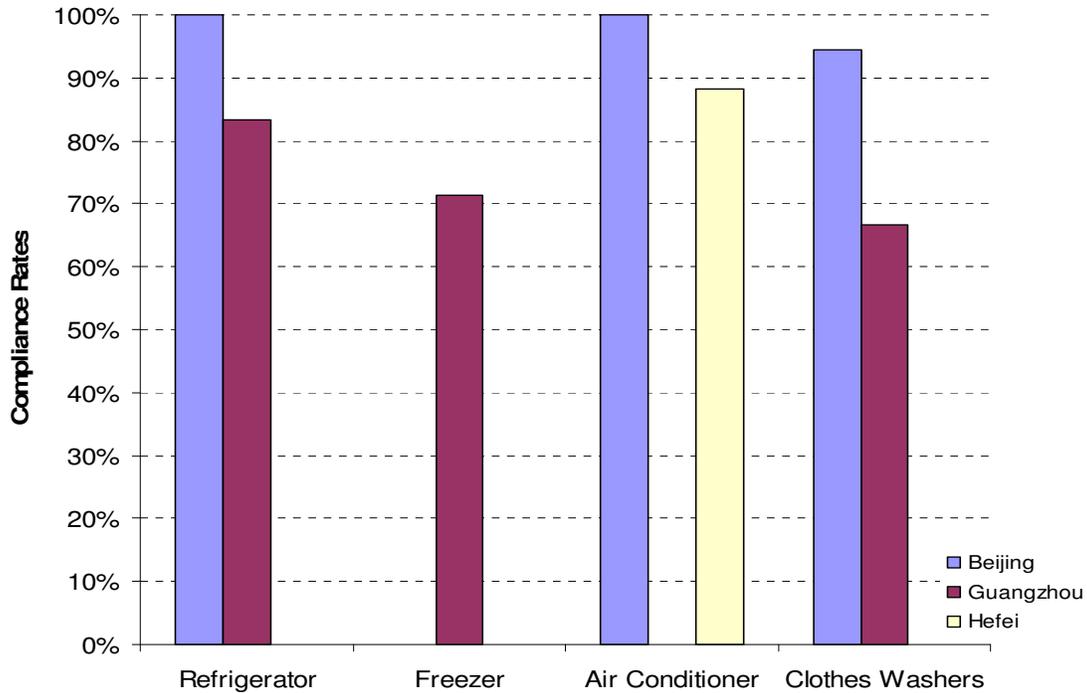
- 1) there is no product registration and reporting requirement for MEPS;
- 2) though such a requirement is in place for the China Energy Information Label this covers only two products;
- 3) monitoring and verification of products performance are inadequate in China, both for the MEPS and the Energy Information Label and in particular limited by sample sizes too small to qualify for vigorous monitoring as well as a lack of attention to energy efficiency versus other issues such as health and safety;
- 4) there is insufficient funding to undertake verification testing for MEPS and the Energy Information Label; and
- 5) the testing infrastructure in China is relatively weak in comparison with the need.

### ***2.3 Check-Testing of Manufacturer Self Reported Labeling Data & Compliance with MEPS***

The 2006 and 2007 check testing of compliance undertaken by CELC reveals that while most products meet the claimed performance levels, there were also cases of non-compliance. Varying compliance rates were observed both by product type and by city. Overall, in the first-round refrigerators, air-conditioners and clothes washers had higher compliance rates than did freezers (Figure 5). The compliance rates were:

