THE COLLABORATIVE LABELING AND APPLIANCE STANDARDS PROGRAM

Accelerating the Adoption of Second-Tier Reach Standards for Applicable Appliance Products in China

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Executive Summary

The minimum energy efficiency standards program for household appliances in China was initiated in 1989. Since 1996, CLASP and its implementing partner, LBNL, have assisted China in developing 11 minimum energy performance standards (MEPS) for 9 products and endorsement labels for 11 products including: refrigerators; air conditioners; clothes washers; televisions; printers; computers; monitors; fax machines; copiers; DVD/VCD players; external power supplies; and set-top boxes (under development).

Before 2003, China's traditional approach to standards development involved small increases in efficiency requirements for implementation within 6 months of a standard's approval. Since 2003, China has adopted a new approach in setting MEPS. This new approach involves the development of two tiers of standards—one for initial implementation and a second tier at a more aggressive level of energy efficiency for implementation three to five years later. The second-tier standard is also referred to as a "reach standard." Reach standards have now been developed in China for: color TVs; refrigerators; air conditioners; and external power supplies.

This report is presented in five sections. After the introduction in Section 1, Section 2 analyzes the distribution of the efficiency of refrigerators and air-conditioners in China based on data collected by the China Energy Label Center for the mandatory energy information label program. The results provide an assessment of the adoption of reach standards for these two products. Section 3 summarizes on-going collaborations with Shanghai related to early local adoption of reach standards, and presents both the impact and an analysis of barriers to the local adoption of reach standard for air-conditioners. Section 4 offers suggestions for local governments on how to move forward in adopting reach standards in their localities and concludes with a summary of the results and a plan for developing local capacity in order to achieve success in adopting reach standards.

By way of background, Section 1 summarizes the history of China's standards and labeling program and in particular the details of the overall rationale for reach standards along with specific levels by product. The introduction also synthesizes the results of prior work undertaken by CLASP, with the support of the China Sustainable Energy Program (CSEP) of the Energy Foundation (EF), to support the city of Shanghai to accelerate the adoption of the second tier reach standard for room air-conditioners in Shanghai ahead of national implementation. In particular, details of the market and policy barriers identified by this earlier project are summarized including:

- On the policy side, China's existing law on standard development stipulates that national standards supersede local standards, so Shanghai's authority on standards could not issue a more stringent local standard for room air-conditioners. As China is in the process of revising its Energy Conservation Law (ECL), a major opportunity exists for addressing this policy barrier. CLASP (with 2006 funding from METI) has continued to work with policy-makers to advocate for the inclusion of a clause that would allow local authorities to set more stringent energy efficiency policies.

- On the market side, cost premiums for the more efficient room air-conditioners are also a major barrier to the accelerated adoption of the reach standards. Air-conditioners meeting the reach standard are priced up to 50% more in retail in Beijing and Shanghai partly due to the fact that these air-conditioners are only a small share of the market at present. Thus, implementation of the reach standard will negatively impact the immediate welfare of some consumers. With METI's support, CLASP is also working with Shanghai local authorities to explore options to mitigate the cost premium of more efficient appliances.

The China Energy Label Center (CELC), a newly established unit within the China National Institute of Standards (CNIS) is the administrator of information labeling program. As of October 2005, a total of 78 manufacturers have submitted application materials for 2100 models of household refrigerator; and, a total of 68 manufacturers have submitted application materials for 4,123 models of room air conditioners, according to CELC. The analysis of the CELC database in Section 2 suggests that the reach standard approach in setting minimum efficiency standards holds great promise in China.

- The results show that over three quarters of household refrigerators are in the top two labeling categories (Grade 1 and 2) which exceed the reach standard for refrigerators, while only 6.9% of room air-conditioners meet the national reach standard (also Grade 2 or better).
- These divergent results are partly due to the fact that the efficiency requirements for the air-conditioners are comparatively more stringent than those for refrigerators and partly to the fact that the refrigerator reach standard becomes effective sooner than that for room air-conditioners.
- **In sum, it appears relatively easy to implement the national reach standard for refrigerators since over 75% of refrigerators already meet or exceed such a standard. The adoption of the reach standard for room air-conditioners seems to be more challenging given that only 6.9% of the room air-conditioners could meet such requirements as of late 2005**.

The results of this analysis of data from energy information label also reveal that the reporting requirements of the energy information label program: (1) help to collect performance data in an efficient and timely fashion; and (2) seem to provide a powerful incentive for manufacturers to produce more efficient refrigerators while also dropping those products that are below the standard requirements. The mandatory information label has also probably helped to boost compliance to the minimum efficiency standards since manufacturers now have to display the energy performance of their products prominently on the label. **Taken in the context of the wide variations in equipment usage patterns and income levels across China, the results also show that early adoption of such reach standards in selected urban centers could bring significant benefits to consumers and municipalities—highlighting the importance of the portion of this project dedicated to analysis of the barriers to early adoption of the reach standard in Shanghai for room air-conditioners.**

With support from the China Sustainable Energy Program of the Energy Foundation, CLASP has worked with the Shanghai Energy Conservation Supervision Center

(SECSC) to explore the possibility of adopting the national reach standard for room air-conditioners ahead of national implementation scheduled in 2009. With METI's support, we have been able to continue our work with SECSC to explore options to support the early adoption of the reach standard in Shanghai.

Shanghai is one of China's largest and most prosperous metropolises. As Section 3 documents, due to lack of local energy resources and rapid economic growth, the Shanghai government is motivated to promote energy conservation and energy-efficient technologies. If Shanghai implemented the reach standard ahead of the national implementation, then significant peak load reductions (approximately 150MW, assuming an annual installation of new air-conditioners of 1.15 million units and a peak coincidence factor of 0.5) could be gained which would continue to grow for Shanghai until the national standard went into affect. Further, annual electricity savings would be worth as much as 100 millions yuan per year and would continue over time as more high efficiency air-conditioners are purchased in subsequent years prior to national implementation. There would also be other social benefits for Shanghai as well, including avoiding billions of yuans of investment in new power plants, avoiding lost productivity from power outages, and lowering air pollution emissions associated with power generation.

