LEARNING BY DOING: THE WEALTH OF EXPERIENCE IMPLEMENTING STANDARDS AND LABELING PROGRAMS IN ASIA

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INTERNATIONAL PROGRESS ON STANDARDS AND LABELING

Internationally, the number of countries implementing energy-efficiency standards and labeling programs has grown rapidly in the past 20 years. The number of countries has increased more than four-fold since 1980 and has more than doubled in the past decade (see Table 1). Nearly half of all program experience with standards and labeling programs is within Asia.

Table 1. Cumulative Number of Standards and Labeling Programs in Asia and Worldwide

	Pre-1980	**1980-1985**	**1986-1990**	**1991-1995**	**1996-2000**
In Asia	1	3	6	10	13
Worldwide	6	9	13	23	28*

Source: Based on Wiel and McMahon (2001)
* Actually, a total of 32 countries have standards or labeling programs in place (of which 15 are in Asia), but the starting date could not be established for 4 of the countries and thus they are not included in the table summaries.

This paper provides snapshot overviews of some of the programs that have been implemented in five different Asian countries. The purpose of this overview is to show the experience and lessons learned at different stages of program design and development. Table 2 summarizes the case studies presented in this chapter. The brief case studies do not necessarily provide a complete overview of each country's programs – rather, they focus on one aspect in the spectrum of program design, development, implementation, and evaluation.

Table 2. Asia Case Studies Presented in This Paper

Country	**Program element reviewed**
Sri Lanka	Feasibility study for appliance testing and labeling program
India	Label design
China	Certification of energy conservation products Unified labeling program development
Thailand	Voluntary labeling leading to minimum efficiency performance standards (MEPS)
People's Republic of Korea	Standards and labeling implementation and upgrading

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SRI LANKA - SETTING THE STAGE: THE FEASIBILITY STUDY

BACKGROUND

Sri Lanka recently took its first steps toward establishing an energy testing and labeling programs for lighting, motors, and appliances. With assistance from the Asian Development Bank, the Sri Lanka commissioned a feasibility study for appliance and equipment testing and labeling program. This study was carried out by Lawrence Berkeley National Laboratory, with assistance from the International Institute for Energy Conservation (IIEC).

FEASIBILITY STUDY FOR THE APPLIANCE TESTING AND LABELING PROGRAM

The study had the following main elements:

International review. It included an international review of experience with implementation of standards and labeling programs. This was used to review approaches and options in other countries and their applicability in Sri Lanka. Relevant aspects included selection of appliances to be covered, testing arrangements, label design, organizational structure, voluntary vs. mandatory approaches, and program impact.

Screening of appliances and equipment to be covered. In this phase, the consultants assessed the energy use and market penetration of the major appliances and equipment. This resulted in recommendations on the potential savings and cost effectiveness for a range of appliances and equipment. The study found that improving the efficiency of five of the leading household appliances could result in energy savings of approximately 345 kWh/year per household, or 268 GWh/year for all of Sri Lanka. This is 19% of the average household electricity bill (see Table 3).

Table 3. Potential Energy Savings for Household Appliances and Equipment in Sri Lanka.

	Base case household energy use (kWh/yr)	Efficient case household energy use (kWh/yr)	Household energy savings (kWh/yr)	Sri Lanka residential energy savings (GWh/yr)
Lighting	664	469	194	151
Ballasts	31	19	12	10
Fans	262	223	39	31
Refrigerators	336	267	69	54
Televisions	157	127	30	23
Totals			*345*	*268*
Percent Savings			*18.8%*	*18.3%*

Source: LBNL 2000

Testing infrastructure needs assessment. The study included an itemized assessment of the costs for equipment, construction, and labor needed to build and operate an energy performance testing program for appliances and equipment.

Program design. The consultants performed an institutional assessment and made recommendations on the design, operation, and institutional responsibilities for the appliance and equipment testing and labeling program. These were reviewed in an initial and draft final stage with members of a stakeholder's steering committee, which was organized by the CEB and included all of the major actors (government agencies, the electric utility, NGOs, and industry groups).