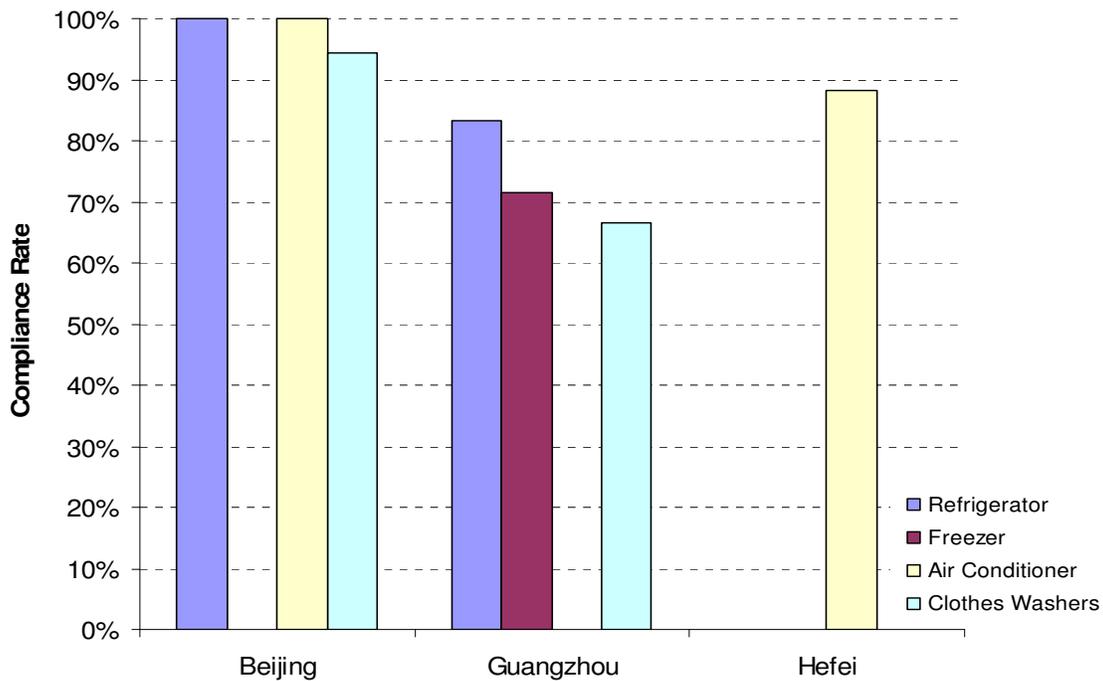
- 87 percent for refrigerators;
- 71 percent for freezers;
- 91 percent for air-conditioners; and
- 90 percent for clothes washers.

The results after re-testing are more favorable and the overall compliance for all products reached 96 percent.



**Figure 5. 2007 Testing Compliance Rates by Product Type in Initial Testing**

Regarding the geographic distribution of the testing results, Beijing had higher compliance rates for each type of product than Guangzhou and Hefei (Figure 6). Of the three cities Guang-zhou had the lowest compliance rate for refrigerators and clothes washers, as well as a relatively low compliance rate for its freezer sample. Clothes washers had geographi-cally divergent compliance rates with Beijing equal to 94 percent versus Guangzhou at 67 percent in the 2007 testing.



Total = 73 models

**Figure 6. Testing Compliance Rates by Region in Initial Testing**

In comparison with the 2006 testing results, the 2007 testing showed significant improvements in compliance across product types and regions (Table 2). The number of non-compliant product models decreased from 11 out of 54 in 2006, to only 3 out of 73 models in 2007. On the regional level, Beijing not only achieved higher compliance rates for refrigerators (from 86 percent to 100 percent), but also achieved 100 percent compliance for air-conditioners and 94 percent for clothes washers. Further, the 2006 performance and compliance rates varied between models sold in high-end, first-tier appliance retailers versus those sold in second- and third-tier retailers, with those sold in high-end retailers having higher compliance. In 2007, this result was not replicated.