However, CLASP's research has documented that several barriers exist to early adoption in the areas of conformity to national laws, uniformity of standards, market feasibility, and consumer economics. For example:

1. The choice of policy tools to take stronger action in energy efficiency is constrained by the current legal framework as China's Standardization Law stipulates that national standards override local standards. A legal revision is expected to be finished by the end of 2007 and may improve this situation.
2. There have been concerns raised that early adoption could lead to local protectionism, favoring products from Shanghai-based producers. This concern prevails though it is not supported by the evidence as air-conditioners made in Shanghai are not the dominant brands in the Shanghai market, and their records of EER have no particular advantages against other national manufacturers.
3. There is a dearth of high efficiency room air-conditioners available in the Shanghai market, largely due to the fierce competitive nature of the appliance market in China, and not to technical feasibility. The great majority of air-conditioners from 29 leading brands present in Shanghai have EERs just meeting the minimum threshold. However, most manufacturers present in the Shanghai market make products that can meet the EER reach requirement. So technically, it is quite feasible for Shanghai to adopt the national reach standard.
4. The increased cost of air-conditioners meeting the reach standard is around 300-500Yuan/unit (4,680-7,800 yen). SECSC estimated that Shanghai consumers could recover the increased investment costs for

efficient air-conditioners in about four years if the price premium were 400 yuan. However, it is expected that the cost premium will decline due to economies of scale and technical innovation.

5. Consumers are not sufficiently educated about the benefits of high-efficiency RACs.

The report concludes that to accelerate the adoption of reach standards, local advocates need to find innovative strategies to overcome financial and information barriers associated with promotion of high efficiency appliances. On the financing front, possible funding sources include local government budgetary allocations, DSM program incentives and other sources of utility revenue, government procurement programs, and possibly revenues from CDM projects.

On the institutional side, experience with the pilot project in Shanghai showed how the SECSC had to navigate the regulatory maze that governs the implementation of appliance standards, as well as deal with manufacturers to understand the technical challenges of producing high-efficiency RACs and to obtain estimates on possible cost increases. Considerable effort also went to working with retailers to figure out possible rebate mechanisms since there is little precedent for consumer rebates but more is needed. There is general need for further reinforcement of such institutional skills in all areas. This includes raising the awareness among staff at the local enforcement agencies on their responsibility of monitoring and verifying the compliance status of appliances to China's standard and labels, since most of the regulatory focus has been on enforcing safety and health related issues. Additionally, local testing laboratories need to be strengthened in order to help with monitoring and verification of appliance performance; training for the staff of local testing laboratories could be very beneficial.

On the information side, there is a need to help local partners develop consumer education materials for consumers to illustrate the benefit of high-efficiency appliances over the life cycle of the products. Developing promotional events focused on energy efficiency with appliance retailers and manufacturers is also very important.

A stronger data collection effort is needed to monitor program progress and achievements, which will help guide necessary program modifications to suite the changing market conditions.

Also on the information front, there is a need to ensure that energy performance information is accurate. Parallel efforts should be made to strengthen supervision of energy labeling through verification testing to ensure the advertised efficiency or cost savings is likely to be achieved. This would provide more reliable information and boost consumers' confidence in the energy performance of high efficiency RACs.

There is an opportunity to also focus on public buildings and appliances. Municipal governments should take advantage of the recently enacted procurement regulation to demand that all public buildings procure high efficiency RACs that meet the national reach standard as they are officially required to do. Municipal governments could also

mandate that all affordable housing projects, which typically receive favorable treatment in permitting, adopt high efficiency RACs.

Finally, one of the concerns raised during the interviews with stakeholders in China is that early adoption of reach standard is likely to benefit international manufacturers since their product offering tends to have a higher percentage of high-efficiency RACs. While the evidence in Shanghai does not support this perception, it would be politically prudent to seek allies among leading domestic manufacturers as well as international manufacturers to support the effort to adopt reach standards.

Overall, this work on reach standards shows that since China first introduced the reach standard mechanism in 2003, it has become a widely accepted approach in setting national standards for appliances. Together with the mandatory information label introduced in 2005, the reach standard approach has significantly improved the efficiency of household refrigerators in China. The implications for China's standard and labeling programs are clear: the development of reach standards and labeling requirement should be integrated; reach standard levels should be set sufficiently high and to correspond only to the top one or two categories for the information label; the information collected under the information label program provides an excellent gauge of efficiency of the market and should be used to set reach standards. **This project also uncovered growing interests from other provinces and major metropolises to adopt more stringent appliance standards to address a host of local issues related to power supply shortage, energy conservation targets, and environmental targets.**

1. Background

The minimum energy efficiency standards program for household appliances in China was initiated in 1989 when the former State Bureau of Technical Supervision announced the first batch of efficiency standards for eight consumer products. Since 1996, CLASP and its implementing partner, LBNL, have assisted China in developing 11 minimum energy performance standards (MEPS) for 9 products and endorsement labels for 11 products including: refrigerators; air conditioners; clothes washers; televisions; printers; computers; monitors; fax machines; copiers; DVD/VCD players; external power supplies; and set-top boxes (under development).

Increasingly, attention is being placed on maximizing energy savings from China's standards and labeling efforts in order to meet the recently announced goal of reducing China's energy intensity by 20 percent by 2010—a part of China's reorientation to decreasing its rapid rate of growth in energy consumption.

Before 2003, China's traditional approach to standards development involved small increases in efficiency requirements for implementation within 6 months of a standard's approval. Since 2003, China has adopted a new approach in setting efficiency standards. This new approach involves the development of two tiers of standards—one for initial implementation and a second tier at a more aggressive level of energy efficiency for implementation three to five years later. The second-tier standard is also referred to as a "reach standard." The lag between the adoption and implementation of the reach standards gives manufacturers time to re-design their products and to re-tool their production facilities. Thus, it is easier for manufacturers to comply with a more stringent efficiency level. This practice has been very effective in the US MEPS program and Japan's Top Runner Program.

Reach standards have now been developed in China for: color TVs; refrigerators; air conditioners; and external power supplies. A summary of the Tier 1 and Tier 2 standard requirements is listed in Table 1.

The development of the reach standard is a major milestone in China's standard program. Besides specifying increased energy savings at some future date, it offers a potential avenue to further increase energy savings by accelerating the adoption of the second tier reach standards for applicable products.

CLASP, with the support of the China Sustainable Energy Program (CSEP) of the Energy Foundation (EF), has previously participated in a pilot program to support the city of Shanghai to accelerate the adoption of the second tier reach standard for room air-conditioners in Shanghai prior to national implementation. In light of Shanghai's severe electricity shortage in 2004 and 2005, this approach promised both to save energy and to reduce Shanghai's peak load challenge.