Final program recommendations. The final report made specific recommendations for the establishment of four testing facilities for lighting equipment, appliances (A/Cs and refrigerators), and electric motors. The report included a breakdown of equipment and construction costs, as well as consulting assistance required to help with laboratory construction, procurement, and program initiation. The start-up costs for establishing the four test laboratories were estimated at US$1.6 million. The annual operating costs for the laboratories and program operation were estimated at US$106,000.

CURRENT STATUS

Sri Lanka hopes to establish one of the proposed testing facilities (for lighting equipment and ballasts) by mid-2002 to support their planned appliance and equipment labelling program. The project will be funded by the World Bank. The facility will be equipped to test compact fluorescent lamps (CFLs), linear fluorescent lamps, and ballasts. It will include power consumption, efficacy, light output, power quality and equipment lifetime. CEB is also intending to seek further funding to cover testing facilities for other appliances described in the feasibility study: refrigerators, air conditioners, motors, ceiling and table fans, and TVs. (Gooneratne 2001)

One lesson from the Sri Lanka experience is that delays often occur due to the requirements and procedures associated with development assistance from international organizations. The delays can be due to bureaucracy, procedures, and politics on both the donor and recipient sides. As a result, some of the momentum in program development can be lost, and staff attrition can be a problem. In the meantime, however, CEB has already worked with local industry to develop a labeling program for fluorescent lamp ballasts, using a star rating system. This is providing a basis of experience upon which to build its future appliance testing and labeling effort.

INDIA - CONSUMER RESEARCH: PROCESS FOR DEVELOPING AN EFFECTIVE LABEL

BACKGROUND

While India does not have an established standards and labeling program for appliances, it has recently completed an important consumer research project that developed the basis for an effective energy label (Dethman et al. 2000, Deshpande 2001). India's power system has a peak demand deficit of 14.5% and transmission and distribution losses of approximately 23%. This is in part due to the rapidly growing demand in the residential sector. The ownership of refrigerators and other has been increasing at a rapid rate. Between 1997 and 1999, for example, the penetration of refrigerators in urban households increased from 23 to 29%.

Several years ago, when progress on standards and labeling were stalled due to political considerations and inadequacies with the appliance testing infrastructure, the U.S. Agency for International Develop (USAID) in India decided to use its program resources to pursue an aggressive energy label development effort. Two USAID contractors, International Resources Group and Taylor Nelson Sofres Mode, carried out a phased consumer research project to lay the foundation for an effective energy label design that was acceptable to stakeholders (e.g., governments, manufacturers, etc.) According to Deshpande (2001), the basic approach was to:

- Listen to consumers and stakeholders
- Reflect their needs and wants; and
- Develop labels accordingly.

DESIGN OF THE LABEL RESEARCH

The research was designed in three phases. Phase 1 was a baseline survey, in which researchers gathered fundamental information about consumer attitudes toward energy efficiency and information preferences. This was done through in-home interviews with 1,833 urban consumers in six major Indian cities. Phase 2 consisted of 10 qualitative consumer focus groups to test 17 label designs constructed from existing successful label formats used in other countries. The basic label formats considered were the Australian-based star format; the European Union's bar-based format; the North American (U.S. and Canada) sliding scale format; and the Thai or Korean number-based format. Phase 3 consisted of focus groups to factor in the opinions of key government and appliance industry experts (i.e. stakeholders) as well as consumers.

LESSONS LEARNED FROM THE INDIAN CONSUMER RESEARCH

The end result of the consumer research was a final energy label design shown in Figure 1 below.