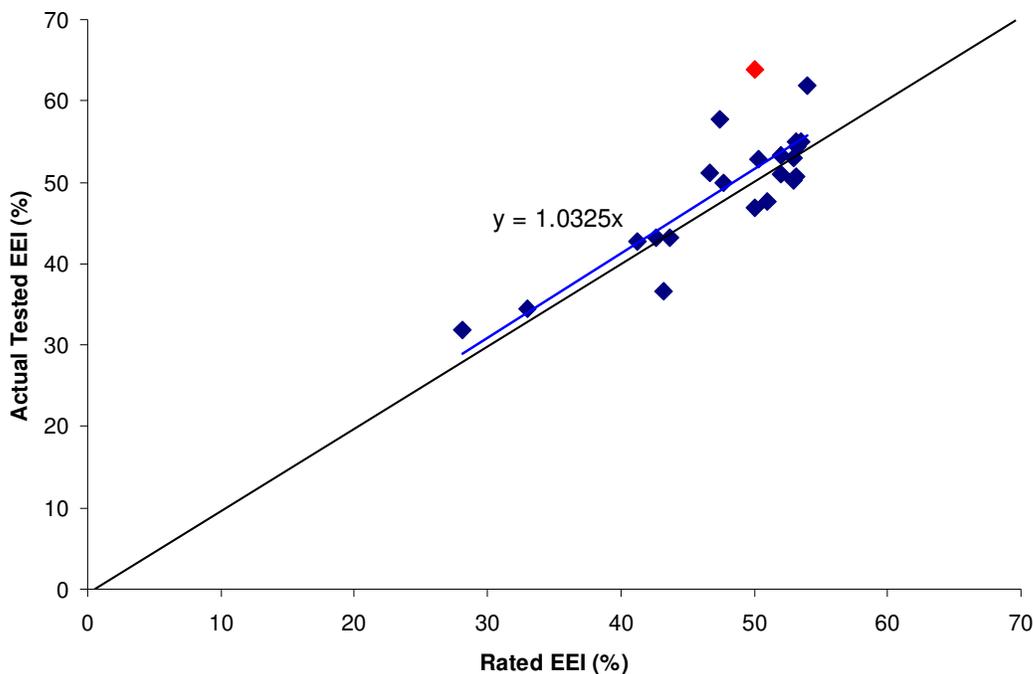
**Table 2. 2006 – 2007 Comparison of Compliance Rates by Product Type and City**

	Beijing		Guangzhou		Hefei		Overall	
	2006	2007	2006	2007	2006	2007	2006	2007
<b>Refrigerator</b>	85.71%	100.00%	N/A	83.33%	71.43%	N/A	80.95%	95.65%
<b>Freezer</b>	N/A	N/A	100.00%	100.00%	50.00%	N/A	54.55%	100.00%
<b>Air Conditioner</b>	N/A	100.00%	93.75%	N/A	83.33%	100.00%	90.91%	100.00%
<b>Clothes washer</b>	N/A	94.44%	N/A	66.67%	N/A	N/A	N/A	90.48%

Note: Highlighting shows direct changes in compliance rates within a city, N/A indicates no testing of that product type.

It is also noted that the testing results can vary significantly when tested in different laboratories. Improving the consistency of test results between test laboratories is a critical and necessary step in setting up a comprehensive national testing program. This can be achieved through a round-robin testing scheme and capacity-building activities.

Further, the 2007 testing shows that most products' actual energy efficiency is in compliance with the product's energy efficiency rating (Figure 7). Also no systematic variation is observed in deviations between actual performance and ratings. There is a slight tendency to overrate energy efficiency. However the difference is not significant. Among the different products, refrigerators show slightly greater overrating with an average deviation of 3.3 percent.



**Figure 1. Rated vs. Actual Energy Efficiency Index of Refrigerators<sup>1</sup>**

Another finding regarding sample selection was that the selection of testing samples seems to be biased towards certain grades. The tested refrigerators were all selected from Grade 1 while freezers were selected from grades 3, 4, and 5. The sample air-conditioners and clothes washers were from wider distribution of grades but lacked a focus on some particular grades. In order to make the testing more meaningful future selection process of test products should target a wider variety of products from across the entire market. Similarly, the study is limited by the fact that so much of the sample (69 out of 73) came from a single retail chain.