Table 1: Reach Standard Requirements in China

	Tier 1	*Tier 2*
Refrigerators (220 liters)	*2004, 1.34 kWh/day*	*2007, 1.21 kWh/day*
Air-conditioners (<4500W)	*2005, EER>=2.6*	*2009, EER>=3.2*
Color televisions (CRT)	*2005, EEI=1.5 Standby<=9W*	*2008, EEI<=1 Standby<=3W*
External power supplies	2007	2009
watt	Efficiency	Efficiency
0 <Po <1	0.39 × Po	0.49 × Po
1<=Po <49	0.107 × ln Po + 0.39	0.09 × ln Po + 0.49
49<=Po <=250	0.82	0.84
	Standby (watt)	Standby (watt)
0 <Po <=10	0.75	0.5
10<Po<= 250	1	0.75

However, the project has encountered both policy and market barriers. On the policy side, China's existing law on standard development stipulates that national standards supersede local standards, so Shanghai's authority on standards could not issue a more stringent local standard for room air-conditioners.[1] Fortunately, China is in the process of revising its Energy Conservation Law (ECL). This represents a major opportunity for addressing this policy barrier. With the support of funding from Japan's Ministry of Economy Trade and Industry (METI), CLASP is continuing to work with policy-makers both at the central and local level to advocate for the inclusion of a clause that would allow local authority to set more stringent energy efficiency policies. There is a precedent. In the area of *environmental* regulations, municipalities and provinces are already allowed to have stricter requirements, such as emissions standards for automobiles.

Cost premiums for the more efficient room air-conditioners are also a major barrier to the accelerated adoption of the reach standards. Air-conditioners meeting the reach standard are priced up to 50% more in retail in Beijing and Shanghai partly due to the fact that these air-conditioners are only a small share of the market at present. Thus, implementation of the reach standard will negatively impact the immediate welfare of some consumers. With METI's support, CLASP is working with Shanghai local authorities to explore options to mitigate the cost premium of more efficient appliances.

For example, CLASP's partner in Shanghai, the Shanghai Energy Conservation Supervision Center (SECSC), continues to advocate consumer rebates to encourage the purchase of more efficient air-conditioners. CLASP is working with SECSC to determine the appropriate level of incentive. In addition to government funding, we are also exploring other sources of funding such as demand-side-management (DSM) programs

[1] Article 6 of Standardization Law of the People's Republic of China.

and the clean development mechanism (CDM). In the former case, consumer rebates for more efficient air-conditioners would be a part of local DSM offering. In the latter case, energy savings and related carbon emission reductions from the adoption of more efficient air-conditioners could be sold to interested buyers of carbon credits, and the revenue would be used to pay for the consumer rebates.

At the time of this report, the Shanghai government is still committed to the adoption of the reach standard in 2007, but likely on a voluntary basis. To assist the uptake of more efficient air-conditioners, the Shanghai government is considering budgetary allocations to support consumer rebates for air-conditioners that meet the reach standard. It also seems likely that the cost premium would come down significantly if the reach standard took effect: some manufacturers have already indicated that if there is a sufficient market, the cost premium could be reduced from the current 50% to about 20-25% (SECSC, 2005). This is a classic "chicken and egg" situation. However, SECSC believes that a combination of consumer rebates and bold marketing from a few manufacturers could break the current stalemate. The International Copper Association (ICA) has shown keen interests in supporting this effort and promised to identify and engage interested manufacturers, since the more efficient air-conditioners would use more copper[2].

With METI's support, we are also working with China's mandatory energy information label program to obtain and analyze label registration data in order to learn the distribution of the energy efficiency of household refrigerators and room air-conditioners currently in the marketplace. Such an analysis will help assess how many products are already meeting the reach standards in order to evaluate the burden on manufacturers to meet the reach standard and the feasibility of accelerating the adoption of these standards throughout China.

This report is presented in five sections. After the introduction, Section 2 analyzes the distribution of the efficiency of refrigerators and air-conditioners in China based on data collected by the China Energy Label Center for the mandatory energy information label program. The results provide an assessment of the adoption of reach standards for these two products. Section 3 summarizes on-going collaborations with Shanghai and presents both the impact and an analysis of barriers to local adoption of reach standard for air-conditioners. Section 4 offers suggestions for local governments on how to move forward in adopting reach standards in their localities and concludes with a summary of the results and a plan for developing local capacity in order to achieve success in adopting reach standards.

2 Analysis of Energy Label Registration Database

As mandated by China's Energy Conservation Law, China launched, on March 1, 2005, a mandatory energy information label that is similar to the EU and Australian energy label. The information label is designed to help consumers make pertinent choices by classifying appliances into five efficiency categories. In the Chinese label, grade/level one is the most efficient and grade/level five the least efficient (a sample label for

[2] Discussion with Wang Geng, a project manager at ICA's Beijing office.

refrigerators is shown to the top right, and for room air-conditioners, to the bottom right). It is also similar in concept to the Australian label, which uses a star-rating scheme with six stars the most efficient and one star the least efficient. The China Energy Label Center (CELC), a newly established unit within the China National Institute of Standards (CNIS) is the administrator of this program. At the moment, only household refrigerators and air-conditioners are subject to this mandatory labeling program. Clothes washers and unitary air-conditioners will be added in 2007.

Manufacturers or importers of appliances covered by the mandatory labeling program are required to submit energy efficiency ratings and relevant test reports to CELC but can apply the label on their products and promoting literatures directly by themselves. As a result of this reporting requirement, comprehensive data on energy performance for all covered products in China and in particular the distribution of products by energy efficiency ratings, is available for the first time. Such data make it possible to evaluate the feasibility of adopting the reach standards.

As of October 2005, a total of 78 manufacturers have submitted application materials for 2100 models of household refrigerators; and, a total of 68 manufacturers have submitted application materials for 4,123 models of room air conditioners (according to CELC). Based on the information in the CELC registration database for the information label, it seems that the information label is having a significant impact on the efficiency of household refrigerators and air-conditioners.

According to an internal analysis by CNIS, prior to March, 2005 (when the information label was launched), 31.4% of room air-conditioners would not have met the minimum standard that came into effect on March 1, 2005. After March, 2005, that percentage dropped to zero as can be seen in Figure 1. So despite protestations by the manufacturers during the standard development process, they all met the minimum standard for room air-conditioners on schedule. The reporting requirement by the energy information label program helps to collect such performance data in an efficient and timely fashion. Also, as seen in Figure 1, at the time the lower Tier 1 standard went into effect, 6.9% of room air-conditioners would have met the higher Tier 2 national reach standard, which is Grade 2 or better.