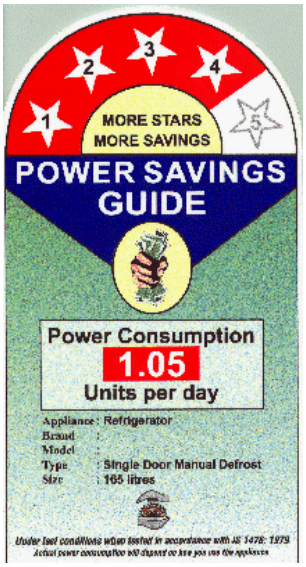

Figure 1. The India Refrigerator Label

Deshpande (2001) summarizes some of the key lessons learned from the Indian research. These lessons may be applied in a number of other Asian countries and even in developed countries. Indeed some of the lessons and methodologies used in the India research were incorporated into a recent consumer research project aimed at improving the effectiveness of the U.S. label (Egan 2001).

Importance of the focus on consumer research. The existence of good consumer research made it possible for policymakers to draw on the results of that research in policy development.

Adoption of a phased approach. The phased approach allowed for the development of a large number of alternative designs and the eventual testing of a small number of the most popular and effective design with both consumer and stakeholder groups.

Cooperation with stakeholders. In the final phase of the project, the top four label designs (incorporating various combinations of formats and design elements) were created and subject to review by groups of both experts (stakeholders from government and industry) as well as consumers. This process helped to assure stakeholder "buy-in" to the research effort. Deshpande provides an example of how the label design allowed tradeoffs between "technical accuracy" and "consumer clarity." The more technically accurate way to present energy consumption would be to use words "energy consumption" along with the units of "kWh." However, the consumer feedback led policymakers to agreed to adopt the term

"power consumption" rather than "energy consumption" and to use the word "units" rather than "kWh", since these terms were shown to be more useful and understandable for consumers. One of the key factors in convincing the stakeholders was a live telecast of an actual focus group discussion with consumers.

CHINA - DEVELOPMENT OF ENERGY CONSERVATION CERTIFICATION AND LABELING SCHEMES

BACKGROUND

One of the most striking features of the booming Chinese economy has been the explosion of consumer demand for home appliances and lighting products (see Table 4). The saturation of refrigerators rose from almost zero in 1980 to about 65% of urban Chinese households in 1997, and the saturation of clothes washers increased from 5% to 90% in the same period in urban China. The saturation of color televisions rose rapidly in the mid-1980s, and by 1997 virtually all urban Chinese households owned at least one color TV. A similar trend has been observed for air-conditioners as well, although in a much shorter time frame. Sales of air-conditioners reached about 8 millions in 1997 from a miniscule level of 250,000 in 1990. Today, China is one of the largest producers of many home appliance and lighting products in the world.

Table 4. Energy Consumption Estimates of Major Appliances in China (1997)

	Saturation %		**Stock**	**Avg. UEC**	**Energy use**
	(urban)	**(rural)**	**(millions)**	**(kWh/yr)**	**(TWh/yr)**
Refrigerators	73	9	95	408	38.6
Freezers	5		5	387	1.8
Air Conditioners	16		17	450	7.5
Clothes Washers	89	22	143	55	7.9
Microwave Ovens	5		5	52	0.3
Color TVs	100	27	166	124	20.6
Electric Fans	166	45	276	20	5.5

Source: Turiel et al, 1998, *China Statistical Yearbook* 1998.
UEC = unit energy consumption

The dramatic increase in the ownership and use of home appliances has led to large increases in residential electricity consumption in China -- around 16% per year on average since 1985. The potential for further growth in household electricity use is enormous. Compared to households in the United States, Chinese households consume about 5% of the US average. The growth in household electricity consumption has contributed substantially to the tremendous increase of generating capacity in China in recent years. Since 1990, China has added on average 16 GW of new capacity each year.

China is pursuing a number of initiatives aimed at increasing the efficiency of electric appliances and equipment. These include a program to improve the quality and efficiency of compact fluorescent lamps, a program to improve the efficiency of domestic refrigerators, and development of minimum efficiency performance standards for a range of products. Below we briefly summarize some ongoing efforts to develop energy labeling schemes for the Chinese market.