<sup>1</sup> Red square represents the non-compliant product.

### **3. International collaboration**

#### ***3.1 Impact of the International Collaboration***

Over the years, the Collaborative Labeling and Appliance Standards Program (CLASP) has partnered with several Chinese institutions to promote energy-efficient products in China. CLASP, together with its implementing partner Lawrence Berkeley National Laboratory (LBNL), has assisted China in developing and updating 11 minimum energy performance standards (MEPS) for 9 products and endorsement labels for 11 products including: refrigerators; air conditioners; televisions; printers; computers; monitors; fax machines; copiers; DVD/VCD players; external power supplies; and set-top boxes. CLASP has also assisted China in the development of the mandatory energy information label. In the process, CLASP, with the support of METI/IEEJ, collaborated with CNIS to develop the efficiency grades, providing technical input to the process, comment and advice on particular technical issues, and evaluation of the results. In addition, in order to effectively evaluate the impact of the label on China's market, CLASP further provided assistance to CNIS to collect data on both the efficiency distribution and product volume distribution of refrigerators on the market.

Because of the increasing need for the development of a monitoring system to track compliance with the standard, CLASP, with support from Japan's Ministry of Economy, Trade and Industry (METI) and the Institute of Energy Economics, Japan (IEEJ), has expanded its on-going collaboration with the China National Institute of Standards (CNIS) to include enforcement and monitoring. CNIS has already begun working on the issue of compliance. CNIS has already begun working on the issue of compliance and, since 2005, has: held a workshop with key stakeholders on enforcement and monitoring roadmap planning; interviewed stakeholders on the need and scope of national compliance tests and testing infrastructure; conducted research on past enforcement activities; analyzed compliance data from the mandatory energy information labeling program; and developed a roadmap for future activities. Concerned about the integrity of the mandatory energy information labeling and MEPS, CNIS (with support METI/IEEJ, and technical assistance from LBNL), conducted modest sample testing in 2006 for refrigerators and room air-conditioners, and repeated the same task in 2007 with a similar sample size - for three products (refrigerators, air-conditioners and clothes washers). The results show meaningful impact of forcing manufacturers to ensure compliance, as the improvement between 2006 and 2007 compliance rates observed. The experience of this first round of testing could be quite helpful in developing a full-scale national verification testing program.

As China's capacity for S&L implementation has grown, the nature of CLASP's support has shifted from technical training and capacity-building for the domestic program to assistance in extending market transformation effects internationally through harmonization of efficiency specifications. Most notably, in 2005, China, Australia, and the US adopted a harmonized set of efficiency specifications for external power supplies, based on a single testing standard. Current efforts support both the application of China's S&L pro-

grams into new market transformation programs domestically (such as government procurement) as well as the expansion of China's outreach internationally in additional harmonization efforts.

The essence of CLASP's work in China has been technology transfer, transferring to China the last 20 years of experience and toolkits that have been developed around the world to support S&L programs. The success relies heavily on cooperation with a wide range of organizations and groups and training of Chinese counterparts. For example, LBNL alone provided 196 person-weeks of training for 90 officials from five agencies, split roughly evenly between training at LBNL and training inside China.

### ***3.2 Future Activities***

- With METI support, CLASP could assist CELC to expand the verification testing program to cover more models and products as well as to develop a plan for ramping up national verification testing over the next three to five years.
- Additional focus could be put on surveying sales models and testing products from second- and third-tier distribution channels outside of the major retail centers in large cities to gauge the response of lower-income and rural buyers.
- Future effort could also be put on evaluating the impact of testing effort, to identify whether the elements in the enforcement plan and regime would induce a change in behavior, or simply the existence of this check-testing program that provoked changes, further investigation and continuous testing effort is needed in order to observe systematic trend.
- CLASP could also assist CELC in planning a round-robin testing scheme, first among the three national laboratories, and subsequently expanding this program to other regional test laboratories, with the goal of improving the consistency of testing results from different testing laboratories. CLASP could also facilitate the involvement of leading international test laboratories in this exercise. CELC could then develop training workshops after the round-robin tests to enhance the capacity of regional test laboratories.