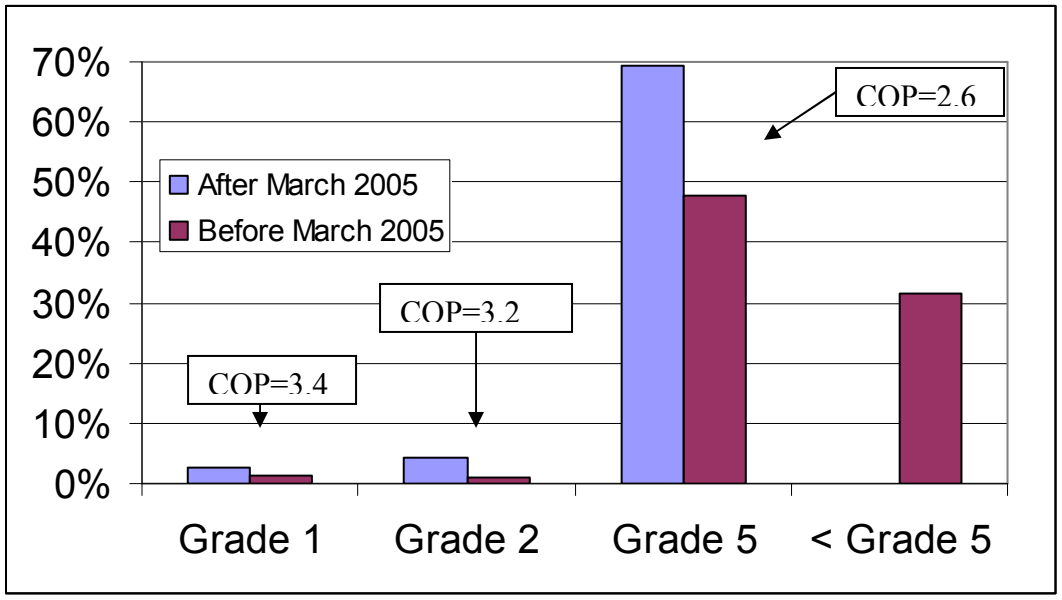

Figure 1: Market share of room air-conditioners by efficiency grades in China

Before March 2005, 26.4% of the household refrigerators were already in the highly efficient Grade 1 category, as shown in Figure 2. After March 2005, that percentage went up to 41.6%. So the information label provided a powerful incentive for manufacturers to produce more efficient refrigerators. There was also a small percentage of refrigerators that did not meet the minimum Tier 1 standard requirement before March 2005, but compliance went up to 100% after March 2005. The mandatory information label probably also helped to boost compliance to the minimum efficiency standards since manufacturers now have to display the energy performance of their products prominently on the label.

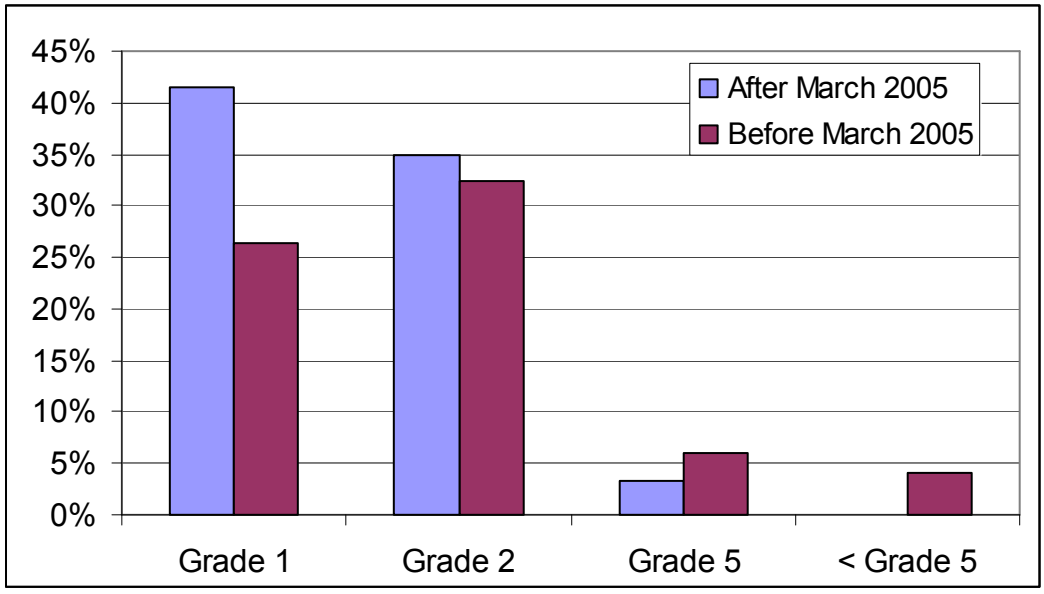

Figure 2: Market share of refrigerators by efficiency grades in China

The results of this analysis reveal that over three quarters of household refrigerators are in the top two labeling categories (Grade 1 and 2) which exceed the reach standard for refrigerators, while only 6.9% of room air-conditioners meet the national reach standard (also Grade 2 or better). These divergent results are partly due to the fact that the efficiency requirements for the air-conditioners are comparatively more stringent than those for refrigerators and partly to the fact that the refrigerator reach standard becomes effective sooner than that for room air-conditioners.

Furthermore, the results indicate that it is relatively easy to implement the national reach standard for refrigerators since over 75% of refrigerators already meet or exceed such a standard. This is not entirely surprising given that the national reach standard for refrigerators is expected to go into effect on July 1, 2007, two years sooner than the room air-conditioner reach standard. The next step is to revise the requirements of the refrigerator reach standard for the next round (Tier 3) to be effective around 2010.

For room air-conditioners, the adoption of the reach standard seems to be more challenging given that only 6.9% of the room air-conditioners could meet such requirements as of late 2005. But this dearth of high efficiency models is not due to technical feasibility. In fact, there is little technical difficulty in meeting the reach standard for room air-conditioners. Most technologies in the air-conditioner industry in China were imported from Japan, the US, and Europe. And Chinese manufacturers are major exporters of room air-conditioners to those markets as well, where efficiency requirements are higher. For example, while China's reach standard is EER 3.2, the minimum EER in South Korea is 3.37; that in Japan is about 4.9 (although most Japanese room air-conditioners are of the inverter-type); and that in the US for residential central air-conditioners is about 3.4.

However, high efficiency air-conditioners tend to be more expensive to purchase. Since many Chinese consumers tend to use room air-conditioners only when it is extremely hot, they are not convinced the energy savings of high efficiency air-conditioners could justify their higher purchase prices. Furthermore, this usage pattern could change quickly, as rapidly rising incomes are driving the demand for comfort. The strong growth of the air-conditioner market in urban China is testimony to such rising demand for cooling services. There are also considerable variations in climate conditions across China: people in Guangzhou in southern China use their air-conditioners almost all year round, while people in the northeast only turn on their air-conditioners in the hottest months in the summer. So the cost-effectiveness of reach standards for air-conditioners is greater in southern China and urban centers along the coast.