ENERGY LABELING IN CHINA

The basis for energy labeling in China was established in the "Law on Energy Conservation in China," which took effect in 1998. The law set the basis for measures to develop energy efficiency standards and

energy labeling of appliances and equipment. The government also developed plans to take energy efficiency into account in its own equipment purchasing (Tienan 2001).

Originally, as the Chinese were developing their updated refrigerator standards in 1997, they concurrently developed a mandatory label providing categorical ranking of refrigerator energy use, modeled directly after the categorical energy label in use in the European Union. The government eventually decided not to issue the refrigerator label, but rather to develop a consistent national policy was set on mandatory labeling. The State Economic and Trade Commission (SETC) received the mandate to do this work.

At the same time, the government decided to issue a voluntary endorsement label, similar to the U.S. Energy Star labeling program. The design was created early in 1999, and the SETC established the China Energy Efficient Production Certification Center (CECP). The endorsement label was formally launched in September 1999, with the award of 103 labels to refrigerator manufacturers.

The CECP was founded in 1998 under the initiation of the State Economic and Trade Commission. It was authorized by the China State Bureau of Quality and Technical Supervision, but was established as an independent, non-profit organization. The goal of the certification program is to develop requirements in order to certify products as being safe, high-quality, and energy-saving. CECP develops certification criteria based on relevant international and national standards and technical requirements. Products that meet the criteria are designated as energy-conserving products and receive an "Energy Conservation Product Certificate." They are also legally permitted to use the Energy Conservation Products Symbol, which is shown in Figure 2 below.

Figure 2. The CECP Certification Logo for Energy Conservation Products

The basic requirements for certification are as follows:

- The manufacturer must have a quality management system that meets CECP requirements.
- Product performance must meet national regulation requirements for product performance and safety (in accredited test laboratories).
- The product energy efficiency must meet the technical specifications set by CECP for that product (in accredited test laboratories).

Currently, CECP has active certification programs for refrigerators, fluorescent ballasts, and air conditioners, and wave traps. It is planning to expand the certification program to cover a wide range of additional technologies, such as air compressors, electric water heaters, water pumps, washing machines, electric cookers, microwave ovens, fluorescent tube lamps, self-ballasted lamps, audio-visual products, information technology products, and construction materials. CECP also plans an initiative to certify products with low stand-by losses, since this is a large waste of electricity in many household appliances.

THE CHINA UNIFIED ENERGY LABELING PROGRAM

China is currently developing plans for a unified energy rating label that will be applied for a range of appliances and equipment used throughout the economy. The program is led by the SETC and is receiving international financial and consulting assistance. While the program is still under development, the basic elements are outlined below.

Promulgation of an energy labeling framework:

- Development of an energy labelling implementation plan
- Development of associated product energy performance testing infrastructure
- Development of energy labelling legislation

Design of a unified energy label:

- Selection of targeted appliance types
- Development of energy consumption and performance metrics
- Establishment of energy performance test procedures
- Determination of the desired informational content needed in the label
- Determination of the presentational format and design of the energy label

The goal of the program is to lay a legislative basis and framework for an energy labeling program that will apply consistently across all energy-using products sold in the country. It is intended to support and complement the CECP certification program mentioned above, which rewards the most energy-efficient products in any one category. Consumer and market research is seen as an important element in the design of a unified label format that is well understood by consumers while also acceptable to stakeholders (government officials, manufacturers, etc.)

THAILAND - AN EFFECTIVE VOLUNTARY LABELING PROGRAM LEADS THE WAY TO STANDARDS

BACKGROUND

In November 1991, Thailand became the first Asian country to approve a nationwide, comprehensive demand-side management (DSM) program. The Thai DSM Master Plan called for a total five-year investment of US$189 million to achieve a peak demand reduction of 238 MW and energy savings of 1,427 GWh/yr at a cost of saved energy less than half of the utilities' long-run marginal cost of production.