## **4. Conclusions**

China has already developed a solid legal foundation and has key elements in place to support the development and enforcement of energy efficiency standards and labels. AQSIQ, as directed by the State Council, has clear authority to develop, promulgate, and enforce energy efficiency standards and labels for appliances. However, monitoring and enforcement effort for appliance efficiency standards and labels are grossly under-funded in China, especially compared with the need of the largest and perhaps most dynamic appliance market in the world. In addition, there are no reporting and certification requirements for products covered by MEPS, making it difficult to monitor the overall compliance situation. For the mandatory energy information label, the reporting requirement provides a very useful platform for the China Energy Label Center to collect product performance information, to provide public access to such information, and to

keep track of the distribution of energy efficiency for refrigerators and room air conditioners.

The limited funding for monitoring and enforcement effort has hindered the ability of program administrators to monitor the compliance status of appliance products in China. The only funded verification testing of the energy performance of regulated appliances so far is the national product quality supervision test. With a sampling rate of about 1% of the appliance models on the market, it has limited deterrence. Without adequate monitoring and verification testing, it is difficult to enforce the compliance to both the mandatory standards and labeling programs. Therefore, the critical next step, is to significantly expand the national verification testing program.

With the support of METI and CLASP, and the technical assistance of LBNL, CELC has been able to initiate the first household appliance check-testing program ever to be implemented in China. The goal of this check-testing was to measure how well the actual information matches the claimed energy performance for refrigerators, room air conditioners and clothes washers in three cities across China. The results showed that while most products meet the claimed performance levels, there are also cases of noncompliance. Perhaps more importantly, however, improvement can be seen when comparing the two years of testing. Specifically, the number of non-compliant product models decreased from 11 out of 54 in 2006, to only three out of 73 models in 2007. The positive change may be attributable to greater awareness of compliance enforcement after the 2006 round of testing. In addition, the 2007 testing showed that the actual energy efficiency of most products is in compliance with the claimed energy efficiency, and no systematic variation is observed in deviations between ratings and actual-performance. However, limitations exist in the current testing effort. The sample selection in this study was relatively small. First, sample testing was conducted only in the markets of three top-tier cities and top-tier retailers. The product model samples tested were representative of only 1 percent of the total product model size, and are not representative of the whole country and the whole market. In addition, the results of both years suggest that the testing results can vary significantly when products are tested in different laboratories. Improving the consistency of test results between test laboratories is a critical and necessary step in setting up a comprehensive national testing program. This can be achieved through a round-robin test scheme and capacity-building activities.

Nevertheless, spot-testing has the meaningful impact of forcing manufacturers to ensure compliance, as the improvement between 2006 and 2007 compliance rates demonstrates. The experience of this first round of testing could be quite helpful in developing a fullscale national verification testing program. With METI support, CLASP could assist CELC to expand the verification testing program to cover more models and products as well as to develop a plan for ramping up national verification testing over the next three to five years. CLASP could also assist CELC in planning a round-robin testing scheme, first among the three national laboratories, and subsequently expanding this program to other regional test laboratories, with the goal of improving the consistency of testing results from different testing laboratories. CLASP could also facilitate the involvement of leading international test laboratories in this exercise. CELC could then develop training

workshops after the round-robin tests to enhance the capacity of regional test laboratories.

It is agreed that expanded and persistent verification testing over time is the most effective approach to increase compliance to mandatory standards and labels and consequently energy savings of these programs. As China strives to achieve its 20% target for energy intensity reduction in the current Five-Year-Plan (FYP), maximizing energy savings from the appliance standards and labeling programs is likely to become one of the most prominent policy goals in China.