The analysis of the CELC database suggests that the reach standard approach in setting minimum efficiency standards holds great promise in China. Once a future target is set, manufacturers would respond with new and more efficient product offering to stay competitive and drop those products that are below the standard requirements. The mandatory energy information label is not only useful for consumers, but also a power driver for manufacturers to upgrade their products. As the date for reach standard implementation approaches, product mixes would change to meet the standard. Given the wide variations in usage patterns and income levels across China, early adoption of such

reach standards in selected urban centers could bring significant benefits to consumers and municipalities. In the section below, we will examine in more detail barriers to early adoption of the reach standard in Shanghai for room air-conditioners.

3 Analysis of Energy Savings Potential from Application of Reach Standard in Shanghai

Shanghai is one of China's largest and most prosperous metropolises and a showcase of China's economic achievement over the last quarter of a century. In recent years, demand growth has far outpaced the growth in generating capacity, leading to severe electricity shortages, especially during summer months, and causing frequent interruption of electric services and significant economic losses. Therefore, energy conservation is of strategic importance to Shanghai's social and economic development. The recently announced target of reducing energy intensity by 20% by 2010 has further strengthened support for energy conservation in Shanghai.

With support from the China Sustainable Energy Program of the Energy Foundation, CLASP has worked with the Shanghai Energy Conservation Supervision Center (SECSC) to explore the possibility of adopting the national reach standard for room air-conditioners ahead of national implementation scheduled in 2009. With METI's support, we are able to continue our support to SECSC to explore options to support the early adoption of the reach standard in Shanghai. In this section, we will describe the market situation for room air-conditioners in Shanghai and presents an analysis of barriers and possible solutions.

Rapid social and economic development in Shanghai in the last two decades has significantly improved the standard of living in Shanghai, and created strong demand of air-conditioning, among other amenities. This has exacerbated the problem of peak power shortage for the local electric grid, which has not been able to keep up with soaring demand to power thousands of skyscrapers and factories, and especially millions of new air-conditioners. It is estimated that the air-conditioning load accounts for more than 40% of the peak load in Shanghai, and household air-conditioner usage is a major part of that load.

By the end of 2004, household ownership of air-conditioners in Shanghai had reached 159 units per hundred families, and was likely to continue to grow in the foreseeable future. Annual sales of household air-conditioners in Shanghai have increased at 7% per year from 2001 to 2005 as shown in Table 2.

Table 2: Sales of Household Air-Conditioners in Shanghai

Year	2001	2002	2003	2004	2005
Sales volume (10,000 Units)	82	94	110	115	107

The total number of air-conditioners has reached 5.66 millions units in urban areas – and there is a considerable amount of rural population in the outlaying areas of Shanghai.

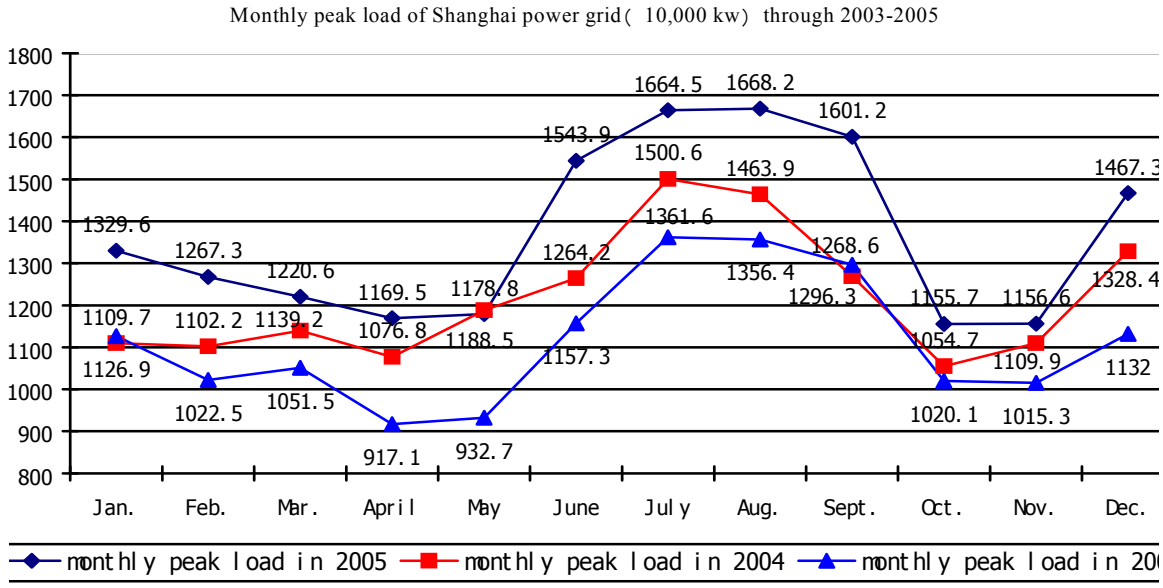

Figure 3: Monthly Peak Load in Shanghai, 2003-2005

The peak load of Shanghai power grid was 16.68 GW in 2005 – an increase of 1.68 GW from that of 2004 as shown in Figure 3. Household air-conditioners alone represented 22% of the peak load in Shanghai in 2005.

Incremental load due to new air-conditioners alone will increase by 863 MW per year, assuming that annual sales remain 1.15 million units (the same as in 2004), power consumption of each unit is 1.5 kW, and the peak coincidence factor is 0.5. The peak load growth was about 1.68 million KW in 2005. Therefore, half of the increased peak load in 2005 is a result of installation of new room air-conditioners! As sales of air-conditioners continues to rise due to a booming housing market, the impact on peak load of increased air-conditioner installation will increase as well and is likely to exceed 1000 MW per year in the near future.

3.1 POTENTIAL IMPACT OF ADOPTION OF REACH STANDARD IN SHANGHAI

China's latest minimum energy efficiency standards for room air-conditioners (RAC) published in 2004 laid out several sets of interlinked efficiency requirements for standards and labels[3], including: a minimum efficiency requirement; a labeling requirement for the mandatory information label; and a labeling requirement for an energy endorsement label. The efficiency measurement is the energy efficiency ratio (EER) or coefficient of power (COP).