The original DSM Master Plan called for a broad range of programs that were based on DSM experience in North America, and relied on a combination of incentives and program marketing to spur a shift toward more energy-efficient products and services. [2] As actually implemented since 1993, the Thai approach to DSM has been to seek voluntary agreements with manufacturers and to supplement these agreements with nationwide advertising campaigns and interest-free loans for customers where necessary. The initial focus of the program was a voluntary agreement with the manufacturers of fluorescent lamps. This was followed by the introduction of a voluntary energy labeling program for refrigerators and room air conditioners. Below we briefly summarize the results of these two labeling programs.

REFRIGERATORS

In early 1994, EGAT approached the five manufacturers of household refrigerators and quickly gained their cooperation for a voluntary energy labeling program for the largest category of Thai refrigerators, which range from 4 to 6 cubic feet. The efficiency scale on the energy labels ranges from 1 to 5, with 3 as the average and 5 as the most efficient. A selection of the models in this size range was tested during the fall of 1994 to establish the average efficiency level. Models that fell within 10% of the mean are rated at

[2] The Thai DSM Master Plan relied on a combination of customer rebates and incentives for manufacturers. The majority of the DSM programs implemented in North America during the 1980s provided rebates to the consumer or end user and not to the manufacturer.

3; models that are 10-25% more efficient than the mean are rated at 4; and models that are more than 25% more efficient than the mean are rated at 5.

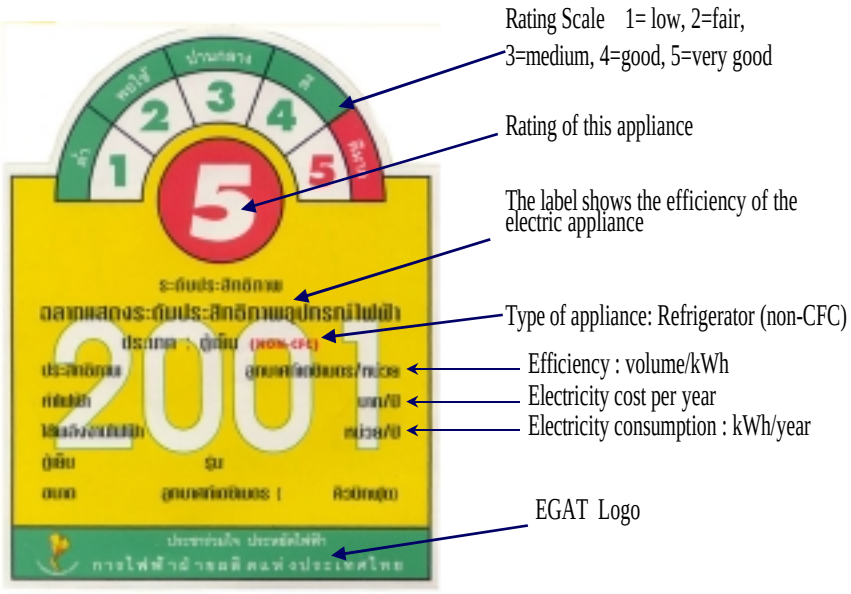

Figure 3. The Updated Thai Refrigerator Label, Introduced in 2001

The energy labeling program began as a voluntary program. There is no "penalty" for having an inefficient unit, since the manufacturer is not required to apply a label. Rather, the manufacturers of energy-efficient units rated at 4 or 5 have an incentive to put the label on the product and market it as an energy-efficient model.

AIR CONDITIONERS

A similar labeling program for air conditioners began in early 1996. The negotiations with manufacturers were more difficult because of the diverse and fragmented nature of the Thai air-conditioner industry -- the Thai air conditioner industry consists of nearly 100 manufacturers and assemblers, many of which are small, local assembly operations. Efficiency testing for the air conditioners began in late 1995. Air-conditioners produced by multinational corporations received the highest ratings. These firms launched large promotional campaigns touting the energy-saving benefits of their air conditioners.