Table 3 lists the requirements for the most popular type of room air conditioners—split type air conditioners with a cooling capacity under 4500 watts. As the Table shows, under the mandatory information label scheme, room air conditioners are classified into

[3] GB12021.3-2004 , Limited Energy Efficiency Value and Energy Efficiency Grades for Room Air-Conditioners.

five categories: Level 1 is the highest grade, with an EER threshold of 3.4; and Level 5 is the lowest grade, with an EER threshold of 2.6 (which is also the current minimum standard for room air-conditioners). Level 2 serves as the threshold for the endorsement label as well as for the reach standard that will become effective in 2009. Room air conditioners that are in Level 1 and 2 are also commonly referred to as high efficiency RACs.

Table 3: MEPS and Labeling Efficiency Requirements for RAC in China

	Cooling Capacity (CC, W)	Energy Efficiency Grade				
		5	4	3	2	1
Split	*CC≤4500*	2.60	2.80	3.00	3.20	3.40

If Shanghai implements the national reach standard of EER of 3.20 ahead of the national implementation, then the annual reduction in peak load would be approximately 150MW, assuming an annual installation of new air-conditioners of 1.15 million units and a peak coincidence factor of 0.5. The peak savings would continue to grow for Shanghai until the national standard went into affect.

In addition to peak load savings, electricity savings would be substantial as well. The average annual usage of room air-conditioners in Shanghai household is estimated to be 817 hours[4]; therefore, one air-conditioner would save 206 kWh of electricity per year if the efficiency were raised from 2.6 to 3.2. Together, 1 million units of high efficient air-conditioners would lead to annual electricity savings of 200 million kWh. Assuming average residential tariff of 0.50 Yuan/kWh, then the reduced expenses on electricity in Shanghai can reach 100 millions yuan per year. Such savings in electricity use and fees for the units purchased in the first year of Shanghai's implementation would continue over time and the annual savings would grow as more high efficiency air-conditioners are purchased in subsequent years prior to national implementation.

There would also other social benefit for Shanghai as well. Since the cost of reducing peak load through more efficient air-conditioners is likely to be much lower than that of building conventional power plants and lost, billions of yuans of investment would be avoided, with even greater savings from avoiding lost productivity due to power outages. In addition, reduced electricity consumption would also lower air pollution associated with power generating and help Shanghai meet the 10% pollution reduction target laid out in the 11th Five Year Plan.

3.2 BARRIERS AFFECTING EARLY IMPLEMENTATION OF REACH ENERGY EFFICIENCY STANDARD IN SHANGHAI

During the feasibility research on early adoption of the national reach standard, SECSC conducted a wide-ranging consultation with interested stakeholders in government and industry. The feedback from central and local government agencies and from local

[4] Base on a survey of 1000 households in Shanghai in 2004 by SECSC.

manufacturers was generally supportive of Shanghai's effort to take the lead in implementing the reach standard for room air-conditioners. Considering that the majority of room air-conditioners on the market still have efficiency ratings of level 5 (COP of 2.6) as the CELC data shows, early implementation of reach standard for room air-conditioners (COP of 3.2) in Shanghai would lay a good foundation for effective implementation of the reach standard nationwide in the future.

However, several concerns were raised as well over the course of 2006 in the areas of conformity to national laws, uniformity of standards, technical feasibility, and consumer economics.

China's Standardization Law stipulates that national standards override local standards: once a national standard for particular products is issued, local standards cease to be effective. Local government agencies could only develop and issue standards on products that are not covered by national standards. The only exception has been environmental standards, where localities are allowed to issue standards that are more stringent than national standards such as fuel quality standards.

During extended discussions with Shanghai Bureau of Technical Supervision (SBTS), the local agency that oversees the development and implementation of efficiency standards, it was clear that Shanghai will not be able to issue a local standard on RACs that is more stringent than the national standard, without an explicit exemption from the central government agencies, which they have not been willing to give in written endorsement form despite their verbal support. This is not an uncommon stalemate in policy reform in China. The central government is quite willing to implicitly support local innovation, but unlikely to lend formal support before such innovation proves to be successful.

SECSC then proposed that Shanghai should adopt the national reach standard ahead of the national implementation – earlier timing, instead of separate local standards. As this debate gains more attention within the industry, there have been concerns raised as to whether this would lead to giving Shanghai-based manufacturers an advantage in the market place. Since SECSC's proposal of adopting the national reach standard will not create a new standard, but affect the timing of the implementation of the announced national standard, any benefit that actually accrued would result only from one manufacturer's ability to meet the standard sooner than another's . However, since Shanghai-based manufacturers of room air-conditioners are mostly international, some domestic manufacturers were able to put pressure on central government agencies.

While many policy makers from the central government agencies have expressed their support, Shanghai's effort to adopt the national reach standard has been hindered by lack of a clear regulatory mechanism to implement such a strategy. There is no readily available policy tool or direct precedent to prescribe the early adoption of the national reach standard.

There is a dearth of high efficiency room air-conditioners available in the Shanghai market as well. Statistics from Shanghai Household Appliance Trade Association show that the great majority of air-conditioners from 29 leading brands present in Shanghai

have EERs just meeting the minimum threshold of 2.6; and only 1% of them meet the EER requirement of the level 2 criterion.

The dearth of high efficiency RACs in Shanghai is largely due to the fierce competitive nature of the appliance market in China, not to technical feasibility. Both Chinese manufacturers and consumers are very price-sensitive and they are unlikely to produce or buy high cost models without clear benefits.

According to estimates obtained by SECSC from manufacturers, the increased cost of each air-conditioner would be around 300-500Yuan/unit (4,680-7,800 yen) if EER were increased from 2.6 to 3.2. However, manufacturers are unwilling to put more money into efficiency improvement because of the fierce price competition and low profit margins for room air-conditioners right now. They are also hesitant to market high efficiency air-conditioners due to perceived lack of promotion and supervision of efficiency requirements. For example, high-efficient compressor technology has been available and costs only 20 Yuan more than low efficient products. However, only a few manufacturers adopt such technology for fear that they would be disadvantaged in the current pricing war.

Consumers are not sufficiently educated about the benefits of high-efficiency RACs. They are also wary of claims made by manufacturers regarding energy or cost savings of high-efficiency RACs. Therefore, promotion and education effort should be strengthened in order to raise consumers' awareness of energy efficiency.

SECSC's research also shows that manufacturers are strongly in favor of increased supervision and inspection efforts by the government agencies to build consumers' confidence in energy efficiency labels and to promote a friendly market environment for high-efficiency air-conditioners.

3.3 FEASIBILITY FOR EARLY IMPLEMENTATION OF REACH NATIONAL STANDARD IN SHANGHAI

Shanghai has always been a leader in China in socio-economic development, promoting advanced and efficient technologies, and in promoting energy conservation. The Shanghai municipal government also considers it a high priority to establish a resource-efficient city due to its lack of natural resources. Early adoption of the reach standard for RACs thus fits well with Shanghai's strategic goals and is supported by the municipal government.

While there are legal challenges in implementing the reach standard ahead of the national schedule, the Shanghai government is still motivated, as this report is being written[5], to find appropriate policy solutions in consultation with national government agencies. China's call for a 20% reduction in energy intensity also provides a good impetus for Shanghai to seek policy innovations such as implementing the reach standard ahead of the schedule.

[5] Last consultation with SECSC by CLASP on February 26, 2007.

Most manufacturers present in the Shanghai market already have products that can meet the EER requirement of 3.2 (see Table 4). Among leading brands in the Shanghai market (Haier, Chunlan, Changhong and Xinfei), Chunlan has 23 models that meet the reach standards requirement; the number of high efficiency models is 6 for Changhong, 21 for Haier, and 7 for Xinfei. In fact, about 18% of Haier's products can meet the reach standard requirement. So technically, it is quite feasible for Shanghai to adopt the national reach standard.

Table 4: EER Distribution of Main Brands of Air-conditioner

		EER of level 1& 2		EER of level 5	
Brand	Number of Models	Number of Models	Percent (%)	Number of Models	Percent (%)
Chunlan	314	23	7.3	264	84.1
Changhong	231	6	2.6	210	90.9
Haier	117	21	17.9	89	76.1
Xinfei	64	7	10.9	56	87.5
Panasonic	268	11	4.1	178	66.4
Sharp	78	5	6.4	71	91
Hitachi	59	2	3.4	40	67.8
Mitsubishi Heavy Industries	85	24	28.2	23	27.1
Mitsubishi Electric	48	16	33.3	12	25
Daikin	20	—			100

There have been concerns that the early adoption of the national reach standard in Shanghai could lead to local protectionism, favoring products from Shanghai-based producers. This concern is not supported by the evidence. Statistics from the Shanghai Household Appliance Trade Association show that among 1.07 million units of air-conditioners sold in Shanghai, the top ten brands accounted for 66% (see Table 5).

Table 5: Market shares of air-conditioner by brand names in 2005

Brand	Sales (unit）	Market share（%）
Haier	116,652	10.9
Hitachi	100,708	9.4
Media	78,818	7.4
Green	66,264	6.2
Sharp	63,686	6.0
Chunlan	61,806	5.8
Mitsubishi Electric	59,812	5.6
Panasonic	57,884	5.4
Aux	56,378	5.3
TCL	51,530	4.8

Among the top 10 brand names, Hitachi, Sharp, and Mitsubishi Electric have established production bases of air-conditioners in Shanghai, and they occupied about 20% market share in 2005. So air-conditioners made in Shanghai are not the dominant brands in the Shanghai market, and their records of EER have no particular advantages against other national manufacturers. Therefore, if Shanghai took the lead in implementing the national standard, local enterprises would face a fair, competitive market.

One of the key barriers identified by SECSC is the increased cost of more efficient air-conditioners—roughly 300-500 yuan(4,680-7,800 yen). However, it is expected that the cost premium will decline due to economies of scale and technical innovation. If consumers can expect to recover the increased purchase price, they will be more willing to bear the higher price. SECSC estimated that Shanghai consumers could recover the increased investment costs for efficient air-conditioners in about 4 years, based on the assumptions that annual usage of room air-conditioners is 817 hours and average increased purchase price of 400 Yuan (6,240 yen).

Consumers' willingness to pay would be further strengthened if they were convinced that the energy efficiency improvement is real. To this end, the Shanghai government agencies should strengthen monitoring and supervision of the use of energy information labels to enhance consumers' confidence of efficient air-conditioners and better inform consumers cost savings of efficient air-conditioners over its life cycle.

In addition, the Shanghai government could further promote high efficiency RACs by subsidizing part of the increased price. This is a customary measure for governments to support efficient technologies and promoting energy conservation in developed economies. Such subsidies could serve as a catalyst to transform the appliance market toward higher efficiency. Based on the assessment of government support and market and cost conditions, it seems quite feasible to adopt the reach standard in Shanghai ahead of national implementation schedule.

3.4 SUGGESTIONS FOR EARLY IMPLEMENTATION OF THE NATIONAL REACH STANDARD IN SHANGHAI

Due to lack of local energy resources and rapid economic growth, the Shanghai government is motivated to promote energy conservation and energy-efficient technologies. However, the choice of policy tools to take stronger action in energy efficiency is constrained by the current legal framework. Fortunately, the National People's Congress is in the process of revising China's Energy Conservation Law. It has been proposed that a clause be added to specifically allow local government to issue more stringent local standards on energy efficiency. The ECL revision is expected to be finished by the end of 2007.

In the meantime, the City of Shanghai can issue a local regulation to promote high efficiency RACs through policy incentives, such as offering consumer rebates to defray the incremental cost of buying RACs with an EER or 3.2 and higher, and tax credits and other rewards for manufacturers that promote the sales of high efficiency RACs in Shanghai.

While there is clear interest in Shanghai to use consumer rebates to promote high efficiency RACs, the challenge is to raise the necessary funding for such an effort. The cost of the rebates would be around 75 million RMB if the rebate is set at 150 RMB per unit and covered 500,000 units (about half of the current market in Shanghai).

In additional to a potential budget allocation for consumer rebates, Shanghai is also exploring a variety of fiscal approaches to support this effort. In the developed economies, a rebate is often financed through a small charge on electricity. Shanghai is currently exploring the possibility of setting up its own utility-based demand-side management (DSM) program. Consumer rebates for high efficiency appliances could be a program component. Moreover, Shanghai could tap into the expanding CDM opportunities to support promotional activities related to the early adoption of the reach standard including consumer rebates, because the additional energy savings and related emissions reductions could be sold to interested buyers of such emissions credits.

4 Conclusions and Next Steps

4.1 Acceleration of Reach Standards

Since China first introduced the reach standard mechanism in 2003, it has become a widely accepted approach in setting national standards for appliances. Together with the mandatory information label introduced in 2005, the reach standard approach has significantly improved the efficiency of household refrigerators in China. Over three quarters of new refrigerators in 2006 already exceed the reach standard that is expected to take effect in July 2007. This achievement further validates the rationale for setting reach standards in China, and proves that significant improvement in appliance efficiency is possible if the market is allowed sufficient lead time and a tool is provided to distinguish appliance products by their energy performance. The results also demonstrate the complementary nature of standards and labeling programs as meeting the reach standards earns higher ratings in the labeling scheme.