PROGRAM EXTENSION

The voluntary program for refrigerators was gradually extended. In early 1998, the DSM Office worked with the Thai Consumer Protection Agency to make the energy labels mandatory for single-door refrigerators. The DSM Office also reached agreement with the manufacturers to raise the efficiency categories on the label for single-door refrigerators by 20%, effective in January 2001 (see Figure 3). Labeling began for two-door refrigerators in mid-1998, and is expected to become mandatory in 2002.

The success of the energy labeling program led the government to fund the development of minimum energy performance standards (MEPS) for six types of products: refrigerators, air conditioners, compact fluorescent lamps (CFLs), fluorescent tube lamps, ballasts, and electric motors (Resanond 2001). This study was completed by ERM-Siam in 2000, and the government is expected to adopt the proposed standards beginning in 2004.

PROGRAM IMPACTS AND LESSONS LEARNED

Thailand also has a staff of more than 200 professionals implementing Asia's first comprehensive set of DSM programs. The impact of the appliance labeling programs has been significant: more than 150 peak MW has been achieved, and more than 200 additional MW of peak demand reductions are expected during the coming five years (by 2005). (Phumaraphand 2001)

Table 5 shows the DSM program savings through mid-2000. Both of the energy labeling programs (refrigerators and air conditioners) far exceeded their targets. In fact, the peak reductions achieved by both programs were more than three times higher than expected. And the benefit-cost impacts for the refrigerator and air-conditioner programs were rated at 1.6 and 1.1 using the total resource cost test (Phumaraphand 2001).

Table 5. DSM Program Savings through June 2000

Program	**Launch Date**	**Savings Targets**		**Evaluated Results**		**Percent of Target Achieved**	
		Peak (MW)	**Energy (GWh/yr)**	**Peak (MW)**	**Energy (GWh/yr)**	**Peak**	**Energy**
Lighting	9/93	139	759	399	1,973	287%	260%
Refrigerators	9/94	27	186	84	849	310%	456%
Air conditioners	9/95	22	117	84	318	381%	272%
Motors	12/96	30	225	--	--	--	--
Commercial Buildings	10/95	20	140	--	--	--	--
Total		238	1,427	566	3,140	238%	220%

Source: Singh and Mulholland, 2000.

The Refrigerator Program has successfully transformed the single-door refrigerator market, increasing the market share of the most efficient units (level 5) from 12% in 1995 to 96% in 1998. The Air Conditioner Program had a slower market transformation effect. The market share of energy-efficient air conditioners (level 5) increased from 19% in 1996 to 38% in 1998. Given this rapid increase in the market share of energy-efficient units, a market share of 50% should be quite attainable. (Sulyma et al. 2000)

The lower presence of labels for air conditioners reflects the fact that the air conditioner industry has a much wider range of efficiency levels and a much larger number of manufacturers and distributors. As a result, it was harder for the DSM Office to attain as wide compliance in this market. (Vine et al. 2000).

The different results in the refrigerator and air conditioner programs have shown that voluntary labeling programs are not as effective as mandatory programs, since they do not provide incentives for manufacturers to place labels on the lower efficiency models. (Singh and Mulholland 2000)

In Thailand, as noted above, the energy label has also paved the way for the introduction of minimum energy performance standards (MEPS), which will take effect beginning in 2004.

Clearly, however, Thailand is setting an example for other developing countries that are considering energy labeling and standards as a resource that can cost-effectively postpone or avoid the need for investment in at least some future power plants.

REPUBLIC OF KOREA - AN EFFECTIVE MEPS AND LABELING PROGRAM

BACKGROUND

Over the past 20 years, energy consumption in the Republic of Korea has increased more than four-fold – from 43.9 million TOE in 1980 to 181.2 million TOE in 1999. This makes the country the 10th largest energy-consuming country in world. Policymakers are especially focused on ways to conserve energy use (and increase energy efficiency) because of the fact that 97% of energy needs are imported.