The implications for China's standard and labeling programs are clear:

1. The development of reach standards and labeling requirement should be integrated;

2. Reach standard levels should be set sufficiently high and to correspond only to the top one or two categories for the information label; and

3. The information collected under the information label program provides an excellent gauge of efficiency of the market and should be used to set reach standards.

This project also uncovered growing interests from other provinces and major metropolises to adopt more stringent appliance standards to address a host of local issues related to power supply shortage, energy conservation targets, and environmental targets In addition to Shanghai, Beijing is exploring options of adopting reach standards; and Guangdong has expressed interests as well to promote high efficiency appliances as part

of its nascent DSM effort. These local governments are further motivated by the new political guidance from the central government to seek more resource-efficient and sustainable development models. The current regulation that does not allow more stringent local standards than national standards is clearly a bottleneck that hinders policy innovations at the local levels.

China's call for a 20% energy intensity reduction and the revision of the Energy Conservation Law provide a great opportunity to advance China's energy efficiency standards program. What opportunities exist for outside assistance? It would be beneficial for providers of technical assistance to support interested stakeholders both at the central and provincial level in China to add a clause in the revised Energy Conservation Law to allow local government greater flexibility to introduce more stringent energy efficiency standards or implement reach standards ahead of the national deadline.

4.2 SUBSIDIES AND TAX INCENTIVES

To accelerate the adoption of reach standards, local advocates need to find innovative strategies to overcome financial and information barriers associated with promotion of high efficiency appliances. On the financing front, possible funding sources include: local government budgetary allocations; DSM program incentives; government procurement programs; and possibly revenues from CDM projects. Most local advocates are not well versed in developing CDM projects, and would benefit from international assistance to build internal capacity. Providers of outside technical assistance could usefully support local partners in exploring financing options to support consumer rebates for high efficiency appliances to mitigate the cost premium of high efficiency appliances.

Consumer rebates can help induce the desired market transformation. If rebates are offered to consumers who purchase high efficiency RACs, it is likely that the market share of high efficiency RAC will increase sharply. As the volume of such products increases, their price declines significantly and they would hopefully become the first choice for consumers. However, it is crucial that such rebates are offered over a period of time, not just for a year or two and it is therefore necessary to develop a sustainable funding source.

In the more developed economies, demand-side-management (DSM) programs have been widely used to support consumer rebates and other market transformation programs. The funds are typically collected through a fee or surcharge on electricity. Most municipalities in China are already collecting a surcharge to pay for urban infrastructure ("city construction fee"). So it is possible that this funding mechanism could be used to pay for the consumer rebates for high efficiency RACs.

The electricity tariff could also be adjusted to promote high efficiency RACs—for example, introducing a time of use tariff with a high peak tariff for the residential sector. Moreover, a connection fee for electricity could be introduced for building developers to stimulate the demand for high efficiency RACs. A connection fee is typically a fixed charge based on the highest electric demand during a specified period; therefore the

savings from the adoption of high efficiency RACs would partially or totally offset the connection fee.

4.3 INSTITUTIONAL NEEDS

On the institutional side, it would be beneficial for outside providers to help local partners coordinate early adoption of reach standards by agencies that are involved in energy conservation and standard implementation. Experience with the pilot project in Shanghai showed how the SECSC had to navigate the regulatory maze that governs the implementation of appliance standards. SECSC also worked with manufacturers to understand the technical challenges of producing high-efficiency RACs and to obtain estimates on possible cost increases. Considerable effort also went to working with retailers to figure out possible rebate mechanisms since there is little precedent for consumer rebates but more is needed. There is a general need for further reinforcement of such institutional skills in all areas. This includes raising the awareness among staff at the local enforcement agencies on their responsibility of monitoring and verifying the compliance status of appliances to China's standard and labels, since most of the regulatory focus has been on enforcing safety and health related issues. Additionally, local testing laboratories need to be strengthened in order to help with monitoring and verification of appliance performance; training for the staff of local testing laboratories could be very beneficial.

On the information side, there is a need to help local partners develop consumer education materials for consumers to illustrate the benefit of high-efficiency appliances over the life cycle of the products. Interested cities could also promote high efficiency RACs through consumer education campaigns to familiarize consumers with the benefit of high efficiency RACs, especially the cost savings over a products' lifetime. Developing promotional events focused on energy efficiency with appliance retailers and manufacturers is also very important.

Local advocates such as SECSC could also benefits from support to strengthen the data collection effort to monitor program progress and achievements, which will help guide necessary program modifications to suite the changing market conditions. Lack of data on appliance sales and efficiency makes it difficult to evaluate how successful a promotional effort has been. Manufacturers are generally reluctant to release such corporate information. However, it is possible to work through industry associations to obtain relevant information without revealing proprietary data. Such information can provide critical insight on what is the viable strategy to promote the early implementation of reach standards.

Also on the information front, there is a need to ensure that energy performance information is accurate. Parallel efforts should be made to strengthen supervision of energy labeling through verification testing to ensure the advertised efficiency or cost savings is likely to be achieved. This would provide more reliable information and boost consumers' confidence in the energy performance of high efficiency RACs.

There is an opportunity to also focus on public buildings and appliances. Municipal government should take advantage of the recently enacted procurement regulation to demand that all public buildings procure high efficiency RACs that meet the national reach standard as they are officially required to do. A list of energy efficient products has been created by China Standards Certification Center (CSC) to help procurement managers to identify energy-efficient products6. However, the implementation of the government procurement guideline has just started. Local advocates for the early adoption of reach standards could initiate a targeted education effort to accelerate the implementation of the new government procurement guideline, which will hopefully become a powerful market driver for high efficiency appliances.

Municipal governments could also mandate that all affordable housing projects, which typically receive favorable treatment in permitting, adopt high efficiency RACs. Many building projects in China today are trying to qualify as energy-efficient buildings or green buildings. Government agencies could include high efficiency RACs as part of the criteria of any rating guideline for Energy-Efficient Building or Green Buildings.

One of the concerns raised during the interviews with stakeholders in China is that early adoption of reach standard is likely to benefit international manufacturers since their product offering tends to have a higher percentage of high-efficiency RACs. While the evidence in Shanghai does not support this perception, it would be politically prudent to seek allies among leading domestic manufacturers as well as international manufacturers to support the effort to adopt reach standards. Municipal governments, for example could reward these manufacturer partners with public recognition for those with the highest sales of high-efficiency RACs.

[6] www.cecp.org.cn