Much of the focus of the country's policy was placed on ways of reducing consumer energy use, including automobiles (the country was the first country in Asia to set minimum efficiency standards for passenger automobiles). In the electricity sector, household electricity use accounts for nearly one-fifth (18.8%) of total electricity use.

Table 6 shows the saturation of various common household appliances. A main driver of demand in the residential sector is the dramatic increase in the share of households using electric appliances during the past 20 years.

Table 6. Saturation of Household Appliances in the Republic of Korea

Appliance Type	**1981 saturation (% of households)**	**1991saturation (% of households)**	**% Increase**
Refrigerators	43	110	156
Air conditioners	1	9	900
Televisions	15	127	747
Video players	0.6	51.6	8,500
Clothes washers	15.2	86	466
Microwave oven	<1	32	>> 3,000

Source: Lee 2001

HISTORY OF LABELING AND STANDARDS

In 1992, the government approved a *Regulation on Energy Efficiency Standards Setting and Rating Labeling.* This initially applied to six items:

- refrigerators and refrigerator-freezers;
- room air conditioners;
- incandescent lamps;
- T-10 fluorescent tube lamps
- fluorescent lamp ballasts; and
- passenger cars.

In 1999, additional three products were regulated: screw-based compact fluorescent lamps (CFLs), clothes washers, and household gas boilers.

The legislation calls for the following steps:

1. In the first year for a given product, mandatory energy labeling goes into effective and minimum energy performance standards (MEPS) are announced.
2. In the second year, MEPS come into effect (mandatory).
3. In the third year, target energy performance standards come into effect (voluntary)

The legislation established a 5-rank system for labeling the energy use of appliances. The most energy-efficient models receive a #1 grade, and the least efficient receive a #5 grade (see Figure 4). Note that this is the *opposite* of the classification system used in Thailand in which the most efficient models receive a #5 grade. Generally, grade 1 products can save 30-40 percent compared to grade 5 products.

Figure 4. Energy label for a fluorescent ballast in the Republic of Korea

The goal of MEPS is to *push* the market by prohibiting the sale of the manufacture and sale of the lowest grade (least energy-efficient products). The MEPS target is usually based on lowest grade, #5. The grade classifications are adjusted upward (made more efficient) every three years.

On innovation in the MEPS policy is that it applies to shipment-weighted average efficiency of each manufacturer. This is different than other countries, which set a minimum efficiency level for any individual product. The philosophy behind the MEPS is that it can be attained with existing technology or technological innovation, at little or no extra cost. The target of TEPS is to *pull* the market by promoting a *voluntary* higher-efficiency target that can be achieved by manufacturers within a given time period and reduce current energy consumption in the range of 10-30 percent.

IMPACT OF THE LABELING AND STANDARDS PROGRAM

By any measure, the energy labeling and standards implemented by the Republic of Korea has been successful. There is a very high awareness of the energy label -- 85% of general consumers and 96% of appliance shoppers were aware of the label.

The program has also led to a substantial market transformation: the percentage of energy-efficient appliances on the market (grade 1 or grade 2) has increased from 55.4% in 1993 to 66% in 2000 (even with adjustments in label ranking scheme). Table 7 below shows the improvement in average efficiency levels for some of the appliances regulated.

Table 7. Improvement in Average Appliance Efficiency Levels in the Republic of Korea

Appliance Type	**Measurement units**	**1993 energy use (market average)**	**2000 energy use (market average)**	**% improvement in efficiency**
Refrigerator-freezers	KWh/mo/liter	0.113	0.065	74%
Air conditioners	Coefficient of performance	2.4	3.7	54%
Incandescent lamps	Lumens/W	10.0	11.0	10%
Fluorescent lamps	Lumens/W	65.0	90.0	39%

Source: Lee 2001

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